



EURON
IST-2000-26048
European Robotics Network

KA 1.9 RESEARCH ACTORS IN EUROPE



Project funded by the European Community under the "Information Society Technologies" Programme (1998-2002)

AUGUST 20, 2006

Contents

1 Austria	1
1.1 Seibersdorf	1
1.2 Steyr	2
1.3 Vienna	3
2 Belgium	4
2.1 Brussels	4
2.2 Leuven	5
3 Bulgaria	6
3.1 Sofia	6
4 Czech Republic	8
4.1 Prague	8
5 Denmark	9
5.1 Aalborg	9
5.2 Kongens Lyngby	10
5.3 Odense	11
6 Estonia	12
6.1 Tallinn	12
7 Europe	13
7.1 Joint Research Centre	13
8 Finland	14
8.1 Helsinki	14
8.2 Oulu	15
9 France	16
9.1 Cergy	16
9.2 Clermont-Ferrand	17
9.3 Grenoble	18
9.4 INRIA	19
9.5 Montpellier	20
9.6 Nantes	21
9.7 Paris	22
9.8 Robosoft	23
9.9 Toulouse	24
10 Germany	25
10.1 Aachen	25
10.2 Bielefeld	27
10.3 Bochum	28
10.4 Bremen	29
10.5 DaimlerChrysler AG	31
10.6 Fraunhofer	32
10.7 Freiburg	36
10.8 Hagen	37
10.9 Hamburg	38

10.10Hannover	39
10.11Ilmenau	40
10.12Kaiserslautern	41
10.13Karlsruhe	42
10.14Kuka Roboter	44
10.15Munich	45
10.16Osnabrueck	46
10.17REIS Robotics	47
10.18Siegen	48
10.19Siemens AG	49
10.20Stuttgart	50
10.21Ulm	51
10.22Weingarten	52
10.23Wessling	53
10.24Würzburg	54
11 Greece	55
11.1 Athens	55
11.2 Halkida	57
11.3 Thessaloniki	58
12 Hungary	59
12.1 Budapest	59
13 Israel	61
13.1 Tel Aviv	61
14 Italy	62
14.1 Ancona	62
14.2 Bologna	63
14.3 Brescia	64
14.4 Catania	65
14.5 ENEA	66
14.6 Genoa	67
14.7 Milan	68
14.8 Naples	70
14.9 Padua	71
14.10Parma	72
14.11Pisa	73
14.12Perugia	75
14.13Rome	76
14.14Siena	79
14.15Turin	80
14.16Verona	81
15 Netherlands	82
15.1 Amsterdam	82
15.2 Eindhoven	83
15.3 Twente	84
15.4 Utrecht	85

16 Poland	86
16.1 Lodz	86
16.2 Poznan	87
16.3 Warsaw	88
16.4 Wroclaw	90
17 Portugal	91
17.1 Aveiro	91
17.2 Coimbra	92
17.3 Guimaraes	94
17.4 Lisbon	95
18 Russia	97
18.1 St. Petersburg	97
19 Slovenia	98
19.1 Ljubljana	98
20 Spain	99
20.1 Barcelona	99
20.2 Cartagena	101
20.3 Castelló	102
20.4 Girona	103
20.5 Las Palmas	104
20.6 Madrid	105
20.7 Malaga	107
20.8 Palma de Mallorca	108
20.9 Seville	109
20.10Valencia	110
20.11Zaragoza	111
21 Sweden	112
21.1 ABB	112
21.2 Lund	113
21.3 Stockholm	116
21.4 Örebro	117
22 Switzerland	118
22.1 Lausanne	118
22.2 Martigny	119
22.3 Zurich	120
23 United Kingdom	121
23.1 Aberystwyth	121
23.2 Birmingham	122
23.3 Edinburgh	123
23.4 Essex	124
23.5 Leeds	125
23.6 London	126
23.7 Manchester	128
23.8 Oxford	129
23.9 Plymouth	130
23.10QinetiQ	131

23.11 Reading	132
23.12 Shadow Robots	133
23.13 Sheffield	134
23.14 Southampton	135
23.15 Sunderland	136
23.16 Sussex	137
23.17 Ulster	138

Preface

This document contains a brief outline of research activities in Europe. It is to be considered an active document that is updated on a regular basis. The initial compilation of the report was contracted out. Further updates will be performed by the EURON management. For information about the report and updates please contact the EURON coordinator Henrik I Christensen <mailto:hic@nada.kth.se>.

1 Austria

1.1 Seibersdorf

Institution:	ARC Seibersdorf Research GmbH
Address:	P.O. Box WPA A-2444 Seibersdorf Austria
Contact:	Gernot Kronreif
Phone:	+43 50550 2218
Fax:	+43 50550 2204
Email:	gernot.kronreif@arcs.ac.at
URL:	http://www.arcs.ac.at/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Mechatronic Automation Systems unit of “ARC Seibersdorf research G.m.b.H.” has been active in the development of multi-functional handling systems since 1999. Special attention is given to applied research on the use of robotics in medicine and rehabilitation.</p> <p>The main emphasis is on sensorics and electronics whereby, through close cooperation with the customers, we strive to adapt the system to the requirements of our user in an optimal way. This principle is currently being used, for example, in the development of a control unit for a coronary catheter, and of a new kind of ergo meter. Furthermore, service-robots for deployment in the areas of Therapy and Diagnostics are being developed along with intelligent rehabilitation aids and telemonitoring.</p> <p>Current projects in rehabilitation robotics include developing an intelligent wheelchair control system and a robot to assist in the therapy of disabled children.</p> <p>In medical robotics, one recent project deals with the development of an integrated robotic system for different kinds of percutaneous interventions. The aim is to develop a prototype for an active robotic system linked to CT and US images in order to assist the physician to place the biopsy needle precisely and accurately. The physician indicates the desired biopsy path, then the robot places the needle at the desired position and orientation faster and more accurately than the physician could.</p>

1.2 Steyr

Institution:	PROFACTOR Produktionsforschungs GmbH
Address:	A-4407 Steyr-Gleink Im Stadtgut A2 Austria
Contact:	Dr-Ing. Christof Eberst
Phone:	+43 7252 885 300
Fax:	+43 7252 885 101
Email:	christof.eberst@profactor.at
URL:	http://www.profactor.at/
Faculty:	10 Researchers
Post-Docs:	
Students:	
Projects	<p>PROFACTOR GmbH has carried out more than 150 projects and 28 EC projects with more than 110 companies focused on developing new methods for integrated production technologies and management systems.</p> <p>Major projects include:</p> <ul style="list-style-type: none"> • FlexPaint: efficient low volume high variant robotized painting. • Ultra-sensitive proteomics and genomics, • FIBRESCOPE: flexible inspection of bores with an robotic endoscope • ActIPret: interpreting and understanding activities of a expert operators for teaching and education, • AMADEUS: autonomous mobile manipulator for dexterous and universal services. <p>Our expertise covers: robotic endoscopes, robotic inspection, inspection robots, quality control, flexible automation, range sensing, vision-guided robots, painting, co-operative robots, distributed robotic systems, multi-agent coordination, multi-robot systems, sensor fusion, service robots, software architecture, robot design, clean-room robots, machine loading, industrial manipulators, and computer vision.</p>

1.3 Vienna

Institution:	Automation and Control Institute, Vienna
Address:	Vienna University of Technology Gusshausstr. 27-29 / E 376 A-1040 Wien Austria
Contact:	Prof. Dr. Markus Vincze
Phone:	+43 (01) 58801 - 37661
Fax:	+43 (01) 58801 - 37697
Email:	Vincze@acin.tuwien.ac.at
URL:	http://www.acin.tuwien.ac.at/
Faculty:	3 Professors, 2 Associate Professors, 12 Lectors, 12 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The Automation and Control Institute of the Electrical and Information Technology Department at the Vienna University of Technology has expertise in developing methods for robust visual sensing and a reusable framework for building robotics systems for real-world applications.</p> <p>Our vision research is founded on real-time tracking and a generic object recognition (categorisation). We emphasize vision based tracking with applications in virtual and augmented reality, indoor and outdoor navigation, and quality control. We believe that spatio-temporal reasoning can improve object recognitive performance.</p> <p>One major current project involves the fusion of stereo vision and inertial sensors. We plan to use a sensor suite consisting of a fixed, calibrated stereo rig together with an "inertio-tracker" based on accelerometers and gyroscopes. These two sensor types provide complimentary characteristics: visual sensing is very accurate at low velocities while inertial sensors can track fast motions but suffer from drift particularly at low velocities. This inside-out tracking system will be subjected to arbitrary motion and shall operate in cluttered multi-object scenes with multiple and independent motion and some static, but 3D background. A typical example might be a person carrying the sensors and walking through a city. The primary goal is a reliable reconstruction of the trajectory of the system itself, as well as the recovery of 3D structure required for successful tracking. Similar to the perceptive capabilities of a human, the system shall operate autonomously, without requiring additional information about its localisation and pose.</p> <p>Another current project uses colour image segmentation for robust and reliable detection of coloured objects.</p> <p>Our "ActIPret" system for teaching and education aims to develop a cognitive vision methodology that interprets and records the activities of people handling tools. The focus is on active observation and interpretation of activities, on parsing the sequences into constituent behaviour elements, and on extracting the essential activities and their functional dependence. The tool-handling activities are interpreted and stored using natural language expressions in an activity plan, an indexed manual in the form of 3D reconstructed scenes, which can be replayed to users using Augmented Reality equipment.</p>

2 Belgium

2.1 Brussels

Institution:	Royal Military Academy, Brussels
Address:	30, Avenue de la Renaissance 1000 Brussels Belgium
Contact:	Mr. Eric Colon
Phone:	+32 2737 6552
Fax:	
Email:	eric.colon@rma.ac.be
URL:	http://www.rma.ac.be/rmadotnet/?Lang=E
Faculty:	
Post-Docs:	
Students:	
Projects	The Unmanned Ground Vehicles Center of the Royal Military Academy (RMA) focuses on the development of mobile robots, including electro-pneumatic and electrical robots, as well as on the development of distributed control and Human Machine Interfaces for tele-operated and autonomous vehicles. The Unmanned Aerial Vehicles Center focuses on research related to medium, mini and micro UAVs. The main objectives are the understanding of low Reynolds number aerodynamics, the development of lightweight propulsion systems, autonomous navigation and micro-cameras for day and night vision. Birdlike and insect-like flying techniques as well as crawling capabilities are also studied.

2.2 Leuven

Institution:	Department of Mechanical Engineering (PMA Division)
Address:	Katholieke Universiteit Leuven Celestijnenlaan 300B B-3001 Heverlee Belgium
Contact:	Prof. Herman Bruyninckx
Phone:	+32 16 322773
Fax:	+32 16 322987
Email:	Herman.Bruyninckx@mech.kuleuven.ac.be
URL:	http://www.mech.kuleuven.ac.be/pma
Faculty:	7 Professors, 7 Associate Professors, 2 Assistant Professors
Post-Docs:	12 persons
Students:	66 Ph.D. students
Projects	<p>Production engineering, Machine design and Automation (PMA) at K.U.Leuven carries out research in the areas of production engineering, machine design and mechatronics. More specifically, the research themes include new production processes, CAD/CAM/CAPP, assembly automation, dimensional metrology and reverse engineering, machine and instrument design, structural dynamics and acoustics, motion control, programming and control of robots and intelligent machines, and life cycle engineering. We pursue a balance between basic or long-term research on the one hand, which is vital in order to maintain an advanced scientific level, and applied or short-term research on the other hand, which is probably the most important mission of an engineering research laboratory.</p> <p>The following research groups are active at PMA:</p> <p>Production processes, multi-agent co-ordination and control, computer integrated manufacturing, dimensional metrology and quality control, design of light weight structures, design of mechatronic systems, micro- and precision engineering, noise and vibration engineering, autonomous manipulation, mobile learning robots, and life cycle engineering.</p>

3 Bulgaria

3.1 Sofia

Institution:	Institute of Mechanics, Bulgarian Academy of Sciences
Address:	Acad. G. Bonchev Street, bl. 4 1113 Sofia Bulgaria
Contact:	Prof. Dr. Galia Vassileva Tzvetkova
Phone:	+359 2 979 6465
Fax:	+359 2 870 74 98
Email:	gtzvet@imbm.bas.bg
URL:	http://www.imbm.bas.bg/
Faculty:	11 Professors, 47 Associate Professors
Post-Docs:	
Students:	
Projects	<p>The Institute of Mechanics at the Bulgarian Academy of Sciences researches four main areas: mechanics of discrete systems, solid mechanics, fluid mechanics and biomechanics. Among the numerous research topics are kinematics and dynamics of complex mechanical systems; identification, modeling and control of robotic systems; and the development of intelligent mechatronic systems.</p> <p>The Department of Robotics and Mechatronics researches control systems, sensors, electronics, robot design, systems analysis, laser systems, and interferometry. Projects include building a lightweight 6dof anthropomorphic arm with a Euler type wrist, a robotized module for grinding, modular robots which allow most types of industrial robots to be assembled for educational purposes, and a hand-eye coordination project which created a 4dof arm with 2/3 full revolutions per joint.</p> <p>The Mechatronic Systems Department main research topics are: precise positioning systems, parallel manipulators and adaptive modules, gear transmissions, walking devices, and specialized sensors. Current projects include developing: a robotised system for micro and mini manipulators, a biomechatronic proprioceptor stimulation for stepping, a biomechanical system to restore motor function for patients suffering from spinal cord-brain pathology, and an automatic inspection system to look for structural defects in ferro-magnetic materials.</p> <p>The Controlled Mechanical Systems Department research subjects include: optimal point-to-point motion of robot manipulators, robust feedback control of robot trajectory tracking; time/energy optimal control in biped robots; identification of mass-inertial parameters of rigid bodies; computer modeling and optimization; learning control; synthesis of time/energy optimal point-to-point motion for flight; and underwater robotics. Biomechanics research areas involve theoretical and experimental investigations of the mechanical behavior of living systems under normal, pathological and extreme conditions.</p>

Institution:	Laboratory for Autonomous Mobile Robots (LAMOR), Bulgarian Academy of Sciences
Address:	Institute of Control and Systems Research 1, 15 Noemvri Str 1040 Sofia Bulgaria
Contact:	Prof. Ognyan B. Manolov
Phone:	+359 2 700 354
Fax:	+359 2 703 361
Email:	o.b.manolov@icsr.bas.bg
URL:	http://www.icsr.bas.bg/Departments/OC/OC_LAMOR.html
Faculty:	1 Associate Professor, 1 Senior Researcher
Post-Docs:	
Students:	1 Ph.D. student
Projects	<p>The Institute of Control and Systems Research (ICSR) of the Bulgarian Academy of Sciences (BAS) has its main research and education activities in the area of automatic control and cybernetics. The main objectives are the development of intelligent micro-systems and complex control systems for bio-processing, autonomous mobile vehicles and environmental protection. The Laboratory for Autonomous Mobile Robots (LAMOR) is a part of the Optimal Control Department of ICSR-BAS.</p> <p>LAMOR aims to develop: a) advanced methods for optimal, adaptive and robust control of mobile robots; b) tools for modelling of dynamical systems and real time simulation; c) algorithms for state estimation of dynamical objects by fusing information from different sensors; d) self learning structures and fuzzy sets for modelling, navigation and control of autonomous mobile objects; e) approaches for trajectory and path planning of autonomous vehicles in deterministic and/or partially unknown environment; f) strategies for cooperative behaviour of autonomous mobile robots group for rescue activity and hazardous situations. g) WEB-based remote control of mobile robots</p> <p>Significant laboratory results are the series of unique mobile robots, whose latest version is LAMOR-TV, with algorithms for intelligent behaviour, cooperative localization and navigation. These have also been implemented and tested with the WHISKERS robot (property of LADSEB-CNR, Padova, Italy).</p>

4 Czech Republic

4.1 Prague

Institution:	Gerstner Lab (CTU-GL), Czech Technical University
Address:	Department of Cybernetics Faculty of Electrical Engineering Technická 2 166 27 Prague 6 Czech Republic
Contact:	Dr. Libor Preucil
Phone:	+420 224 357 290
Fax:	
Email:	preucil@labe.felk.cvut.cz
URL:	http://cyber.felk.cvut.cz/gerstner/
Faculty:	4 Professors, 5 Associate Professors, 2 Assistant Professors, 3 Research Assistants
Post-Docs:	1 person
Students:	43 Ph.D. students
Projects	<p>The Gerstner Lab (CTU-GL) for Intelligent Decision-Making at the Faculty of Electrical Eng. carries out basic research in distributed artificial intelligence, multi-agent systems, machine learning and system diagnostics, knowledge-based systems, data warehousing & data mining, evolutionary computing, intelligent robotics and biocybernetics. The areas of applied research include computer integrated manufacturing, software testing and software diagnostics, and system diagnostics.</p> <p>Intelligent and Mobile Robotics group research is focused on the design and development of self-guided vehicles (SGV). The overall goal is to develop highly robust cognitive control systems for this kind of robot and to bring novel ideas to solution. Four central tasks are considered: sensing the environment, sensor data processing and data understanding, all leading towards automated building and/or updating of world models. The world knowledge representations used are optimised for planning self-navigation in indoor environments. As such a system requires highly complex control and decision-making, the crucial part is always the sensing and sensor data understanding.</p> <p>Current projects include: Complex system for mobile robot navigation (CoSyNa), Range-data based correction of position errors, Building a 2D environment map from laser range-finder data, Feature extraction and map building using ranging sensors, Solving collision situations in mobile robotics, Symbolic world modelling, cognitive processes and robot control using spoken language, and Robocup simulation league.</p> <p>Agent Technology group research includes agent modelling, inter-agent communication, social intelligence, coalition formation, community monitoring and meta-reasoning issues. Applied research focuses on the design and development of multi-agent systems and on improving their collaborative behaviour, especially with regard to our Robocup Rescue Simulation team.</p> <p>Latest research also incorporates the issues of cooperation and coordination of intelligent robots and humans in a hybrid set up.</p>

5 Denmark

5.1 Aalborg

Institution:	Center for Sensory-Motor Interaction (SMI), Aalborg University
Address:	Fredrik Bajers Vej 7 D-3 DK-9220 Aalborg Denmark
Contact:	Prof. Dejan Popovic
Phone:	+45 9635 8726
Fax:	+45 9815 4008
Email:	dbp@smi.auc.dk
URL:	http://www.smi.auc.dk/
Faculty:	6 Professors, 13 Associate Professors, 8 Assistant Professors, 4 Research Assistants
Post-Docs:	
Students:	29 Ph.D. students
Projects	<p>The purpose of the Center for Sensory-Motor Interaction (SMI) in Aalborg is to study basic and clinical aspects of human sensory-motor interaction and to develop methods to restore impaired sensory-motor functions. The research encompasses three inter-linked areas: motor control, sensory systems such as pain, and rehabilitation technology.</p> <p>The objective of the Motor Control Research group is to study the principles governing human movement with the primary goal of improving existing rehabilitation methods for restoring locomotion. Research comprises theoretical and experimental analyses of the central and segmental interaction between motor and sensory control mechanisms and the biomechanical structures of the lower extremities in healthy people and in motor- and sensory- impaired people.</p> <p>The Neural Prosthesis and Rehabilitation Technology group investigates the neural coding of the human sensorymotor system and develops new technologies for interfacing, stimulating, recording, and processing electrical signals from muscles and nerve tissue. Experimental and theoretical studies investigate the neuroelectrical interface characterising skin, muscle, and bladder afferents and apply these in closed loop FES controllers and in cognitive feedback applications. Preclinical trials are initiated in the use of cutaneous afferent feedback to control dropfoot in hemiplegic patients and to control hand grasp in tetraplegic patients.</p> <p>The aim of the Sensory Systems group is to develop and apply quantitative techniques to induce pain experimentally to human skin, muscles, and viscera and to develop and apply techniques to assess the induced nociceptive responses under normal and pathophysiological conditions. Human experimental pain research is a way to gain quantitative insight into the basic mechanisms involved in the neuroplastic transduction, transmission, processing, and modulation of nociception. The sensory responses to various stimulus modalities are needed to assess the differentiated reactions to the different natural sensory stimuli. Better knowledge of the mechanisms underlying central neuroplasticity can lead to better management of painful conditions.</p>

5.2 Kongens Lyngby

Institution:	Automation (AU), Technical University of Denmark
Address:	Ørsted - DTU, Automation Elektrovej, bldg. 326 DK-2800 Kgs. Lyngby Denmark
Contact:	Prof. Ole Ravn
Phone:	+45 45253560
Fax:	+45 45881295
Email:	or@oersted.dtu.dk
URL:	http://www.oersted.dtu.dk/au/index.html
Faculty:	3 Professors, 8 Associate Professors, 2 Assistant Professors, 2 Research Assistants
Post-Docs:	
Students:	8 Ph.D. students
Projects	<p>The Institute of Automation (AU) at the Technical University of Denmark conducts research and teaches within the areas of control and supervision of complex dynamic systems. The aim of the research is to develop a systems approach that integrates control theory, artificial intelligence and advanced signal processing techniques in the design of robust, fault tolerant and transparent control systems. Research results are used within several industrial domains such as autonomous robots and manipulators, space systems, and process controls.</p> <p>AU works with autonomous systems on several levels. Some of the activities include development of methods and software architectures for general autonomous systems. The software architectures are hierarchical and covers the spectrum from the servo level to the mission planning level. The methods developed are tested on different kinds of systems, including underwater vehicles, autonomous vehicles and system manipulators.</p> <p>For example, we have initiated research into a new kind of unmanned aerial vehicle (UAV) that endeavours to remove the pilot altogether, and to investigate an autonomous system for flight control. It is the goal of this investigation that the control system will control the airplane to autonomously take off from a landing strip, conduct a series of manoeuvres and return to land safely on the landing strip. The commands to the control system are established through a description of a route map by a series of waypoints.</p> <p>Many experimental systems have been designed, developed and built at the department in the context of research on autonomous systems and manipulators. The experimental setups are used heavily in the research done in the group and many projects include experiments on real robots in real environments.</p>

5.3 Odense

Institution:	Mærsk Mc-Kinney Möller Institute for Production Technology, University of Southern Denmark
Address:	Campusvej 55 DK-5230 Odense M Denmark
Contact:	Prof. John Hallam
Phone:	+45 65 50 35 46
Fax:	+45 66 15 76 97
Email:	john@mip.sdu.dk
URL:	http://www.mip.sdu.dk/
Faculty:	5 Professors, 2 External Professors, 5 Associate Professors, 5 Assistant Professors, 7 Research Assistants
Post-Docs:	
Students:	13 Ph.D. students
Projects	<p>The Maersk Mc-Kinney Möller Institute for Production Technology at the University of Southern Denmark in Odense hosts research groups in software engineering, applied mathematics, industrial robotics, self-reconfigurable robotics and modern AI methods. The AdapTronics group performs research in the field of embodied artificial intelligence with focus on the integration of morphology, control, and material. The Intelligent Artefacts project develops physical building blocks that have processing power. The way that the user puts the electronic bricks together determines the functionality of the construction as well as the shape. The HYDRA project develops artefacts inspired by cell-biology and based on simple building blocks. The aim is to construct robotic systems that can change morphology, and should result in flexible, robust and applicable artefacts. A team of our Viki small humanoid robots won the RoboCup Humanoids Free Style World Championship in 2002.</p> <p>The main research areas of the Robotics group are applied mathematics, computer systems for industrial automation, and industrial computer vision. Applied Mathematics topics include the creation of new meta level robot motion planning methods aimed at increasing robustness both during robot tasking and intertask movements, computational classical mechanics aimed at developing precise mathematical models for control and for solving kinodynamic problems within robot control, control theory of mechanical systems such as robots with a main focus on the development of automatic control methods for underactuated mechanical systems, and process modelling handling new methods for using advanced CAD for computing trajectories for surface treatment tools, e.g. spray painting tools, based on process models.</p> <p>Topics within Computer Systems for Industrial Automation are: safety critical and real-time performance analysis, and the interaction and composition of software and hardware in flexible production systems with the goal of minimizing the costs of installation, startup and maintenance of these systems.</p> <p>The aim of research in Industrial Computer Vision is fast and flexible vision systems interpreting the highly complex 3D scenes encountered in industrial manufacturing, so that the automation of small-series production becomes feasible and profitable. The main topics are recognition and localization of randomly piled objects by means of stationary cameras, and camera-robot feedback systems using cameras mounted on the gripping tool of the robot.</p>

6 Estonia

6.1 Tallinn

Institution:	Tallinn Technical University
Address:	Akadeemia tee 21 Institute of Cybernetics 12618 Tallinn Estonia
Contact:	Prof. Jüri Vain
Phone:	+372 6 204 190
Fax:	+372 6 204 151
Email:	vain@ioc.ee
URL:	http://www.ttu.ee/
Faculty:	1 Professor, 4 Research Assistants
Post-Docs:	
Students:	5 Ph.D. students
Projects	<p>Tallinn Technical University (TUT), Estonia, incorporates research groups in mechatronics, industrial robotics, CS, control and system sciences who jointly pursue research and development on intelligent autonomous systems.</p> <p>Research focuses on the following topics:</p> <ul style="list-style-type: none"> • Hybrid dynamical systems; • Nonlinear control theory; • Field robotics and mechatronics technologies; • Rehabilitation related robotics. <p>TUT is an initiator in developing a research-intensive enterprise environment and is one of the founders of Tallinn Technology Park Development Foundation. In the long term TUT plans to set up an international-level technology centre in Tallinn.</p> <p>The Mechatronics group in the Mechanical Engineering Dept. pursues collaborative projects including joint courses with the Helsinki University of Technology (Finland) and the ROBOTEX robot building competition with the Royal Institute of Technology (Sweden) and the University of Tartu (Estonia). Among their most successful projects are: development of a soot blower with super long travel, implementation of a super-sonic flame sprayer, and design and implementation of biomedical rehabilitation devices.</p> <p>Intelligent Manufacturing Systems and Robust Control research groups are located in the Control Systems Dept. The Real Time Systems Group (ISP) is in the Department of Computer Control.</p>

7 Europe

7.1 Joint Research Centre

Institution:	Institute for the Protection and Security of the Citizen
Address:	Via E. Fermi 1 I-21020 Ispra (VA) Italy
Contact:	Emilio Ruiz Morales
Phone:	+39 0332 78 9889
Fax:	+39 0332 78 5409
Email:	emilio.ruiz@jrc.it
URL:	http://ipsc.jrc.cec.eu.int/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Remote Inspection and Tele-operation Laboratory of the Institute for the Protection and Security of the Citizen (EC- Joint Research Centre), is involved in the design, development, validation and demonstration of robotics technologies (including mechanical systems, mobile robots, manipulators, 3D computer simulation, software architectures and sensory integration) to be applied in Nuclear Safeguards and in storages of strategic material.</p> <p>The Surveillance and Information Retrieval sector is involved in R&D and support activities related to the development of systems for surveillance, tele-operation in advanced storage areas and plant design verification. The technologies used in this work cover: 3D-scene reconstruction; augmented reality; robotics; and secure data transmission and information retrieval.</p> <p>The centre also does considerable work in the field of Monitoring Agriculture with Remote Sensing.</p>

8 Finland

8.1 Helsinki

Institution:	Automation Technology Laboratory, Helsinki University of Technology
Address:	P.O. Box 5500 FIN-02015 HUT Finland
Contact:	Prof. Aarne Halme
Phone:	+358 9 451 3301
Fax:	+358 9 451 3308
Email:	aarne.halme@hut.fi
URL:	http://www.automation.hut.fi/
Faculty:	3 Professors, 19 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The Automation Technology Laboratory in Helsinki deals with automation and industrial process control technology, mechatronics and robotics in mobile applications, media and network technology, and certain fields of new energy technology, like fusion technology and fuel cells. The group working in robotics has background and long term experience in mobile robotics, perception and navigation technology. The group working on media and network technology has experience in virtual reality, augmented tele-presence and tele-operation technologies.</p> <p>We have produced a ball shaped mobile robot which can move on the ground using an internal driving mechanism and on-board micro-controller based control system. It has many interesting features and creates challenges in motion control, environment perception and navigation problems. Applications are being sought in the field of service robotics, in space exploration or in the amusement industry. It is also used in a tele-education project, where six universities in the United States and Europe co-operate to set up a virtual international laboratory for control experiments related to aerospace and robotics.</p> <p>Research into mobile multi-robot societies uses small robots which can execute tasks together in a co-operative way. A small prototype underwater robot called SUBMAR has been developed for the inspection of the inside of liquid processing plants. Multiple SUBMARs can form a multi-robot system called "bacterial robot society". An industrial product development phase has been started with research foci on adding sensors and actuators, and on diminishing the size of the robots by using micro-mechanical components.</p> <p>We are involved in the design and development of the control and imaging system for an in-vessel inspection system for the ITER (International Termonucleic Experimental) Reactor, a very challenging project. Further research includes the development of a smart rowing robot which can imitate human rowing with equally low power consumption, a laser-based collision avoidance and navigation system for fast small scaled ships commuting in European coastal or in-land waters, and the design and manufacture of a prototype small scale ROV for inspecting oil tankers' ballast tanks while loaded with water.</p>

8.2 Oulu

Institution:	Intelligent Systems Group, University of Oulu
Address:	Computer Engineering Laboratory PO BOX 4500 FIN-90014 Oulu Finland
Contact:	Prof. Juha Röning
Phone:	+358 9 451 3301
Fax:	+358 9 451 3308
Email:	Juha.Roning@ee.oulu.fi
URL:	http://www.ee.oulu.fi/research/isg/
Faculty:	2 Professors
Post-Docs:	
Students:	14 Ph.D. students
Projects	<p>The Intelligent Systems Group at the University of Oulu studies mobile robots that serve humans. The work concentrates on software architectures, control methods, and machine vision. We emphasize the need to adapt to the environment. We see robots as components of an intelligent environment.</p> <p>The principal goal of our research is to develop components for intelligent systems which are autonomous, adaptive, and able to correct their own mistakes. Such features imply that the system has an ability to perceive, reason, act, and learn from experience.</p> <p>In signal analysis research, we are interested in identifying technical and biological systems and in determining their state. This information can be used in diagnostics applications for inferring whether a target system is working properly and in predicting the future behaviour of a system. Another area of application is in intelligent systems that perceive environmental signals in order to adapt to them.</p> <p>Our work on intelligent systems and signal analysis focuses on context-aware mobile systems, biomedical signal analysis and data mining.</p>

9 France

9.1 Cergy

Institution:	Equipe Traitement des Images et du Signal (ETIS)
Address:	6, avenue du Ponceau 95014 Cergy-Pontoise Cedex France
Contact:	Mathias Quoy
Phone:	+33 1 30 73 62 92
Fax:	+33 1 30 73 66 27
Email:	Mathias.Quoy@dept-info.u-cergy.fr
URL:	http://www-etis.ensea.fr/
Faculty:	5 Professors, 13 Assistant Professors, 2 Research Assistants
Post-Docs:	
Students:	15 Ph.D. students
Projects	<p>ETIS is a joint lab of the Cergy-Pontoise University (UCP) and the engineering school in electronics and applications (ENSEA). Inside this lab, the neurocybernetics team is developing control architectures for autonomous and reactive mobile robots in unknown (inside) environments. The emphasis is on the cognitive aspects by the study of learning and imitation algorithms. These architectures are based on neubiological models using artificial neural networks. Navigation is solely based on visual information extracted from a panoramic image. Different places in the environment are learned and combined in a cognitive map that enables movements planning and action selection.</p> <p>Neurocybernetic research aims to understand the mechanisms used when an animal learns how to survive in its environment and apply them to autonomous robots. This leads us to adopt an approach which does not allow supervised neural networks and to consider only algorithms whose phases of training and use are not separate.</p> <p>We have a team of robots which learn to survive in an indoor environment. In the pre-training phase, our robot extracts a great number of visual indices from a camera image, enabling the robot to focus attention on particular areas which can be learned. After individual training, with its research problems of navigation, of planning and action selection, collective training may take place. This work relates to the study of the imitation as an adaptive process for training autonomous robotics, using gestures for interaction, communication and social exchange. The ability to imitate, makes it possible to facilitate and accelerate the sensorimotor training and exploration. A robot provided with a mechanical arm could thus quickly learn from a model the relevant actions necessary for a given task.</p> <p>Our thesis is that one can obtain a simple imitative behaviour, called "proto-imitation", without requiring high level concepts like the recognition of oneself, of other, or intentionality.</p>

9.2 Clermont-Ferrand

Institution:	GRAVIR team, LASMEA laboratory
Address:	24 Av des Landais 63177 AUBIERE Cedex France
Contact:	Philippe Martinet
Phone:	+33 4 73 40 72 50
Fax:	+33 4 73 40 72 62
Email:	martinet@lasmea.univ-bpclermont.fr
URL:	http://www.lasmea.univ-bpclermont.fr/
Faculty:	9 Professors, 10 Assistant Professors, 4 Research Assistants
Post-Docs:	
Students:	20 Ph.D. students
Projects	<p>The GRAVIR group has been engaged in research in the field of vision for robotics for nearly twenty years. Its work is aimed at designing machines endowed with a considerable degree of autonomy ("intelligent" machines), thanks to perception systems employing sensors such as CCD video cameras, radar, lidar or GPS. The continually rising social and economic demand for such machines is the result of scientific and technological advances achieved over the last few years, to which the group has made significant contributions which are recognized nationally, internationally and in the world of industry.</p> <p>Our major research focus is into perception in its widest sense, from the modelling of sensors capable of perceiving the environment to the interpretation of the scenes observed, and including the extraction of visual primitives and the fusion of heterogeneous data.</p> <p>This includes the calibration or self-calibration of video sensors; the complete calibration of the geometrical model of robot arms; the segmentation of depth images; the fusion of video and telemetric data and the creation of an original virtual reality prototype dedicated to surgical operations; the recognition of three-dimensional objects for robotics; the identification of types of pollen, dust and moulds in suspension in the air; and the interpretation of sound signals, the objective being recognition of a speaker and measurement of the intelligibility of speech. Other recent work has concentrated on visual location, the dynamic monitoring through video flow of three-dimensional objects, dense reconstruction by axial stereoscopic vision, and the development of original techniques for modelling generalized cylinders, this last activity being designed to reconstruct scenes of pipework such as those found in many industrial sites.</p> <p>Our other major research focus is the Assisted Driving Project, which aims to study the activity of car driving and to identify assistance functions which could improve driver comfort and safety, with particular focus on perception of the environment for location, recognition and control; and on on-board architectures. We also carry out research into architectures (machines for vision, fast prototyping), control (visual servoing, mobile robot guidance), robotics for agriculture and the food industry, and remote manipulation and virtual reality.</p>

9.3 Grenoble

Institution:	University of Josef Fourier
Address:	TIMC lab BP 53 38041 Grenoble cedex 9 France
Contact:	Jocelyne Troccaz
Phone:	+33 4 56 52 0006
Fax:	+33 4 56 52 0055
Email:	jocelyne.troccaz@imag.fr
URL:	http://www.ujf-grenoble.fr/ujf/fr/welcome.phtml
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The TIMC (Techniques for Imaging, Modelling and Cognition) laboratory is affiliated both to the Université Joseph Fourier (UJF) and to the CNRS (Centre National de la Recherche Scientifique) and has specialised in the application of mathematical and computer science tools to medical problems. Inside this laboratory of 150 researchers, a team of about 35 researchers is devoted to a programme called Computer Assisted Medical Interventions (CAMI). The clinical objective is to assist physicians by providing them with systems for accurate planning, simulation and computer or robotic assistance for medical or surgical actions. The scientific activity of the CAMI group includes: image processing and data fusion, human tissue modelling, simulation of medical interventions, computer-based medical instrumentation including the development of various types of assistance for physicians, robotics, methodology, design and evaluation of man-machine interfaces for CAMI, and a virtual university for surgery. The team has developed several systems used in clinical routine. Its main partners are the Grenoble University Hospital and the PRAXIM company.</p> <p>We are particularly interested in medical robotics, and developed one of the first robots used worldwide for neurosurgery. Our philosophy is to design robotic systems enabling real interaction with the clinician and robots fully adapted to the clinical constraints. Several robotic projects are going on: a robot named Passive Arm with Dynamic Constraints (or PADyC) is a generic tool for constraining the movement of a surgical tool with respect to a surgical plan. We are also developing three light “body-supported robots”: one endoscope holder, one slave robot for tele-echography, and one puncture robot to be used in CT or MRI imaging machines; and a robotic instrument for knee surgery. Recently we have started a project on biochemical robot actuation.</p>

9.4 INRIA

Institution:	The French National Institute for Research in Computer Science and Control (INRIA)
Address:	<p>Domaine de Voluceau Rocquencourt - B.P. 105 78153 Le Chesnay Cedex France</p>
Contact:	Christian Laugier
Phone:	+33 1 39 63 55 11
Fax:	+33 1 39 63 53 30
Email:	christian.laugier@inrialpes.fr
URL:	http://www.inria.fr/index.en.html
Faculty:	
Post-Docs:	
Students:	
Projects	<p>INRIA is a scientific and technological institute working in the fields of Control and of Information Technology & Communication. INRIA Rhône-Alpes is the research site working in the fields of computer vision, and robotics and control. The main research topics covered are visual servoing, world reconstruction, motion modeling and synthesis, motion planning, mobile robot navigation and control, autonomous vehicles, walking robots, and real-time systems.</p> <p>Research is divided into five main themes: biological systems, cognitive systems, communicating systems, numerical systems, and symbolic systems.</p> <p>Multimodal and incremental modeling of space and motion involves incrementally building several types of models having complementary functional specialisations (as suggested by the neurophysiologists) based on preliminary knowledge and a continuous flow of perceptual data. The intrinsic nature of the problem (world dynamicity, environment complexity, hazards, etc.) leads us to make use of an incremental approach involving techniques for predicting the motions of the potential sensed obstacles, and techniques for combining sensory data and executed actions.</p> <p>Motion planning for the physical world has to simultaneously take into account various constraints such as non-collision, environment dynamicity, or reaction time, while mastering the related algorithmic complexity. These problem characteristics lead us to develop techniques for reasoning about suitable representations of the space-time, e.g. the space of instantaneous safe speeds, or iterative planning under strong temporal constraints.</p> <p>Other research interests include image synthesis; virtual environments for animation and image synthesis of natural objects; 3-dimensional interaction; visual learning and recognition; modeling, localization, recognition and interpretation in computer vision; perception, recognition and integration for observation of activity; architectures of networks of services; programming and operating systems for applications in real-time; system validation; algorithms and scheduling for distributed heterogeneous platforms; regularity; and massively parallel computing.</p>

9.5 Montpellier

Institution:	Laboratory for Computer Sciences, Robotics and Microelectronics of Montpellier (LIRMM)
Address:	161, rue Ada 34392 Montpellier Cedex 5 France
Contact:	Dr. Etienne Dombre
Phone:	+33 467 418 558
Fax:	+33 467 418 500
Email:	dombre@lirmm.fr
URL:	http://www.lirmm.fr/w3rob/
Faculty:	
Post-Docs:	1 person
Students:	23 Ph.D. students
Projects	<p>The Laboratory for Computer Sciences, Robotics and Microelectronics of Montpellier (LIRMM) is a research center jointly depending from the French National Council for Scientific Research (CNRS) and the Montpellier University. Its research activities covers three areas : i) design, modeling, identification, optimization and control of complex mechanisms, ii) perception, navigation and pilotage of mobile vehicles, iii) optimization and supervision of complex systems. These topics are complementary and interact through the application fields they address: manufacturing, industrial robotics, machine-tools, medical robotics, intervention service robotics, underwater robotics, artificial locomotion, and telerobotics.</p> <p>The medical robotics group aims to create intrinsically safe robotics systems intended to assist doctors and surgeons. Our main research interests are kinematic design and optimization, analysis of surgeon motion and of the interaction between surgical instruments and organs, development of advanced robust control (model-based control, sensory-based control, position-force control), and skill acquisition through the programming of complex surgical tasks. We are currently involved in the design of BRIGIT (from MEDTECH company, Nîmes), a robotic device to assist orthopaedic surgeons, and are also designing a platform for the development and assessment of advanced robotic functions for minimally invasive surgery (MIS), with great emphasis on beating heart procedures.</p> <p>Research in the Robot Design and Control group primarily addresses robotics systems for medical applications involving force control, dynamic parameter identification and advanced control, and the design and control of parallel mechanisms for robotics and machine-tools.</p> <p>Research in the Perception and Mobile Robotics Group includes omnidirectional robot control, mobile robot localization and environment mapping, and and biologically inspired robotics.</p> <p>Networked Robots research focuses on cooperative mobile robots, hybrid position/signal level control architecture using GPS/Wifi technologies, and supervisory control for wireless connections.</p> <p>We also conduct research into tele-robotics; navigation, perception and control of mobile vehicles; cooperation and coordination of multi-robot systems; the management and supervision of complex systems; and have developed the Autonomous Underwater Vehicle TAIPAN 1.</p>

9.6 Nantes

Institution:	The Communication and Cybernetics Research Institute of Nantes (IRCCyN)
Address:	1, rue de la Noë P.O. Box 92101 44321 Nantes Cedex 03 France
Contact:	Wisama Khalil
Phone:	+33 240376946
Fax:	+33 240376930
Email:	Wisama.khalil@irc cyn.ec-nantes.fr
URL:	http://www.irc cyn.ec-nantes.fr
Faculty:	
Post-Docs:	
Students:	15 Ph.D. students
Projects	<p>The Communication and Cybernetics Research Institute of Nantes (IRCCyN) is a joint research center between two engineering schools (Ecole Centrale de Nantes and Ecole de Mines de Nantes) and of the University of Nantes. The main research topics of IRCCyN include automatic control, robotics, radar, communication, signal processing, and computer sciences. The research topics in robotics include: modeling, design, identification, calibration, and control of robots-manipulators (serial or parallel, rigid or flexible) and mobile robots (wheeled or walking), localization of mobile robots, and tele-operation.</p> <p>Robot modeling is the first step in the design and control of robots. This is necessarily based on a good study of the characteristics of robot models. We model rigid robots, flexible structures for robotics, and attempt to identify rigid robots and systems with lumped elasticity. Accurate knowledge of the values of the geometric and inertial parameters as well as electromechanical actuator constants is essential to any model based control law and also to off-line programming.</p> <p>Robot control is the principal objective of our modeling and identification work. We work with both rigid and flexible industrial robots, and with wheeled mobile robots. Our work with mobile robots includes research into localization, identification and control of mobile robots, reference trajectories for walking robots, control of walking robots, and control of indoor flying robots.</p>

9.7 Paris

Institution:	Laboratory of Physiology of Perception and Action, Collège de France
Address:	11 place Marcelin Berthelot 75005 Paris France
Contact:	Prof. Alain Berthoz
Phone:	+33 1 44 27 14 04
Fax:	+33 1 44 27 13 82
Email:	michel.francheteau@college-de-france.fr
URL:	http://www.college-de-france.fr/chaieres/chaire3/index.htm
Faculty:	
Post-Docs:	
Students:	30 Ph.D. students
Projects	<p>The Laboratory of Perception and Action at the College de France concerns itself primarily with human physiology. The main themes of research are the following:</p> <ul style="list-style-type: none"> • a 3D visual shape and object perception and multi-sensory integration in structure from motion, including psychophysics, modeling, brain imaging (fRI-MEG), and Bayesian modeling of navigation and gaze control; • b Control of eye movements (saccade, vergence, accomodation, child development). Techniques used include psychophysics, TMS, and brain imaging with fMRI; • c Vestibular and visual interaction in motion perception. Equipment used include a mobile robot and virtual reality. Tests are carried out on both neurological and psychiatric patients; • d Steering of locomotion and coordination between posture and locomotion, using mathematical modeling and biomechanical motion capture techniques on neurological patients; • e Spatial memory during navigation, including problems of reference frames. This work on neurological patients, done in cooperation with roboticists, uses virtual reality and brain imaging (fMRI); • f Motor control, haptic-visual cooperation, and force feedback. <p>The main research themes concerning animal physiology are the following: (a) Neural mechanisms of visuo-motor transformations in colliculus and brain-stem for the control of eye movements; (b) Neural mechanisms of multisensory interaction in the parietal cortex; (c) Development of the visual cortex; (d) Neural mechanisms of spatial memory in the hippocampus.</p> <p>The laboratory participates in EUREKA industrial projects, Human frontier, and EEC 5th program projects, and also has projects on the International space station with ESA CNES and NASA.</p>

9.8 Robosoft

Institution:	Robosoft
Address:	Technopole d'Izarbel 64210 Bidart France
Contact:	Dominique Villenave
Phone:	+33 5 59 41 53 60
Fax:	+33 5 59 41 53 79
Email:	dominique.villenave@robosoft.fr
URL:	http://www.robosoft.fr/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>ROBOSOFT was established in 1985 by INRIA researchers, and is now recognized as a leading supplier of advanced robotics solutions throughout Europe and beyond. ROBOSOFT has built up unique expertise in service activities automation. Our experience in robotics, more precisely in subsets integration and automatic control, allows provision of operational robotic solutions in five areas:</p> <ul style="list-style-type: none"> • Education and research in robotics, • Transport : automatic transport of goods and people, automatic gas refuelling, • Cleanliness : automatic floor and windows cleaning, • Security : remotely operated mobile robots, • Health : assistive mobile robots for elderly and handicapped people. <p>While education, transport, cleanliness and security have reached a commercial level with identified products and running applications, health area is still at the research level.</p> <p>Nowadays our main application areas are in three sectors: Biomedical, Automotive and Safety & Surveillance. ROBOSOFT supplies advanced mobile robotics solutions to drastically reduce the cost of services in transport and cleanliness, thanks to its line of mobile robots, called ROBUTERS TM, its embedded technology of embedded control systems and its expertise demonstrated in various fields of service robotics since 1985, including research. We are also able to build, from an existing installation, need or idea, a robotic solution which is both essential and profitable.</p> <p>ROBOSOFT has long experience in designing complex robotic solutions in both manufacturing and services, which with good marketing and industrialization experience leads to cost effective and usable products.</p>

9.9 Toulouse

Institution:	Robotics and Artificial Intelligence group, LAAS
Address:	LAAS-CNRS 7, avenue of Colonel Roche 31077 Toulouse France
Contact:	Raja Chatila
Phone:	+33 5 61 33 63 44
Fax:	+33 5 61 33 64 55
Email:	raja@laas.fr
URL:	http://www.laas.fr/RIA/RIA.html
Faculty:	4 Professors, 17 Researchers
Post-Docs:	4 persons
Students:	32 Ph.D. students
Projects	<p>LAAS is a research unit of the French National Centre for Scientific Research (CNRS) associated with Toulouse Universities and Schools (UPS, INP, INSA). Its domains are Automatic Control, Computer Science, Microelectronics, and Robotics. The Robotics and Artificial Intelligence group focuses its research on the study and design of autonomous machines integrating perception, action and reasoning capabilities. These machines have to interact rationally with a variable and dynamic environment for achieving a wide diversity of tasks. The rationality of a robot's behavior corresponds to its performance, autonomy and robustness, with respect to the variability of the environment and diversity of tasks. It is a rationality bounded by the complexity of time constrained processing, the inaccuracy and uncertainty of sensory information, and the incompleteness of models and programs. The group conducts its research through formal developments and experimental investigations.</p> <p>The objective of the project "Robotics in Natural Environments" is to study, design, develop and integrate on-board a robot the various functionalities required by autonomous navigation in outdoor environments. It led to some important results, for example, in autonomous navigation and environment modeling, consistently integrating several models with multiple representations, and in robot motion planning, control and sensing capabilities. Recently, the project evolved towards aerial robotics and multi-robot cooperation.</p> <p>The project "Robotics in Human Made Environments" concerns well structured environments, indoor or outdoor, for which a priori knowledge is available. It addresses problems such as navigation in cluttered environment integrating motion and exteroceptive perception, scene modeling and understanding, coordinated motion and manipulation, dynamic planning and supervision, as well as multi-robot cooperation for sharing resources, tasks and goals. It raises the important issue of human - robot interactions.</p>

10 Germany

10.1 Aachen

Institution:	Aachen University of Technology (RWTH Aachen)
Address:	Department of Technical Computer Science Ahornstraße 55 52074 Aachen Germany
Contact:	Prof. Dr. Karl-Friedrich Kraiss
Phone:	+49 241 80 26101
Fax:	+49 241 80 22308
Email:	kraiss@techinfo.rwth-aachen.de
URL:	http://www.techinfo.rwth-aachen.de/
Faculty:	1 Professor, \approx 14 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The Knowledge-Based Systems and Cognitive Robotics Group at RWTH Aachen is involved, among other things, in designing, implementing, and applying high-level languages for the control of mobile robots. In particular, we have recently extended the logic-based language GOLOG, originally developed at the University of Toronto, to account for continuous change, event-driven behavior and noisy sensors and effectors. The language has been implemented on an RWI B21 and custom-built robots intended for the Robocup Mid-Size League. The target of this project is developing a deliberative component supporting precisely coordinated behaviour of multirobotic systems under real-time constraints in highly dynamical environments.</p> <p>Other work involves sound localization on mobile robots, diagnosis of execution failures, cooperative perception and problem solving, and multi-robot localization.</p> <p>Computer Science group research interests include mobile service robots, robot simulation, active vision for object localization and identification. The 3D-reconstruction of the robots' working area also constitutes a field of interest, as does automatic sign language recognition, including vision-based hand analysis and mimic exploitation.</p> <p>Adaptive tutoring systems (also known as "intelligent user interfaces" or "Associates") research deals with the extraction of a user's knowledge based only on the observation of a user's interaction with a device.</p>

Institution:	European Centre for Mechatronics (APS)
Address:	Reutershagweg 4 52074 Aachen Germany
Contact:	Günther Starke
Phone:	
Fax:	
Email:	Starke@aps-mechatronik.de
URL:	http://www.aps-mechatronik.de
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The European Centre for Mechatronics (ECM) is a research facility located in Aachen, Germany. We develop interdisciplinary concepts and solutions in cooperation with national and international industry partners, contracting authorities and researchers. We focus on introducing smaller and middle-sized enterprises to the use of innovative technologies.</p> <p>Key research areas include mobile robotics and teleservice, sensor development and sensor fusion, actuator development, production automation, automated handling of hazardous goods, and advanced control systems.</p> <p>Current projects include the Autonomous Robot System, Road Robot, and the de-commissioning of hazardous industrial machinery.</p>

10.2 Bielefeld

Institution:	Applied Computer Science Group, University of Bielefeld
Address:	Technische Fakultät Angewandte Informatik Postfach 100 131 33501 Bielefeld Germany
Contact:	Prof. Dr.-Ing. Gerhard Sagerer
Phone:	+49 521 106 2935
Fax:	+49 521 106 2992
Email:	sagerer@techfak.uni-bielefeld.de
URL:	http://www.techfak.uni-bielefeld.de/ags/ai/
Faculty:	2 Professors, 1 Assistant Professor
Post-Docs:	4 persons
Students:	13 Ph.D. students
Projects	<p>The Applied Computer Science Group at Bielefeld University is carrying out interdisciplinary research in different fields of pattern recognition and analysis. The main research areas investigated are computer vision, speech recognition and understanding, cognitive systems, human-machine interaction, and bio-informatics.</p> <p>The main focus of research is on building cognitive systems for man-machine interaction in real environments. The ultimate goal is to model the ability of humans to understand visual and acoustic information, to communicate using spoken language, to plan and execute actions, and to establish a multi-modal memory representation of a dynamic environment. Techniques for robust scene understanding, recognition of manipulation actions, multi-modal dialogue integrating speech and vision processing, and architectures for large distributed pattern analysis systems are developed.</p> <p>The Cognitive Robotics section of the Neuroinformatics group uses a robot system with a multi-fingered manipulator and an active binocular camera head to investigate how to coordinate robot actions with those of a human partner. We focus on dextrous manipulation of objects, combining tactile and visual sensing, the joining of action primitives into action sequences and the development of learning algorithms.</p> <p>Active research areas include:</p> <ul style="list-style-type: none"> • The GRAVIS (Gestural Recognition Active Vision) robot architecture • Wave expansion neural networks for robotic exploration and path planning • Tactile control of a multifingered hand • Combination strategies for robot motion primitives • Rapid learning in robotics • Active vision with a binocular robot head • Tracking of eye movements and visual attention

10.3 Bochum

Institution:	Institute of Neurocomputing, Ruhr-University, Bochum
Address:	Universitätsstr. 150 Building ND 44780 Bochum Germany
Contact:	Prof. Dr. Christoph von der Malsburg, Prof. Dr. Gregor Schöner
Phone:	+49 234 32 28998
Fax:	+49 234 32 14210
Email:	systembiophysik@neuroinformatik.ruhr-uni-bochum.de , Gregor.Schoener@neuroinformatik.ruhr-uni-bochum.de
URL:	http://www.neuroinformatik.ruhr-uni-bochum.de/top.html
Faculty:	2 Professors, 1 Junior Professor, 2 Lecturers, 25 Research Assistants
Post-Docs:	2 persons
Students:	
Projects	<p>The Institute for Neurocomputing is an independent university research institute. Our scientific goals are behavioral organization, perceptual modeling, learning of manipulation skills, integration of modalities, and human-machine interaction. Our approach consists of distilling biological findings and models into technical solutions.</p> <p>Our research in object recognition attempts to classify objects in terms of their shape independently of surface markings. We have developed a system based on Elastic Graph Matching which is able to perform such classification based only on object contours. We have also developed a mechanism to control visual attention.</p> <p>Object manipulation research is divided into three topics. First, grip planning dependant upon visual object recognition and commands from humans. Second, the planning and generation of trajectories, and third the handling of tactile sensor contact during grasping.</p> <p>Our research on human-computer interaction uses gestures, since these are robust with respect to the noise present in "real-world" environments.</p> <p>We are also involved in the NEUROS project (Neural Skills Of Intelligent Robots), which is a collaborative project which aims to develop the architecture for a general service robot and build a demonstrator which can be used as a research platform; and to develop and implement the basic skills generally needed for service robots.</p>

10.4 Bremen

Institution:	Institute of Automation Technology (IAT), University of Bremen
Address:	IAT Institute of Automation Otto-Hahn-Allee, Building NW1 D-28359 Bremen Germany
Contact:	Prof. Dr.-Ing. Alex Gräser
Phone:	+49 421 218 7325
Fax:	+49 421 218 4596
Email:	ag@iat.uni-bremen.de
URL:	http://www.iat.uni-bremen.de , http://www.iat.uni-bremen.de/default_eng.html
Faculty:	3 Professors
Post-Docs:	1 person
Students:	11 Ph.D. students
Projects	<p>The research group at the Institute of Automation concentrates on problems related to rehabilitation robotics as well as on some aspects of industrial robotics. The research focus is visual servoing, programming by demonstration, software control architectures, semi-autonomous task execution and redundant kinematics.</p> <p>Service robotic research work concentrates on the support of handicapped or older humans. Both classical and behavior-based algorithms for semi-autonomous control of mobile systems equipped with a bionic arm are examined. One control technique is "Programming by demonstration" (PbD), which makes the programming of complicated motions much easier. The basic principle involves the detection and processing of a human demonstrating the task to be programmed. The resultant stored motion sequence is then repeated by the robot</p> <p>The PbD method has been used to teach the rehabilitation robot FRIEND to pour drinks into a glass. The pouring trajectory is first demonstrated to the robot, recorded by a Polhemus sensor. Next the recorded data is transformed with regard to a reference point, which in this case is the neck of the bottle relative to the edge of the glass. This transformed trajectory is saved in a list. During the re-execution phase of the robot, the pre-processed relative trajectory will be first transformed to the robot base system, then a camera -system is integrated in the execution loop for the control of the pouring process.</p> <p>Logistics and regulation of product quality are also research foci.</p>

Institution:	International University of Bremen (IUB)
Address:	School of Engineering and Science P.O. Box 750 561 28725 Bremen Germany
Contact:	Prof. Dr. Andreas Birk
Phone:	+49 421 200 3113
Fax:	+49 421 200 49 3113
Email:	a.birk@iu-bremen.de
URL:	http://robotics.iu-bremen.de/
Faculty:	1 Professor
Post-Docs:	
Students:	
Projects	<p>The International University Bremen (IUB) is a private, independent research university founded in 1999. Robotics research at IUB focuses on autonomous systems. The expertise of the robotics group ranges from the development of embedded hardware over mechatronics and sensors to high-level software. On the basic research side of autonomous systems, machine learning and cooperation are core themes of robotics research at IUB. The systems developed at IUB are used in various domains including rescue robots and underwater robots in cooperation with the oceanography group at IUB.</p> <p>One of our research foci is optimising the level of tele-operation for rescue robots. There is a trade-off to be made between full autonomy and full tele- operation. Some degree of autonomy of the robots is highly beneficial. On the other hand, there should always be a human in the loop to judge the correctness and the implications of the provided data.</p> <p>One recently finished project is RoboGuard, a mobile security robot which can be sent by a human to any place where an alarm was generated. Onboard cameras and sensors transmit information through wireless Ethernet to the data network of the company. The images and sensor data transmitted by the robot are sent through the Internet to an authorized person. This project developed an affordable technology infrastructure that reduces the burden caused by the many false alarms generated by standard security systems.</p> <p>Another research area is the improvement of Remote Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs) for the survey and mapping of continental margins. They will also be able to conduct long term monitoring work around offshore installations or e.g. find locations at the sea floor with enhanced fluid/freshwater seepage.</p>

10.5 DaimlerChrysler AG

Institution:	DaimlerChrysler AG, Research & Technology
Address:	Cognition and Robotics Group Alt-Moabit 96A 10559 Berlin Germany
Contact:	Dr. Frieder Lohnert
Phone:	+49 30 39982 239
Fax:	+49 30 39982 491
Email:	frieder.lohnert@daimlerchrysler.com
URL:	http://www.daimlerchrysler.com/dccom
Faculty:	
Post-Docs:	
Students:	
Projects	<p>Technological expertise, speed and flexibility have made DaimlerChrysler the driving force behind progress in the automotive industry. Around 28,000 employees are working worldwide on the research and development of technical innovations. Our research focus is on traffic safety, CO2 reduction and new vehicle concepts.</p> <p>The Cognition and Robotics research group has a broad range of activities in the field of advanced robots for flexible manufacturing for company-internal use, such as sensor-based control, mobile robots, mobile manipulation, robot teams, human/robot interaction, and learning, including safety aspects. DaimlerChrysler is responsible for the “Manufacturing Assistant” mobile manipulator with learning and interaction capabilities in the German funded project MORPHA (www.morpha.de).</p> <p>The core idea of the MORPHA project is to equip intelligent mechatronic systems, particularly robot assistants or service robots, with the capability to communicate, interact and collaborate with human users in a natural and intuitive way.</p> <p>Accomplishing a task sequence in real constantly-changing factory environments requires a maximum of flexibility, achieved by man and machine working together. In particular, the robot needs to be shown round the manufacturing environment and have selected places named, so that it can build a model of the surroundings; and the worker needs to demonstrate complex sequences of operations from which the robot can extract and generalize appropriate task plans. Instruction has to take place not only during an initial training and learning phase but also during regular operation (incremental learning).</p> <p>The human worker is responsible for the command, supervisory, and instructional functions, while the robot assistant carries out boring, repetitive and strenuous operations. In cases where the robot does not know how to proceed, the human worker intervenes to provide guidance and additional instruction. Robot and human worker are, therefore, partners in a joint manufacturing process.</p>

10.6 Fraunhofer

Institution:	Fraunhofer Institute for Autonomous Intelligent Systems (AIS)
Address:	Schloss Birlinghoven 53754 Sankt Augustin Germany
Contact:	Thomas Christaller
Phone:	+49 (0) 22 411427 56
Fax:	+49 (0) 22 411423 84
Email:	thomas.christaller@gmd.de
URL:	http://www.ais.fhg.de/index.en.html
Faculty:	
Post-Docs:	
Students:	
Projects	<p>Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration. The organization participates in future-oriented research projects with the aim of finding innovative solutions to issues concerning the industrial economy and society in general.</p> <p>58 institutes and establishments in Germany and around the world offer their research services to industry and government. Autonomous Intelligent Systems (AIS) is a Fraunhofer Institute based in Sankt Augustin.</p> <p>Knowledge computing and autonomous robots represent the two main focal areas of AIS. Through its activities, the Institute contributes to the emergence of a sustainable information society. Pre-competitive basic research in the field of information technology culminates in application-related developments and individual solutions for customers from industry, research institutions and government departments.</p> <p>Our robot-relevant research areas includes: behavior-based robotics, edutainment robotics, RoboCup, control architectures, sensors, sensor fusion, mathematic modeling, development environment for robots, real time simulation and control of nonlinear systems, Sensor data fusion, Adaptability and learning, Mechatronic and intelligent controllers, Learning aid and learning environments 2 learning materials for robotics, active perception,</p> <p>The spectrum of robot systems developed at AIS are wheeled robots, holonomic robots, walking machines, snake-like robots as well as robot construction kits and modular versatile robot platforms.</p> <p>Current application domains are exploration, inspection, education and entertainment. A particular application focus is sewer robots www.sewerobots.de, in particular semi-autonomous exploration and fault-finding by our snake robot.</p>

Institution:	Fraunhofer Institute for Factory Operation and Automation (IFF)
Address:	Sandtorstrasse 22 39106 Magdeburg Germany
Contact:	Prof. Michael Schenk
Phone:	+49 (0) 391 4090 471
Fax:	+49 (0) 391 4090 473
Email:	info@iff.fhg.de
URL:	http://www.iff.fhg.de/ , http://www.iff.fhg.de/eng/index_engl.html
Faculty: Post-Docs: Students:	
Projects	<p>The Fraunhofer Institute for Factory Operation and Automation (IFF) in Magdeburg conducts application-oriented research and development focusing on the fields of virtual development and training, logistic systems and networks, information logistics, automation, and production and plant management.</p> <p>The Automation division consists of the two departments: Robotic Systems and Intelligent Sensor Systems. Its main expertises are in the areas of service robotics, mobile robots, walking machines, climbing and inspection robots, intelligent handling and assembly systems, laboratory automation, micro- and nano-positioning systems, 3D image processing and analysis, non-visual sensor systems for geometrical and kinematic values. The automation division offers a project spectrum covering feasibility studies, product design, technical development, and the realisation of prototypes in the field of robotics.</p> <p>Fraunhofer IFF also closely collaborates with various institutes at Otto-von-Guericke University in the areas of logistics workshops and simulation techniques, information engineering, visualization techniques and robotics and machine vision. An especially important partnership exists with the university's Institute for Materials Handling and Logistics (IFSL) in the Mechanical Engineering Department.</p>

Institution:	Fraunhofer Institute for Manufacturing Engineering and Automation (IPA)
Address:	Nobelstraße 12 70569 Stuttgart Germany
Contact:	Dipl.-Ing. Martin Hägele
Phone:	+49 (0) 711 970 1203
Fax:	+49 (0) 711 970 1008
Email:	mmh@ipa.fhg.de
URL:	http://www.ipa.fhg.de/english/index.php
Faculty:	5 Group Leaders, 7 Research Assistants
Post-Docs:	
Students:	21 Ph.D. students
Projects	<p>The main focus of the research and development work carried out at the Fraunhofer Institute for Manufacturing Engineering and Automation IPA is directed at solving organizational and technological problems faced by industrial companies active in the manufacturing field. However, more and more often we are also dealing with task fields associated with developments and changes taking place in the service sector.</p> <p>The objective of the research and development projects is to identify and exploit automation and rationalization potentials in enterprises in order to strengthen international competitiveness by making manufacturing sequences cheaper and more environmentally friendly, and also to improve the work place situation.</p> <p>The Fraunhofer IPA aims to realize this objective by developing, testing and implementing methods, components and devices up to and including complete machines and systems. Most of the work carried out is financed by industrial companies. Parallel to this, projects are being worked on which are sponsored as part of public research programs.</p> <p>The long-term strategic aspects of the research - the implementation of which will benefit industrial companies - are being dealt with as part of the research programs sponsored by the BMBF, the DFG and the European Union.</p> <p>With its know-how, the experience it has gained over many years, its qualified personnel and its technical/technological equipment, the Fraunhofer IPA is ready to deal with any manufacturing problem.</p>

Institution:	Fraunhofer Institute for Production Systems and Design Technology (IPK)
Address:	Pascalstraße 8-9 10587 Berlin Germany
Contact:	Prof. Dr.-Ing. Eckart Uhlmann
Phone:	+49 (0) 30 390 060
Fax:	+49 (0) 30 391 1037
Email:	eckart.uhlmann@ipk.fraunhofer.de
URL:	http://www.ipk.fhg.de/english
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Fraunhofer Institute for Production Systems and Design Technology (IPK) conducts applied research and development in future-oriented technologies for production processes in factories. Furthermore, its activities are extending increasingly into new areas of application in the flourishing fields of medical technology, service robotics, traffic management, globalization management, service management, virtual product and process development, product manufacturing, process control and optimization, and safety, security and testing systems.</p> <p>IPK was and is still involved in many national and international projects, which are either publicly funded or sponsored by industrial companies. In co-operation with partners from industry, research results are transferred to industrial practice.</p> <p>R&D covers all areas of industrial robotics, service robotics and medical robotics. The main areas of relevant research are carried out by the Automation and Robotics group. These include precision enhancement; new control methods and algorithms; planning and simulation systems; robot simulation; simulation for training and development; diagnosis systems and teleservice; sensor integration; optimization of technological processes; mobile systems and service robotics.</p> <p>The Security and Testing group carries out research in various types of automatic image analysis, including movement analysis and visual linear measuring systems.</p>

10.7 Freiburg

Institution:	Department of Computer Science
Address:	University of Freiburg Georges-Koehler-Allee Geb. 079 79110 Freiburg im Breisgau Germany
Contact:	Prof. Dr. Wolfram Burgard
Phone:	+49 (761) 203-8026
Fax:	+49 (761) 203-8007
Email:	burgard@informatik.uni-freiburg.de
URL:	http://www.informatik.uni-freiburg.de/index.en.html
Faculty:	3 Professors, 1 Assistant Professor
Post-Docs:	5 persons
Students:	≈ 10 Ph.D. students
Projects	<p>At the Department of Computer Science of the University of Freiburg the groups Autonomous Intelligent Systems, Foundations of Artificial Intelligence as well as Pattern Recognition and Image Processing are carrying out research in the field of robotics. Over the past years these groups have developed a variety of innovative techniques for robot navigation, robot coordination, state estimation, sensor interpretation, and control that lead to robust and successful robotic systems. These systems range from tele-operated mobile robots that operated as interactive agents in populated environments for extended periods of time to a highly successful RoboCup team (world champion in the mid-size league in 1998, 2000 and 2001).</p> <p>We use the soccer game as a testbed for developing and testing new techniques, particularly in the areas of self-localization and navigation, cooperative sensing and multi-agent cooperation, rationale action selection, and learning.</p>

10.8 Hagen

Institution:	Control Systems Engineering Group (PRT), University of Hagen
Address:	Department of Electrical Engineering P.O. Box 940 D-58084 Hagen Germany
Contact:	Prof. Dr.-Ing. Michael Gerke
Phone:	+49 (2331) 987 1100
Fax:	+49 (2331) 987 354
Email:	Michael.Gerke@FernUni-Hagen.de
URL:	http://prt.fernuni-hagen.de/prt-eng.html
Faculty:	1 Professor, 4 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The Control Systems Engineering Group covers control and robotic related topics within Fern University Hagen. With respect to robotics, research is done in the areas of control of linear motors, optimisation of neural network training, genetic algorithms for robot control, hybrid control systems, coordinated operation and collision avoidance in multi-robot systems, autonomous mobile robots with non-conventional propulsion systems, and flexible configurable control systems for the handling of mobile devices in the field of rehabilitation and geronto techniques.</p> <p>We designed an omnidirectional wheelchair with an integrated robot arm for service purposes. A comfortable handling device with user functionality is built, taking into account simplified modes of operation as well as maximum safety and reliability. These demands require the application of intelligent control structures. In addition to multisensor integration the dominant research deals with safety aspects including collision detection and avoidance.</p> <p>Multirobot workcells include robots of different kinematics and dynamics which carry out coordinated tasks within common workcells. They have to take care of each other in realtime and to interact with common peripheries (such as feeders, machines, AGVs) avoiding collisions. This implies strategies for flexible task management, dynamic assignment of priorities, and fuzzy approaches.</p> <p>Mobile robot research focuses on non-conventional drives and control concepts, and alternative steering systems and drive systems. Mobile robots with conventional drive systems have limited degrees of freedom, whereas 4-wheel-drives in combination with omnidirectional MECANUM wheels provide 3 degrees of freedom in the Cartesian plane. The mathematical description of the vehicles dynamics leads to nonlinear coupled differential equations. The development of a time-domain control to guarantee synchronisation and to avoid slippage is a dominant research topic in this field.</p>

10.9 Hamburg

Institution:	University of Hamburg
Address:	Fachbereich Informatik, Arbeitsbereich TAMS Vogt-Kölln-Straße 30 D - 22527 Hamburg Germany
Contact:	Prof. Dr. Jianwei Zhang
Phone:	+49 40 42883 2430
Fax:	+49 40 42883 2397
Email:	zhang@informatik.uni-hamburg.de
URL:	http://tech-www.informatik.uni-hamburg.de/tamsen.html
Faculty:	3 Professors, 8 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The general purpose of the Technical Aspects of Multi-modular Systems (TAMS) group at the Faculty of Informatics, University of Hamburg is to develop methods and implement integrated real-time systems for acquiring, processing and applying information from multiple channels like robotic vision, speech and sound, touch through action, etc. The research topics include multi-modal control architecture, sensor-based manipulation, robot learning, human perception, man-machine-interaction, computer architecture and VLSI design technologies. In the future, we will further develop methods and systems and apply them in service robots, active media, intelligent sensors and advanced nano-manipulation platforms.</p> <p>Robotics projects include: Context aware digital assistant for accessing complex information systems; Development of new methods of following gestures for man-machine interaction, Action and perception autonomy in interaction with instruction, Multi-sensor-supported aggregate assembly, Nano-manipulation, Navigation and localization of mobile robots in dynamic environments, and Grasping of novel objects utilising vision to detect similarity with known objects.</p>

10.10 Hannover

Institution:	Hannover Centre for Mechatronics (MZH)
Address:	FB Maschinenbau Appelstraße 11 30167 Hannover Germany
Contact:	Prof. Bernardo Wagner
Phone:	+49 (511) 762 5516
Fax:	+49 (511) 762-4012
Email:	wagner@rts.uni-hannover.de
URL:	http://www.mzh.uni-hannover.de
Faculty:	3 Professors, 6 Research Assistants
Post-Docs:	1 person
Students:	≈ 20 Ph.D. students
Projects	<p>The Hannover Center for Mechatronics (MZH) is a joint research center at the University of Hannover for mechatronics and robotics established in 2000. Research fields are: mobile service robots which support people in everyday life, field robots, industrial robots and machine tools in production technology, mechatronics in automotive applications (e.g. anti-lock braking systems), real-time processing and educational robotics. Members of the MZH came from the electrical, the mechanical, and the computer science departments.</p> <p>The Real-Time Systems (RTS) group focuses its work on the fields of distributed automation systems and mobile field robots. Such systems have to interact with real surroundings in a correct, reliable and secure way and furthermore with deterministic time response. Examples of the research fields at the RTS are event-discrete modelling, real-time programming of embedded controllers, networked industrial automation systems, remote handling and control of technical facilities, measuring devices usable over large distances, and real-time compatible operating systems.</p> <p>Some robot research highlights are given below.</p> <p>PaLiDA is a parallel kinematic production machine with linear direct drives. This project investigates the advantages of combining parallel construction with high dynamic drives. The future use of parallel kinematics in industry should augment productivity. Our omnidirectional, autonomous, mobile research platform is now built and available for research into improved localisation, path planning and obstacle avoidance.</p> <p>Our stair climbing project investigates a new operating principle of a wheel based autonomous stair climbing robot. The robots actuators were designed to carry heavy loads e.g. for the transportation of wheelchair users. On plain surfaces the robot moves like a normal four wheeled vehicle in an energy saving manner which is also a very gentle kind of locomotion for the flooring. A special climbing mechanism helps to overcome stages and stairs with different tread and pitch. The mechanisms are arranged in pairs at the front and the rear axle. The stair dimensions are detected by ultrasonic sensors. These data are used to control the wheel and lift mechanisms.</p>

10.11 Ilmenau

Institution:	Neuroinformatics Department, Ilmenau Technical University
Address:	Fachgebiet Neuroinformatik P.O.Box 100565 98684 Ilmenau Germany
Contact:	Prof. Dr. Horst-Michael Gross
Phone:	+49 3677/69 2858
Fax:	+49 3677/69 1665
Email:	Horst-Michael.Gross@tu-ilmenau.de
URL:	http://cortex.informatik.tu-ilmenau.de
Faculty:	1 Professor
Post-Docs:	3 persons
Students:	1 Ph.D. student
Projects	<p>Research in the Department of Neuroinformatics is focused on the development of biologically inspired, behaviour-oriented visuomotor systems, especially mobile robots, with lifelong learning capabilities to adapt perception and behavioral control to changing environmental conditions. The central research topics of the department are: evolution and organization of behaviors in visually guided sensorimotor systems; visually guided mobile robot navigation; adaptive, multi-modal human-robot interaction in complex real environments; and task-relevant visual and auditory attention. The robotics equipment of the department consists of the mobile robots PERSES (PERsonal SERVICE System - based on a B21-platform), HOROS 1+2 (HOME Robot System - based on Pioneer II-platforms), MILVA, and a couple of miniature robots KHEPERA. Today the department is one of the largest and most renowned neural computing and robotics research groups in the eastern part of Germany.</p> <p>PERSES was built as a feasibility study for a shopping assistant for interested customers in the building market. It actively approaches customers, and takes them to the products they need while avoiding obstacles, keeping contact with the customer, and volunteering relevant information. It can also call for technical help. In subsequent projects it is intended to incorporate body language recognition to detect and draw conclusions about the customer's interest or lack of interest.</p> <p>Based on the results achieved within the previous projects PERSES and SERROKON-V, the aim of SERVICE ROBOTER KONZEPTION- Hauptprojekt (SERROKON-H) is to develop a flexible, mobile, and interactive service robot that can be reconfigured for a variety of application domains. In the first instance, in two ambitious prototypical applications: a shopping assistant operating in a home depot store, and a home robot for domestic tasks (entertainment, edutainment, security). Besides the development of the robot platform, special emphasis is placed on the accomplishment of field experiments concerning usability and acceptability within the applications mentioned.</p>

10.12 Kaiserslautern

Institution:	Robotics Laboratory, University of Kaiserslautern
Address:	Arbeitsgruppe Robotersysteme Fachbereich Informatik PO Box 3049 D-67653 Kaiserslautern Germany
Contact:	Prof. Dr. Karsten Berns
Phone:	+49 (0) 631/205 2689
Fax:	+49 (0) 631/205 2640
Email:	berns@informatik.uni-kl.de
URL:	http://agrosy.informatik.uni-kl.de/
Faculty:	1 Professor, 2 Research Assistants
Post-Docs:	
Students:	1 Ph.D. student
Projects	<p>The Robotic Systems research group of Informatics Department of the Technical University of Kaiserslautern focusses mainly on mobile robotic systems for outdoor applications.</p> <p>The main research activities are realization of complex autonomous robotic systems, like wheel-driven indoor- and outdoor vehicles and climbing robots. Main research topics are behaviour based control and sensor fusion for the navigation of autonomous vehicles in unstructured terrain.</p> <p>In the field of humanoid robots, a robotic head will be developed in order to study human-machine interaction. In order to coordinate the complexity of the systems principles taken from nature will be included at all stages: in the development of the mechanism, in the control architecture, and in the intelligent control of behaviour.</p> <p>To expedite the development process of complex robotic systems we are currently developing tools to support implementation of control architectures, and we are also studying innovative computer architectures and electronic concepts.</p>

10.13 Karlsruhe

Institution:	Institute for Computer Design and Fault Tolerance (IRF), University of Karlsruhe
Address:	IRF Dillmann c/o Technologiefabrik Haid-und Neu-Strasse 7 76131 Karlsruhe Germany
Contact:	Prof. Dr. R. Dillmann
Phone:	+49 721 608 3547
Fax:	+49 721 608 4077
Email:	dillmann@ira.uka.de
URL:	http://www.iaim.ira.uka.de/
Faculty:	1 Professor
Post-Docs:	4 persons
Students:	≈ 12 Ph.D. students
Projects	<p>The Institute of Computer Design and Fault Tolerance (IRF) at the computer science department of the University of Karlsruhe researches topics such as autonomous systems, mobile robots, service robots, humanoids, machine learning, human-robot interaction, robot programming by demonstration, and simulation for medicine applications.</p> <p>An associated group at the Research Center for Information Technologies are investigating climbing and service robots and diagnosis systems.</p> <p>In the field of mobile service robots the main focus of the work is the development and steering of high flexible platforms by using multi-joint systems. Actual projects in this field include the development of a four-legged and a six-legged walking machine and a multi-segmental sewer-robot. These robots require adaptive steering systems. Research into the design and architecture of intelligent systems aims to reach the flexibility and "intelligence" of humans as far as possible. Our goal is not only to design intelligent robots, but also to use intelligent systems for the design phase itself. Aspects covered include the construction of robots, their control methods, navigation in intelligent houses, and modelling of interaction and environment. Programming by demonstration, skill learning, skill refinement, gesture and speech recognition (used to command robots), biologically motivated systems, and interactive robot programming using augmented-reality systems are therefore frontline research areas.</p> <p>The medical research group focusses on modelling and simulation of soft tissue and functional biomechanic simulation, intra-operative presentation using see-through-glasses, and oral healthcare. Building complex medical systems requires data acquisition, preprocessing and the generation of geometric models. This is done by using CT and MRI data provided by our medical partners. The forthcoming application of a laser scanning system allows us to extract surface data for evaluation of soft tissue models, for generating virtual plaster casts of teeth or scanning of objects which shall be presented interoperatively. Using this techniques, the medical research group of the IAIM covers the whole chain from data acquisition, data preprocessing, geometrical and functional modelling via planning and simulation of medical tasks up to intraoperative presentation of the results.</p>

Institution:	Institute for Process Control and Robotics (IPR), University of Karlsruhe
Address:	Building 40.28 Kaiserstrasse 12 D-76128 Karlsruhe Germany
Contact:	Prof. Dr. Heinz Wörn
Phone:	+49 721 608 4006
Fax:	+49 721 608 7141
Email:	woern@ira.uka.de
URL:	http://wwwipr.ira.uka.de/
Faculty:	1 Professor, 6 Research Assistants
Post-Docs:	
Students:	5 Ph.D. students
Projects	<p>The scientific team of the Institute of Process Control and Robotics (IPR) performs research in the fields of industrial automation and computer aided therapy both focusing on robotics.</p> <p>Research in the field of industrial automation comprises conception and realisation of sensor based autonomous robots for typical tasks in production i.e. assembly, manipulation, inspection, measuring, and testing. Main issues are collision free motion planning for different robot control systems and algorithms for model based robot calibration. New methods for intuitive and automatic offline-programming of robots are developed as well. Special stress is laid on human robot co-operation integrating multiple sensors and using several co-operation levels. A special challenge is the usage of sensor based co-operative micro robots with direct drives achieving an accuracy of 20 nm in a FEM. One research team designs modular control and diagnosis systems for robots, robot cells and plants i.e. based on multi-agent architectures. We use case based, signal based and model based methods for service and diagnosis of robotic systems. Further research comprises planning and simulation of the digital plant.</p> <p>The coming operating theatre and virtual robot assisted surgery are main issues of our computer aided surgery research programme. This comprises sensor based surgical robots, flexible endoscopes, and visualisation systems for the coming surgical workplace. Methods for modelling and simulating anatomical structures, especially bony tissue and soft tissue close to bones are emphasised. These methods are the basis for our operation planning systems supporting the surgical intervention as well as the planning of the sequential flow of an intervention.</p>

10.14 Kuka Roboter

Institution:	Kuka Roboter GmbH
Address:	Headquarter Blücherstrasse 144 D-86165 Augsburg Germany
Contact:	Arif Kazi
Phone:	+49 (0) 821 797 4000
Fax:	+49 (0) 821 797 1616
Email:	ArifKazi@kuka-roboter.de
URL:	http://www.kuka-roboter.de/
Faculty:	
Post-Docs:	
Students:	
Projects	The KUKA Roboter Group ranks among the world leaders in robot manufacturing, with more than 7000 robots sold in 2002. The company primarily offers solutions for the automotive and metal-working industries, as well as their sub-suppliers. KUKA Roboter has a close relation to both automotive customers and system integrators as full solution providers, yet the share of innovative non-automotive applications is increasing steadily. KUKA has a track record of successful co-operative research projects, both on a European and national level.

10.15 Munich

Institution:	Intelligent Robots Lab, Bundeswehr University, Munich
Address:	Intelligent Robots Lab, LRT / 6 Werner- Heisenberg-Weg 39 85577 Neubiberg Germany
Contact:	Prof. Dr. Volker Graefe
Phone:	+49 89 6004 3587
Fax:	+49 89 6004 3074
Email:	Graefe@unibw-muenchen.de
URL:	http://www.UniBw-Muenchen.de/campus/LRT6
Faculty:	1 Professor, 2 Research Assistants
Post-Docs:	1 person
Students:	
Projects	<p>The Intelligent Robots Lab of Bundeswehr University performs research on intelligent autonomous service robots, including humanoid robots; it continues the work of the former Institute of Measurement Science with largely the same scientists. We aim for both a basic understanding of vision, autonomy and intelligence of technical systems, and the realization of intelligent, seeing robots. These should be able to function dependably in the unpredictable and ever-changing real world and to fulfill various tasks autonomously or in cooperation with humans. From the very beginning our research work has been essentially guided by the rule that all research results have to be verified and demonstrated by practical experiments under real-world conditions. Our emphasis is on robots that co-operate with humans in unmodified environments designed for humans and that interact with humans by natural language, gestures, touch and vision. Key research areas are sensors (including vision), human-robot communication, calibration-free robot control, machine learning and situation-oriented behavior-based system architectures.</p> <p>The humanoid robot HERMES has been built to demonstrate what can be done with current off-the-shelf and newly developed components and advanced control methods. HERMES is able to explore unknown environments, to fulfil transportation and manipulation tasks in spacious human-populated areas, and to interact and communicate even with novice users in a natural and intuitive way.</p>

10.16 Osnabrueck

Institution:	Intelligent Systems, Osnabrueck
Address:	Fachbereich Elektrotechnik und Informatik, Albrechtstraße 30, D-49076 Osnabrueck Germany
Contact:	Prof. Jörg Hoffmann
Phone:	+49 541 969 3018
Fax:	+49 541 969 2936
Email:	Joerg.M.Hoffmann@t-online.de
URL:	http://www.et.fh-osnabrueck.de/forschung/isys/
Faculty:	9 professors
Post-Docs:	5 "Dipl.-Ing"
Students:	
Projects	<p>The interdisciplinary research centre ISYS at the University of Applied Science of Osnabrueck is subdivided into the following specific areas: Sensors, systems technology, and environmental technology. The aim of the centre is to apply new sensors and electronic systems developments to the field of environmental technology. The latest research results will therefore directly lead to marketable products. The research profile of ISYS (Intelligent Systems) comprises research on Artificial Intelligence, software systems for knowledge based natural language processing, primary image analysis, image interpretation, and the examination of empirical works from the perspective of cognitive science. ISYS has interdisciplinary connections to cognitive science, neuroinformatics, mathematics, different engineering sciences, to robotics as well as to other fields of application.</p> <p>Examples of sensor research projects are: Mechanical weed removal with a sensor-controlled cross-hoe, Monitoring of crystallisation processes with modern image processing techniques (CCD cameras), Soil analysis in agriculture, and Obstacle detection for agricultural machinery. The use of micro-electronics, including sensors, in automotive and agricultural vehicles is difficult due to the harsh environments in which the vehicles are operated. Reducing susceptibility to acceleration, dust, humidity and temperature are research issues.</p> <p>Examples of systems research projects are: Computer-aided automated design of intelligent signal processing systems, Simulation of sensor and signal processing systems, Micro-electronics in automotive vehicles, and Construction and joining technologies.</p>

10.17 REIS Robotics

Institution:	REIS Robotics
Address:	Walter-Reis-Str. 1 D-63785 Obernburg Germany
Contact:	Manfred Dresselhaus
Phone:	+49 6022 503 0
Fax:	+49 6022 503 110
Email:	m.dresselhaus@reisrobotics.de
URL:	http://www.reisrobotics.com/
Faculty: Post-Docs: Students:	
Projects	The main business of Reis Robotics is the development and production of industrial robots and robotised automation systems. Reis standard robot units cover a wide variety of kinematic configurations and payloads. In addition to the products in the field of robotics Reis also produces trim presses and mould spotting and try-out presses. Typical applications include: welding, cutting, machining, assembling and part handling. The complexity of the installations range from simple production cells comprising a single robot for welding, up to complete production lines with several robots and the peripheral devices for interlinking. The control of the robots is achieved by the in-house developed ROBOTstar, which is in its 5th generation.

10.18 Siegen

Institution:	Institute of Automatic Control Engineering (ICE), University of Siegen
Address:	Department 12 Hölderlinstr. 3 D-57068 Siegen Germany
Contact:	Prof. Dr. Hubert Roth
Phone:	+49 271/740 4439
Fax:	+49 271/740 4382
Email:	hubert.roth@uni-siegen.de
URL:	http://www.rst.et-inf.uni-siegen.de/eng/index.html
Faculty:	3 Professors
Post-Docs:	
Students:	12 Ph.D. students
Projects	<p>The Institute of Automatic Control Engineering (ICE) at the University of Siegen has research activities centred around the general objective of applying and implementing the concepts of modern control theory in various industrial and non-industrial application tasks. The major research activities are in the fields of mobile robotics, aerospace, tele-control and tele-supervision, simulation and off-line programming of manipulators, control of flexible structures and medical robotics. Current projects include image processing systems for quality assurance, and sensor-controlled deburring with robots.</p> <p>The Centre for Sensor Systems (ZESS) and Center for Multidisciplinary Analysis and Applied System Optimization (FOMAAS), offer a broad and interdisciplinary spectrum of research on sensors, including multi sensor systems, sensor data processing, multi sensor data fusion, and the simulation and optimization of complex sensor systems.</p> <p>The main research work in industrial automation and medical technology concerns itself with the conversion and testing of modern regulation concepts, in close cooperation with industrial enterprises as well as medical partners. One major current project involves developing new mechatronic tools for the support of minimally invasive surgical procedures.</p>

10.19 Siemens AG

Institution:	Siemens AG
Address:	Corporate Technology Otto-Hahn-Ring 6 81730 München Germany
Contact:	Dr. Gisbert Lawitzky
Phone:	+49 89 636 48108
Fax:	+49 89 636 41423
Email:	Gisbert.Lawitzky@mchp.siemens.de
URL:	http://www.siemens.de/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The “Robotics Technologies Group” of the Corporate Technology department collaborates closely with several operating units on various robotics-related applications, and simultaneously keeps strong links to the robotics research community. The group’s main research interests are in the areas of navigation, robot vision, sensor fusion, control, man-robot interaction and robot architecture.</p> <p>In the industrial automation domain, key research areas include managing production uncertainties, midterm planning for engineer-to-order manufacturing, configurable order planning and engineering, easy control programming, machine vision and inspection, and creating a single factory information portal.</p> <p>In the maintenance and service domain our primary goal is to ensure long-term dependability. We have developed a mobile data collector and a knowledge-based diagnostics system to accurately and reliably estimate the remaining lifetime of high-cost products such as X-ray tubes, thus reducing maintenance costs. The mobile unit can also use three-dimensional vision technologies integrated with wireless and a speech-based interface to perform real-time tracking, localization, visualization and real-time wireless access to maintenance databases.</p> <p>SCR is also working on intelligent real-time video compression and transmission. In particular, a maintenance crew could send static images or real-time video to a remote expert. Our R&D efforts aim at enabling the remote expert to provide crucial information that will be overlaid directly onto the real scene viewed by the on-site maintenance crew.</p> <p>Real-time video analysis is a growing security need. SCR’s research in this field centers on design algorithms and systems applied to intelligent cameras, which can be used for infrastructure and transportation security, as well as for home surveillance. Advanced technologies using biometrics such as fingerprint recognition and face detection, and auxiliary technologies for baggage monitoring and explosive detection systems are also being developed.</p> <p>The Siemens Technology-To-Business Center (TTB) in California converts emerging technologies into new Siemens businesses or independent start-up companies. Today, TTB employs 30 researchers representing a spectrum of business, technical and scientific disciplines.</p> <p>Recent innovation highlights can be found on http://www.scr.siemens.com/research.htm</p>

10.20 Stuttgart

Institution:	Neobotix, GPS GmbH
Address:	Nobelstraße 12 70569 Stuttgart Germany
Contact:	Dr.-Ing. Oliver Barth
Phone:	+49 (0) 711 6870 3150
Fax:	+49 (0) 711 6870 3155
Email:	barth@neobotix
URL:	http://www.neobotix.de
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The mobile robotics company Neobotix is a new department of the government inspection department for production systems GPS GmbH. Its foundation in 2000 was initiated by the activities of the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) http://www.ipa.fhg.de.</p> <p>Neobotix mission is to develop easy-to-use service robots for industrial and research applications. We combine mobile robotics, robot manipulators, sensors and software into a highly functional unity representing the new generation of robot systems.</p> <p>The combination of mobility and manipulation enables a fully automated management of industrial tasks, such as transportation of goods in factories, samples in biotechnology or wafers in clean-room environments. In addition, our mobile platform with a robot arm can be used for the quick and reliable management of service tasks in human living surroundings.</p> <p>Neobotix connects mobile robots, manipulator arms, sensor technology and software into a high-functional unit and thus creates suitable conditions for the creation of a new generation of robot systems. Mobile systems can be primarily applied in the fields of industry and research. Mobile robots with a robot arm can be used for the industrial tasks of transportation and assembly. For instance, a mobile system could supply several working stations with raw components and transport completed parts away. Further application scenarios are possible in the field of biotechnology (e.g. for probe handling) or clean-room production.</p> <p>We are pleased to announce the launch in March 2004 of our robot guard system. This new product is based on an extended MP-S400 platform. In order to achieve full functionality expected from a robot guard, sensors and a pan head with a camera are mounted on the platform. The robot contains many highly functional sensors including: a high-quality, weatherproof Mobotix digital camera for live video stream, a double camera option for day/ night application, a PIR sensor, a radar sensor, and a smoke sensor.</p> <p>The main features of the robot guard are: high quality mechanics for indoor and outdoor operation, long battery life, automatic recharging station, robust and reliable navigation, easy-to-use control interface, and configurable sensors for a wide range of applications.</p>

10.21 Ulm

Institution:	Neuroinformatics Dept., University of Ulm
Address:	James-Franck-Ring 89069 Ulm Germany
Contact:	Dr. Gerhard Kraetzschmar
Phone:	+49 731 50 24155
Fax:	+49 731 50 24156
Email:	gkk@neuro.informatik.uni-ulm.de
URL:	http://www.informatik.uni-ulm.de/ni/ , http://www.informatik.uni-ulm.de/ni/index_e.html
Faculty:	2 Professors, 4 Assistant Professors
Post-Docs:	
Students:	19 Ph.D. students
Projects	<p>The Neuroinformatics Department at the University of Ulm performs interdisciplinary research in the areas of computational neuroscience, neural networks, computational learning theory, pattern recognition, biologically-inspired vision and speech processing, neurosymbolic integration, adaptive autonomous agents, autonomous mobile robots, multi-robot teams, and edutainment robotics. Major projects with direct relevance to robotics are our Robocup team, Miro, and Mirrorbot.</p> <p>We are developing new robots for our local RoboCup team, the Ulm Sparrows. The new robots have faster motion using better motors with standard motor-controllers, improved body shape and mass distribution, improved vision with better cameras, and CAN-controllers for sensors and actors.</p> <p>Miro is a distributed object oriented framework for mobile robot control, based on CORBA (Common Object Request Broker Architecture) technology. The Miro core components have been developed in C++ for Linux. But due to the programming language independency of CORBA further components can be written in any language and on any platform that provides CORBA implementations.</p> <p>Project MirrorBot is a European project which will develop and study emerging embodied representations based on mirror neurons. We will develop new techniques including cell assemblies, associative neural networks, and Hebbian-type learning in order to associate vision, language and motor concepts. We will also develop biomimetic multimodal learning and language instruction in a robot to investigate the task of searching for objects.</p>

10.22 Weingarten

Institution:	Steinbeis-Transferzentrum Rechner- und Softwaretechnologie (ARS)
Address:	Postfach 12 61 88241 Weingarten Germany
Contact:	Prof. Dr. Klaus Schilling
Phone:	+49 (0) 271 740 4439
Fax:	
Email:	schi@ars.fh-weingarten.de
URL:	http://www.stw.de/k060/60030/162.htm
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Steinbeis transfer center for applied computer and software technologies (ARS) is a commercial centre for technology transfer, performing research and development for small and medium sized enterprises in the areas of modern information technologies, automation systems and robotics. The technical emphasis of ARS is on projects in the areas of tele-robotics, telematics, control and sensor systems for robots in industrial environments.</p> <p>Central topics of interest include modern data processing techniques and advanced regulation and control techniques.</p> <p>Our most robot-related research includes developing control strategies for autonomous, mobile robots on the basis of Fuzzy logic and neural one nets; hardware and software for medical-technical applications; adaptive control of the sampling of a comet by the Rosetta space probe; DEVICE, a mobile robot for Mars; and an intelligent sensor system for obstacle recognition.</p>

10.23 Wessling

Institution:	Institute of Robotics and Mechatronics, German Aerospace Center (DLR)
Address:	P.O.Box 1116 82230 Wessling Germany
Contact:	Dr. Patrick van der Smagt
Phone:	+49 8153 281152
Fax:	+49 8153 281134
Email:	smagt@dlr.de
URL:	http://www.robotic.dlr.de/
Faculty:	51 Researchers
Post-Docs:	
Students:	
Projects	<p>The Institute of Robotics and Mechatronics, DLR is a robotics research institute working on advanced control system design, multibody dynamics, concurrent engineering, sensor and actuator design, intelligent sensory feedback, man-machine-interfaces, vision, neurocontrol, and 3D-simulation. Main applications are the development of new ultralight multisensory and torque-controlled robot systems and multifingered artificial hand. Another key research topic is the remote (tele-) programming and control of space robots.</p> <p>Newly developed sensors have been packed inside plastic hollow balls to create 6-degree of freedom handcontrollers (the DLR control balls). The SPACE-MOUSE is the most recent licenced product based on these ideas. These sensors have also been integrated into the multisensory DLR-gripper, which contains 15 sensory components. Visual research includes using visual cues to correct and refine pre-defined internal world models, visual servoing, object recognition, geometrical reconstruction of unknown objects, and dynamic world modelling. We use several experimental vision platforms. One is the successor to the multisensory ROTEX telerobot, equipped with a variety of visual sensors such as cameras or laser scanners integrated into the robot gripper. Another is a special robot designed to assist in endoscopic surgery. The third platform consists of a mobile robot equipped with a stereo camera head.</p> <p>The key technologies w.r.t. the telerobotics application are the local sensory feedback control concepts in order to achieve shared autonomy and the powerful predictive graphics simulation (including the sensor behaviour) on the ground station.</p> <p>The neural network research we are doing is aimed at two angles: learning from a teacher, and learning by doing. We are also developing a multi-domain modelling system.</p>

10.24 Würzburg

Institution:	Informatics Institute, Bavarian University of Julius-Maximilians
Address:	Department of Computer Science I University of Würzburg Am Hubland D-97074 Würzburg Germany
Contact:	Prof. Dr. Hartmut Noltemeier, Prof. Dr. Klaus Schilling
Phone:	+49 (0) 931 888 5054 / 6647
Fax:	+49 (0) 931 888 4600 / 6679
Email:	noltemei; schi@informatik.uni-wuerzburg.de
URL:	http://www.informatik.uni-wuerzburg.de/ , http://www.informatik.uni-wuerzburg.de/institut/main_e.html
Faculty:	2 Professors, 1 Associate Professor, 16 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The Informatics Institute of the Bavarian University of Julius-Maximilians, Würzburg, hosts two active research groups in the area of mobile robots: Chair 1 (Prof. Dr. H. Noltemeier) addresses navigation techniques especially motion planning and image understanding. Chair 7 (Prof. Dr. K. Schilling) deals with robotics and telematics.</p> <p>The Institute for Robotics and Telematics has research emphasis on tele-robotics solutions in application areas such as industrial tele-maintenance, space exploration and tele-education. In particular it has a long tradition of research on tele-operated equipment via the internet and its application in engineering tele-education. Modules for remote sensor data acquisition and tele-operations via the internet, as well as related educational units for self-studying, are employed in several international projects.</p> <p>In particular, we are involved in the European CubeSat Collaboration (see http://www7.informatik.uni-wuerzburg.de/cubesat/index.html), which supports activities enabling students to design, implement and launch small satellites as part of their curriculum; and in Pelote (see http://labe.felk.cvut.cz/pelote/), which focuses research on the integration of humans and robots, humans as telematic entities, robots as telematic entities, cooperation and coordination, and communication.</p> <p>Our research emphasis is on controls and sensors for mobile robots, and on autonomous and tele-operated mechatronic systems, covering a broad application range from industrial transport robots to pico-satellites. Robot systems have been developed for tele-maintenance of industrial mobile robots, mobile robot sensor systems for navigation, control of cooperating mobile robots, and advanced user interfaces based on haptic force-feedback and augmented reality methods.</p>

11 Greece

11.1 Athens

Institution:	Control Systems Laboratory, National Technical University of Athens
Address:	Mechanical Design & Control Systems Division Mechanical Engineering Department 9 Heron Polytechniou Str., Zografou Athens 15700 Greece
Contact:	Prof. Kostas J. Kyriakopoulos
Phone:	+30 210 772 3595
Fax:	+30 210 772 3657
Email:	kkyria@central.ntua.gr
URL:	http://www.csl.mech.ntua.gr/
Faculty:	1 Professor, 2 Associate Professors, 2 Research Assistants
Post-Docs:	
Students:	8 Ph.D. students
Projects	<p>The Mechanical Constructions and Automatic Control Section of the National Technical University of Athens conducts research into the following: theoretical and experimental design of machine elements; design for manufacturing, quality and cost; design optimization methods; automatic control systems; dynamics of structures, machines and robots; vehicle design; and computer aided engineering (CAE).</p> <p>Robotic systems research concentrates on sensor based motion planning and control of robotic manipulators, mobile robots, underwater and aerial vehicles. We are also interested in various aspects of mechatronics, especially control systems technology applications to electromechanical systems interfacing, and in production inspection and automation.</p> <p>Current research includes investigation of cooperative (micro)robots, multi-agent/multi-robot planning, nonholonomic systems, sensor fusion, simultaneous localization and map-building, fault detection and isolation, decentralized/distributed control, air-traffic systems, gesture recognition, visual servoing, variational methods, hybrid and switching control for mechanical systems, and real time control systems.</p>

Institution:	Zenon SA, Automation Technologies
Address:	Kanari 5 Glyka Nera GR - 15354 Athens Greece
Contact:	Christos Emmanouilidis
Phone:	+30 210 6655800
Fax:	+30 210 6041051
Email:	christosem@zenon.gr
URL:	http://www.zenon.gr/zenon/english/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>ZENON is the largest robotics company and robotic services provider in Greece. ZENON develops, integrates, and delivers complete solutions in the fields of Robotics and Informatics. Robotics solutions are directed to various industrial sectors from metal constructions, furniture and home appliances to food and transportation. Applications include packaging, welding, assembly, painting, grinding, data collection, while strong participation in EU funded research has recently focused on service robotics for automated inspection and rehabilitation engineering.</p> <p>Main research areas include industrial, mobile and rehabilitation robotics, industrial and building automation, telematics and software engineering. In the last ten years, the R&D Department of Zenon has participated in more than 40 research projects and has cooperated with major industrial companies, research centers and universities throughout Europe.</p> <p>Recent projects include: Development of a robotic system for the inspection of large steel / aluminium plates in industrial plants; Development of new and novel automated inspection technology for GRP wind turbine blades; Development of inspection systems for the inspection of metal pipelines buried underground, in concrete, in water, or covered with coatings; Non-intrusive in-service inspection robotic system for condition monitoring of welds inside floating production storage and offloading (FPSO) vessels; Train mounted sensors and systems for inspection of rails; Practical experimentation by accesible remote learning; Remotely operated tanker inspection system (ROTIS) ; Development of a robotic system for the inspection of aircraft wings and fuselage (ROBAIR); Robotic assistance in neuro and motor rehabilitation; and the Special use of artificial intelligence for inserting traceability tags into fish.</p>

11.2 Halkida

Institution:	IDEASIS Ltd
Address:	Antoniou 12 Halkida 34100 Greece
Contact:	Nikos Katevas
Phone:	+30 22210 61200
Fax:	+30 22210 61205
Email:	nkatevas@ideasis.gr
URL:	http://www.ideasis.gr/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>IDEASIS Ltd was established to provide systems and services that would assist humans in daily life activities. IDEASIS maintains experiences in various fields of robotics focused on mobile & service robots and more specifically on assistive and personal robots. IDEASIS provides products, systems and services related to any software or hardware modalities of service robots: chassis designs, sensor set-ups, system configuration, ultrasonic, laser or vision sensors, data or video links, grippers, human-machine interfaces, simulation, navigation software, etc. IDEASIS also develops, integrates, and adapts robots or accessories according to the customer needs. Industrial design services complete the activities of IDEASIS in robotics and automation.</p> <p>The WebFAIR project addresses the development of a novel system for remote visualisation, over the Internet, of multi-media information from large exhibitions and commercial trade-fairs. Generally, through a web-interface, users all over the world will be able to tele-control the robotic avatar and specify exhibits or interesting places that they may wish to visit.</p> <p>A Robot Inspector for the large steel and aluminum plates used extensively in ship building and construction is being developed. Novel NDT techniques are used that can inspect large areas quickly and reliably, and detect defects in plates even under protective coatings. A similar project develops a robotic inspection system which can walk over large areas of an aircraft structure; carry out automatic data collection and attempt to identify all structural defects, without the need to dismantle components. As well as using conventional NDE sensors, this project involves development in three new technology areas: an acoustic camera; phased arrays and a combined eddy current; and ultrasonic and mechanical impedance system.</p> <p>The wheelchair-mounted Arm unit manipulator compensates for poor or missing human arm and hand function. By means of an input device, such as a keypad or joystick attached to a non-disabled body part (e.g. the chin), the manipulator can be steered towards an object, which can be grasped with a simple gripper.</p>

11.3 Thessaloniki

Institution:	Automation and Robotics Laboratory, Aristotle University of Thessaloniki
Address:	Dept. of Electrical and Computer Engineering Thessaloniki 54 124 Greece
Contact:	Prof. Vasillios Petridis
Phone:	+30 2310 996392
Fax:	+30 2310 996292
Email:	petridis@vergina.eng.auth.gr
URL:	http://control.ee.auth.gr/
Faculty:	2 Professors, 3 Associate Professors, 1 Assistant Professor
Post-Docs:	
Students:	9 Ph.D. students
Projects	<p>The Automation and Robotics Laboratory, Dept. of Electrical and Computer Engineering in Thessaloniki deals with theoretical and basic research problems, algorithms and operational systems. It has expertise in computational intelligence, robotics, control and machine learning. It has developed methods for robotic handling of flexible materials. Also it has developed methods for handling heterogeneous data (static and dynamic) and multiple representations for novel concept representation schemes and semantic processing. The above methods are used for the development of cognitive robots. ARL integrates research in the fields of intelligent systems, automatic control and robotics to develop intelligent and autonomous systems and to control the behaviour of complex systems.</p> <p>Research in the field of intelligent systems consists mainly in the development of novel methods for processing (classification, clustering, segmentation, prediction, etc) of time series and heterogeneous data which arise in many contexts and real-world problems. To this end the methodologies of neural networks, evolutionary computing and fuzzy systems are employed.</p> <p>In the robotics field the lab deals with robot control, grasping (especially grasping and manipulation of objects by multi-fingered hands), remote manipulation and mobile systems. It has expertise in the area of handling of flexible materials such as textiles and leather.</p> <p>In the automatic control field ARL deals especially with complex and uncertain systems where there is no model of the system. Therefore techniques drawing on computational intelligence are employed.</p> <p>Methods and algorithms from the above fields are used as tools by which an agent can develop various abstractions of the environment based on data from sensors. In this sense the problem of concept representation and semantic processing is addressed. This is believed to be a way to the design and development of cognitive agents/robots. The lab has a lot of experience with funded projects.</p>

12 Hungary

12.1 Budapest

Institution:	Department of Manufacturing Engineering, Budapest University of Technology and Economics
Address:	Egry József Str. 1 E building, 2nd floor 11 H-1111 Budapest Hungary
Contact:	Prof. Gusztáv Arz
Phone:	+361 463 2515
Fax:	+361 463 3176
Email:	arz@manuf.bme.hu
URL:	http://www.manuf.bme.hu/IntPage.htm
Faculty:	2 Professors, 8 Associate Professors, 4 Assistant Professors, 4 Research Assistants
Post-Docs:	6 persons
Students:	8 Ph.D. students
Projects	<p>The Department of Manufacturing Engineering, Budapest University of Technology and Economics (BUTE DME) was founded in 1951. The Department has a wide activity in various fields of manufacturing engineering and robotics, especially in industrial and service robots, robot hands/grippers, IT for manufacturing, and VR. A good recent project was REHAROB, supporting rehabilitation of disabled people using industrial robots for upper limb motion therapy. REHAROB's aim was to provide personalised, three-dimensional motion therapy for patients with neuro-motor impairments. The therapy is driven by industrial robots utilising intelligent identification of the required physiotherapy motions. A two hand upper limb physiotherapeutic system called REHAROB was developed.</p> <p>The Department of Applied Mechanics researches applied biomechanics in sports, including various aspects of control (hybrid force/position, vibration).</p>

Institution:	MTA SZTAKI - Computer and Automation Research Institute, Budapest
Address:	Kende u. 13-17 H-1111 Budapest XI Hungary
Contact:	Prof. George L. Kovács
Phone:	+361 279 6140
Fax:	+361 466 7503
Email:	gyorgy.kovacs@sztaki.hu
URL:	http://www.sztaki.hu/
Faculty:	1 Professor, 7 Senior Researchers
Post-Docs:	
Students:	3 Ph.D. students
Projects	<p>MTA SZTAKI is the Computer and Automation Research Institute of the Hungarian Academy of Sciences. Basic and application-oriented research is carried out in an interdisciplinary setting including computer science, intelligent systems, process control, manufacturing and robotics, wide-area networking, and multimedia. Contract-based target research, development, training and expert support for domestic and foreign industrial, governmental and other partners are important activities of the Institute, as well.</p> <p>Amongst other research, we have developed PROARC, an integrated CAD/CAM system for robotized arc welding. Our main current projects are developing a commercial vehicle fleet management system, and sensing computers for telepresence.</p> <p>The main objectives of the commercial vehicle project are the elaboration of theory and methods of intelligent supervision, control and communication systems installed on vehicles, and an associated information service system for fleet management.</p> <p>The scientific and technological fundamentals of the sensing computers and telepresence program are analogue spatio-temporal sensory computers (a revolutionary new computer concept), programmable sensor arrays sensing in different modalities (visual, tactile, auditory, olfactory etc.), multi-modal sensing, complex event detection in visual, auditory and tactile scenes, mobile and combined telecommunication networks and services, and diagnostics in echocardiology. One of the sample application areas is in ultrasound-based heart diagnosis where a system with on-line 3D reconstruction and real-time 2D morphological and motion tracking capabilities will be designed.</p> <p>The engineering result will be a multi-modal sensing computer that, in different modular configurations, could be used as a system for in- and outdoor security/surveillance, industrial quality control or biometrics based recognition combined with telepresence capabilities. Typical products in these areas could be: blind helper bionic eyeglasses identifying characteristic objects and movements, and home watcher-trackers with seeing, sniffing, hearing and mobile communication capabilities.</p>

13 Israel

13.1 Tel Aviv

Institution:	Systems Group, Tel Aviv University
Address:	Department of Mechanics, Materials, and Systems The Iby and Aladar Fleischman Faculty of Engineering Ramat-Aviv, Tel-Aviv Israel
Contact:	Prof. Amiram Moshaiov
Phone:	972 3 640 7098
Fax:	
Email:	moshaiov@eng.tau.ac.il
URL:	http://www.eng.tau.ac.il/
Faculty:	1 Associate Professor, 1 Senior Lecturer, 1 Lecturer
Post-Docs:	
Students:	7 Ph.D. students
Projects	<p>The Systems Group within the department of Solid Mechanics, Materials, and Systems at Tel-Aviv University (TAU) carries out research in 3 separate laboratories: the Robotics and Mechatronics lab, the Computational Systems lab, and the Integrated Systems Lab. Our focus is on systems engineering including mechatronic design; robotics; cybernetics; socio-engineering; computer-aided design; applications of artificial intelligence to engineering; theory and practice of engineering design; engineering informatics and communication; and novel methods for analysis, design and optimization of engineering systems.</p> <p>The Robotics and Mechatronics Laboratories primarily provide essential support for the undergraduate program in Robotics and Mechatronics. Research interests of the staff include mechanics and control of robots; intelligent control of robots; and shipbuilding robotisation.</p> <p>The Robotics Systems Laboratory, Department of Industrial Engineering, contains several types of industrial robots, including an advanced-type conveyor, as well as sensors (touch and vision systems), all controlled by computers. It supports research on real-time scheduling and control of manufacturing and robotics systems, and compatibility of robotics configuration to application.</p> <p>The Samy and Paula Schinazi Robotics and Computer Integrated Manufacturing Laboratory of the Department of Industrial Engineering is intended primarily for teaching, but is also used for projects and research in various aspects of computer-aided design and manufacturing. It includes a fully computerized system of NC machine tools, robots, sensors and conveyors.</p> <p>The Artificial Intelligence Laboratory of the Department of Electrical Engineering Systems is active in developing AI systems for various applications, including recognition of non verbal acoustic information for robot use. Research work in the lab involves fuzzy systems, neural networks, genetic algorithms, learning automata, expert systems and fuzzy expert systems.</p>

14 Italy

14.1 Ancona

Institution:	Polytechnical University of Marche in Ancona
Address:	Department of Mechanical Engineering Via Breccie Bianche, località Montedago I 60131 Ancona Italy
Contact:	Prof. Massimo Callegari
Phone:	+39 071 220 4444
Fax:	+39 071 220 4801
Email:	m.callegari@univpm.it
URL:	http://www.dipmec.univpm.it/ , http://www.dipmec.univpm.it/home_uk.htm
Faculty:	14 Professors, 6 Associate Professors, 16 Research Assistants
Post-Docs:	
Students:	≈ 34 Ph.D. students
Projects	<p>The Polytechnical University of Marche in Ancona, Italy, (UnivPM) has two main groups conducting robotic research. These groups belong to the Department of Mechanics and the Department of Computer science, Management Engineering and Automation & Ingegneria Informatica, Gestionale e dell'Automazione (DIIGA). Both the groups have been involved in robotics research for several years, being especially interested in mechanical control and sensor-fusion design.</p> <p>The Department of Mechanics has a strong research focus in the field of parallel robotics. Two projects stand out: "Parallel Robot Interacting with Dynamic Environment" (PRIDE), and an analysis of mastication.</p> <p>PRIDE focuses on the development of an innovative architecture for the control of motions of pure translation in a parallel robot. Parallel robots have many advantages over serial robots, such as naturally heightened cargo abilities, rigidity and frequencies, reduced size, modularity of construction, faster acceleration, and remarkable accuracy and precision. However these advantages are offset by a complexity in cinematic equations means that these machines can be hard to control. We propose an innovative structure for the robot for motions of pure translation, particularly adapted to operations where high precision and strong contact forces occur.</p> <p>New research into mastication aims to supply a tool for dentists to use in the correction of pathologies resulting from incorrect movements of the mandibola. We record current jaw movements, which can then be replayed with and without corrective options. Our system should be useable both in active mode, where the simulator drives the mechanism, and in passive mode, where the dentist creates the desired movements.</p>

14.2 Bologna

Institution:	Laboratory of Automation and Robotics (LAR - DEIS), University of Bologna
Address:	Via Risorgimento 2 40136 Bologna Italy
Contact:	Prof. Claudio Melchiorri
Phone:	+39 051 2093034
Fax:	+39 051 2093073
Email:	cmelchiorri@deis.unibo.it
URL:	http://www-lar.deis.unibo.it/
Faculty:	3 Professors, 1 Associate Professor, 2 Research Assistants
Post-Docs:	3 persons
Students:	10 Ph.D. students
Projects	The Laboratory of Automation and Robotics (LAR - DEIS) of the University of Bologna (UNIBO) has a well established reputation for the development of advanced robotic systems, in particular for dextrous manipulation, help for disabled people, industrial and space applications. The expertise of LAR-DEIS is focussed in particular on both control and design of mechanical hardware and software.

14.3 Brescia

Institution:	Advanced Robotics Laboratory, University of Brescia
Address:	Department of Electronics for Automation Via Branze 38 I-25123 Brescia Italy
Contact:	Prof. Riccardo Cassinis
Phone:	+39 030 3715453
Fax:	+39 030 380014
Email:	riccardo.cassinis@unibs.it
URL:	http://bsing.ing.unibs.it/cassinis/ARL/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Department of Electronics for Automation (DEA) is an academic Institution devoted to research and education in several fields of Computer Science, Electronics and Telecommunications fields.</p> <p>Recently concluded research projects include the geometric modeling of industrial manipulators, techniques for computing collision-free trajectories, sensory activity planning, self-learning systems for robot sensor control, navigation systems for autonomous robots working in unknown environments, goal identification, omni-directional visual sensors for a Robocup goalkeeper, and the use of nontraditional control structures such as blackboard systems.</p> <p>Our automatic lawnmower makes extensive use of mechanical sensors and has a very low computing power installed. The robot is designed to be fully autonomous, and will work in moderately cluttered environments, such as domestic gardens, golf courses, etc.</p> <p>There are three main research projects that are presently ongoing: Pollicino, bee emulation for robot navigation, and a mine sniffer project devoted to anti-personnel mine localization and neutralization.</p> <p>Pollicino is a self-localization system that uses an omni-directional optical pre-processing system to estimate robot position in a dynamically varying environment, using a neural network that has been previously trained on data gathered from known positions in the same environment. The same optical system can also be used to compute inaccurate but useable estimates of optical flow sufficient for driving a robot along the axis of a corridor, by keeping optical flow equal on both sides of the robot. This, in fact, is what many insects do while flying in narrow passages.</p> <p>An interesting research project concerning the study and emulation of the navigational capabilities of social insects has recently started. Investigation and simulation of the physical structure of bee compound eyes resulted in software that uses images in apparently the same way as bees. Low-resolution images can allow the robot to locate and reach the target position very precisely.</p>

14.4 Catania

Institution:	Dipartimento di Ingegneria Elettrica Elettronica e dei Sistemi DIEES, University of Catania
Address:	Viale A. Doria 6 95125 Catania Italy
Contact:	Prof. Giovanni Muscato
Phone:	+39 095 7382321
Fax:	+39 095 330793
Email:	guscato@diees.unict.it
URL:	http://www.robotic.diees.unict.it
Faculty:	4 Professors, 1 Assoc. Prof, 1 Assist Prof
Post-Docs:	2 persons
Students:	15 PhD students
Projects	<p>The System and Control Group of the DIEES University of Catania is involved in research and teaching activities in the field of Service robotics, Biologically inspired robotics, Complex systems.</p> <p>The group has been involved in research topics regarding robotics and automatic control in many European and national research projects. In the laboratory of DIEES several prototype of service and mobile robots have been designed and built. The unit is expert in the design, realisation and testing of mobile robot prototypes, with particular reference to the development of embedded control systems.</p> <p>The group has carried out research activity in the mobile robotic sector within several projects: local, national (TECSIS Hovering control of underwater vehicles; Realisation of a climbing robot for inspection operations in hostile environments; Innovative materials for mobile microrobots), cooperation with private research centres (Fuzzy logic microcontrollers for mobile robotic applications; Control methods for orange picking robots). Within Europe the unit is an active member of the thematic network CLAWAR 2 (GROWTH) and act as coordinator of the WP Applications, has coordinated the IST project ROBOVOLC, aimed to the realisation and test of a robot for volcano exploration, coordinates the project SPARK (IST) for the introduction of new methodologies for action oriented perception in robots, and is involved in the project ISAMCO for the use of smart materials for sensing and motion control applications</p>

14.5 ENEA

Institution:	National Agency for New Technology, Energy and the Environment (ENEA)
Address:	Lungotevere Thaon di Revel 76 - 00196 Rome Italy
Contact:	Dr. Claudio Moriconi
Phone:	+39 06 36271
Fax:	+39 06 36272 591
Email:	moriconi@casaccia.enea.it
URL:	http://www.enea.it/com/ingl/default.htm
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Italian National Agency for New Technology, Energy and the Environment (ENEA) is a public organization that conducts research and development on behalf of the scientific community, electrical-power industry and environmental groups across Italy. Key research areas include: technological innovation (e.g. laser sources and robotics); energy production (e.g. renewable energy sources and combustion); and environmental problems (e.g. climate change and air pollution).</p> <p>Enea's Robotic Group is a research facility focussing on hostile environment robotics. The group has particularly developed expertise in human-robot interfaces, supervisory and control systems for intelligent mobile systems, and innovative sensors. With reference to underwater robotics the ENEA's group has developed an original AUV (SARA), and is endowed with a fast and flexible ROV (the Falcon submarine) devoted to the survey and monitoring of our cultural heritage.</p>

14.6 Genoa

Institution:	PMARLab, LIRA-Lab, University of Genoa
Address:	Via all'Opera Pia 15/A 16145 Genova Italy
Contact:	Prof. Rezia Molfino, Prof. Giulio Sandini
Phone:	+39 010 3532842
Fax:	+39 010 3532298
Email:	molfino@dimec.unige.it , giulio@dist.unige.it
URL:	http://www.dimec.unige.it/PMAR , http://www.lira.dist.unige.it/
Faculty:	3 Professors, 2 Associate Professors, 5 Research Assistants
Post-Docs:	2 persons
Students:	9 Ph.D. students
Projects	<p>The Robotics laboratory (PMARlab) of the Mechanical Engineering dept at Genoa focuses its research primarily upon: life-cycle integrated design, multi-body kinematics, dynamics modelling and simulation, VR and digital mock-up, innovative grasping, parallel kinematic manipulators, and non-linear model-based control.</p> <p>We have long experience in designing mechanical systems and robotized manufacturing processes with good life-cycle performance and eco-sustainability. Care is focused on after-dismissal recovery/reuse/recycling options, to lower environmental impacts and to preserve non-renewable resources. Solid modeling packages together with dynamic and structural analysis aids and tools to generate digital mock-ups, allow a concurrent engineering approach, with early tests on virtual prototypes being conducted while the design process continues.</p> <p>Robot research activity focusses on several key scientific issues, such as: multi-body systems, kinematics and dynamics analysis, modelling and simulation; mathematical mock-up, model based and non-linear intelligent control; hybrid and impedance control systems; smart actuation (SMA, MR/ER); conception of new task driven macro, medium, mini, and micro mechatronic architectures; co-operative robotic systems design; and parallel kinematics robotics.</p> <p>Applications extend over different industrial and service areas, with developments in underwater, agriculture, construction, decommissioning, etc., up to recent studies for medical and surgical rigs and humanitarian co-botics (demining, rescue,..). The PMARlab takes particular care in the design of innovative task oriented mechanical architectures (PKM, branched chains...) and of task-driven adaptive, modular reconfigurable grasping devices, mainly for handling limp and soft materials.</p>

14.7 Milan

Institution:	Department of Electronics and Information (DEI), Milan Polytechnic
Address:	Via Ponzio 34/5 20133 Milano Italy
Contact:	Prof. Andrea Bonarini
Phone:	+39 02 2399 3400
Fax:	+39 02 2399 3587
Email:	bonarini@elet.polimi.it
URL:	http://www.elet.polimi.it/index.jsp?en
Faculty:	2 Professors, 3 Associate Professors, 1 Research Assistant
Post-Docs:	
Students:	4 Ph.D. students
Projects	<p>The Department of Electronics and Information at Milan Polytechnic is one of the largest CS Departments in Europe. Two groups work on Robotics: Artificial Intelligence and Robotics (AIR) and Industrial Automation.</p> <p>AIR is mainly involved in developing autonomous mobile robots by integrating mechanics, control (traditional and fuzzy), vision (single camera, multi-camera, panoramic), sensor fusion, self-localization, behaviors, robot architectures, learning and adaptation (including neural networks and genetic algorithms). Applications are mainly in the area of service robotics, space robotics, and edutainment. We now have mobile robots with many different kinematic and electrical architectures, and many different sensors e.g. sonar, infrared, cameras, laser, ommatidia, and an artificial nose.</p> <p>The Sensors and Vision group work on multi-sensor data fusion using fuzzy models and pre-defined ontologies, and on omni-directional (panoramic) vision systems for mobile robots operating in service tasks and edutainment.</p> <p>We have participated in the Robocup initiative since 1998, implementing soccer-playing multi-robot systems based on fuzzy behavioral modules, and coordinated also by fuzzy models. The robots can fuse data coming from different sensors (possibly distributed in the team) for self-localization and tracking of fixed and mobile objects present in the environment. They can use machine learning systems to learn and adapt behaviors, the coordination of behavioral modules in a single robot, or the distribution of jobs among teammates. The team is able to adapt its strategy to those of its opponents. We aim to generalise this experience and develop fleets of mini-robots able to coordinate and to learn their task in situations where the quality of sensor data is bad, and the computational resources are low.</p> <p>The Industrial Automation group is mainly involved in control and simulation issues.</p>

Institution:	Informatics for Robotics and Automation Lab (IRA), Study University of Milan-Bicocca
Address:	Via Ponzio 34/5 20133 Milano Italy
Contact:	Prof. Domenico G. Sorrenti
Phone:	+39 026448 7841
Fax:	+39 026448 7839
Email:	sorrenti@disco.unimib.it
URL:	http://www.ira.disco.unimib.it/
Faculty: Post-Docs: Students:	
Projects	<p>The IRA (Informatics for Robotics and Automation) lab is part of the Department of Computer Science, Systems and Communication of the Study University of Milano - Bicocca. IRA conduces research in mobile robotics (including robotic soccer), and computer vision, especially for transport applications.</p> <p>Current computer vision projects include: New mirror geometries for catadioptric vision systems, and validation of genetic algorithms aimed at optimally setting camera acquisition parameters. Robocup current projects are also vision-centred, including the use of omnidirectional vision, and the combined use of conventional cameras to obtain a 3D reconstruction whose data will be matched to a known 3D model of the environment.</p> <p>Another current project involves the adaptation of a self-localization system, currently used in Robocup, to the outdoor application of plant watering. In particular, a set of features extracted from the scene must be detected in the image. The current image processing system will likely fail when applied to the new outdoor environment, and need redevelopment. This is a first trial, aiming at defining the computer vision and robotic aspects of the application, therefore problems like changes in light intensity, passing clouds, changes in colour or temperature, rain, etc. will be given little attention during this phase of the work. The same applies to the precise definition of the watering application itself. Sensing will be based on the use of omnidirectional vision.</p>

14.8 Naples

Institution:	PRISMA Lab, University of Naples
Address:	Dipartimento di Informatica e Sistemistica Via Claudio 21, 80125 Napoli Italy
Contact:	Prof. Bruno Siciliano
Phone:	+39 (0) 81 7683179
Fax:	+39 (0) 62 33226128
Email:	siciliano@unina.it
URL:	http://www.prisma.unina.it/
Faculty:	3 Professors, 4 Associate Professors, 3 Assistant Professors
Post-Docs:	
Students:	3 Ph.D. students
Projects	<p>The PRISMA Lab in the Department of Computer and Systems Engineering of the University of Naples is a research facility which focuses on industrial and service robotics, mechatronics and automation. Major research areas include motion control, inverse kinematics, redundant manipulators, flexible arms, interaction control, coordination of multiple manipulators, underwater robotics, and visual servoing.</p> <p>The cooperative robot manipulator system set-up is the main project in the lab, and is constituted by two 6-axis Comau SMART-3 S industrial robots. The set-up allows experiments in single robot control as well as coordinated control of the dual-robot system. Each robot manipulator has a serial kinematic structure with six revolute joints. The axes of the outer three joints intersect two-by-two making a non-spherical wrist. One manipulator is mounted on a sliding track which provides redundancy with respect to six-degree-of-freedom end-effector tasks. Several grippers can be connected to the manipulators' wrists through 6-axis ATI F/T 130/10 force/torque sensors in order to perform experiments of force-motion control on the single robot as well as on the dual-robot system. Further, a visual system is available.</p> <p>All the research activities of the Robotics and Automation Group are supported by experimental testing, including: dynamic model identification, dynamic control (independent joint control, feedforward, joint space, task space), kinematic control (inverse kinematics algorithms, singularities, redundancy), interaction control (impedance, parallel, hybrid), cooperative manipulators (kinematic control, task space control), visual servoing (object pose reconstruction, visual tracking), and PLC-based control (discrete event systems).</p>

14.9 Padua

Institution:	Department of Information Engineering, University of Padua
Address:	Via Gradenigo 6/B 35131 Padova Italy
Contact:	Prof. Enrico Pagello
Phone:	+39 049 827 7687
Fax:	+39 049 827 7699
Email:	enrico.pagello@unipd.it
URL:	http://www.dei.unipd.it/
Faculty:	61 Professors and Associate Professors, 26 Research Assistants
Post-Docs:	4 persons
Students:	90 Ph.D. students
Projects	<p>The Department of Information Engineering at the University of Padua conducts research and teaches in the areas of computing, electronics, and communication engineering.</p> <p>Robot localization and navigation experiments provide interesting problems for the Logics for Uncertainty group. The robot used is a TRC Labmate with a belt of twelve sonar sensors, a laser-beam projector generating a horizontal line in front of the robot, and two cameras. Localization methods based on possibility theory and/or evidence theory have been studied, in which an annotated topological place maps provide a model of the workspace. A logical description is given for each place in the map, combining high-level symbolic knowledge and sensor-data interpretation. A distribution of certainty levels over the set of places is calculated at each cycle.</p> <p>Localization, control and navigation techniques are also studied in which different uncertainty models are integrated: fuzzy control, possibility theory, probability theory, and belief functions.</p>

14.10 Parma

Institution:	Robotics and Intelligent Machines Laboratory (RIMLab), University of Parma
Address:	Dip. di Ingegneria dell'Informazione Parco Area delle Scienze, 181A 43100 Parma Italy
Contact:	Prof. Stefano Caselli
Phone:	+39 0521 905724
Fax:	+39 0521 905723
Email:	caselli@ce.unipr.it
URL:	http://rimlab.ce.unipr.it/
Faculty:	1 Professor, 1 Assistant Professor
Post-Docs:	1 person
Students:	3 Ph.D. students
Projects	<p>The Department of Information Engineering of the University of Parma hosts research and teaching activities in the areas of computer, electronics, and communication engineering. Current research at the Robotics and Intelligent Machines Laboratory (RIMLab) includes software architectures, motion planning, real-time systems, learning techniques, multi-modal user interfaces, tele-operation infrastructures, and service robot applications.</p> <p>The key idea of our haptics project is to simulate the exploration of an unknown environment with a robotic hand. We build a virtual VRML environment and use a cybertouch device to sample its objects. The collected contact points are then sent to a Surface Reconstruction algorithm that creates an approximate model of the original surface.</p> <p>Technological developments in distributed systems have led to new telerobotic applications, such as virtual laboratories and remote maintenance of complex equipment. These applications must satisfy both the general requirements of distributed computing, e.g. location transparency and interoperability, and the domain-specific requirements of reconfigurability, guaranteed performance, real-time operation, and cooperation among robots and sensory systems.</p> <p>We have developed a software framework for distributed telerobotic systems exploiting advanced CORBA features, including Asynchronous Method Invocation and Real-Time CORBA. The framework allows development of portable and extensible multi-threaded client/server applications supporting concurrent and pre-emptable actions in the target robot system, and has been evaluated in a laboratory setup including a robot manipulator and many sensors, accessible by multiple clients.</p>

14.11 Pisa

Institution:	'E. Piaggio' Interdepartmental Research Center, University of Pisa
Address:	Via Diotisalvi 2 56100 Pisa Italy
Contact:	Prof. Antonio Bicchi
Phone:	+39 050 553639
Fax:	+39 050 550650
Email:	bicchi@ing.unipi.it
URL:	http://www.piaggio.cci.unipi.it
Faculty:	2 Professors, 1 Associate Professor, 2 Research Assistants
Post-Docs:	6 persons
Students:	11 Ph.D. students
Projects	<p>"E. Piaggio" is an interdepartmental research institute of the University of Pisa devoted to multidisciplinary research in the fields of Bioengineering and Robotics. Major robotics research areas include robot arms, robot hands (especially haptics), legged robots, a spherical inspection robot, non-holonomic systems, and hybrid systems. Bioengineering research activities include tactile sensing, kinesthetic sensing and smart fabrics, artificial olfaction, and sensor fusion in food quality assessment. We also develop mechanics and control algorithms for a fiber optic immunosensor, smart catheters, smart laparoscopy, tissue engineering, and tools for minimally invasive surgery.</p> <p>Robotics arm groups consider manipulability, whole-arm manipulation, closed-chain and parallel manipulators, and cooperation between robot arms. Robot Arms for Anthropomorphic Environments research places less emphasis than usual on accuracy but concentrates instead on greater compliance.</p> <p>Robot Hand research obviously includes kinematics, dynamics and grasping. Research into hand control looks at the role of the inner parts of the hand (palm and proximal phalanges) in enhancing both the stability of the grip and the versatility of operation. The non-holonomic nature of the physics of rolling contacts can also be exploited in order to build simpler and more reliable manipulation devices. Force/torque sensors have been miniaturised sufficiently to fit in robot fingers and other miniature devices. Tactile Sensors research considers choice, placement and organisation of basic transducers to maximise sensitivity and minimise errors.</p> <p>We have built a robot hand that can arbitrarily displace and reorient a grasped workpiece without releasing the hold, that utilizes only four motors. The hand has force/torque and tactile sensing capabilities on the rotating fingerpads.</p> <p>We have also built a prototype four-legged semi-autonomous vehicle and a 50-cm diameter spherical inspection robot.</p>

Institution:	Scuola Superiore Sant'Anna, Pisa
Address:	Via G. Carducci, 40 56127 Pisa Italy
Contact:	Prof. Paolo Dario
Phone:	+39 050 883401
Fax:	+39 050 883402
Email:	dario@arts.sssup.it , cecilia@arts.sssup.it
URL:	http://www.sssup.it/sssup/index.jsp?lang=en , http://www-arts.sssup.it/ , http://www-crim.sssup.it/ , http://www.percro.org/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Scuola Superiore Sant'Anna (SSSA) in Pisa is a public University whose mission is to pursue excellence in education and research through multi-disciplinarity. Accordingly, SSSA is carrying out research activities on robotics with an interdisciplinary theoretical and experimental approach. More than 100 researchers in four laboratories are involved in robotics research, and have achieved considerable expertise in such main areas as biomedical robotics, micro-robotics, perceptual robotics and real-time control.</p> <p>The focus of the ARTS Lab (Advanced Robotics Technology and Systems Laboratory) is biomedical robotics and bio-mechatronics, and specifically rehabilitation, humanoids, and neuro-robotics; the CRIM Lab (Research Centre in MicroEngineering) is active in micro-mechatronics and surgical robotics; the PERCRO Lab (PERCeptual RObotics) mainly focuses on the development of robotic systems for haptic feedback, simulation, and tele-operation in Virtual Environments; and the RETIS Lab is active in real-time embedded control systems for robotics and automation. Advanced state-of-the art robotic platforms and major facilities are available at SSSA for fabrication and experimental testing of components and systems.</p>

14.12 Perugia

Institution:	Industrial Automation and Robotics Laboratory, University of Perugia
Address:	Department of Electronic and Information Engineering Via G. Duranti 93 I-06125 Perugia Italy
Contact:	Prof. Paolo Valigi
Phone:	+39 075 585 3684
Fax:	+39 075 585 3654
Email:	valigi@diei.unipg.it
URL:	http://www.diei.unipg.it/liaai/liaai.html
Faculty:	1 Professor, 1 Associate Professor, 1 Research Assistant
Post-Docs:	
Students:	6 Ph.D. students
Projects	<p>The Department of Electronic and Information Engineering of the University of Perugia is active in the field of robotics through its Industrial Automation and Robotics Laboratory.</p> <p>Research interests in the field of robotics concern the multi-robot localisation and navigation problem. Our primary interest is in the design and evaluation of localisation algorithms in non-structured spatial environments, both for cooperating and for competitive robots. Other subjects of interest are also the tele-control and tele-surveillance problems, based on the intensive use of Internet and web technologies.</p> <p>Other research interests cover discrete event systems, hybrid systems, process control and engineering for cardiology.</p> <p>Topics currently under investigation include team-based mobile robot exploration for industrial applications, a Rehabilitation Ventricular Assist Device for the rehabilitation of cardiac muscle, fast prototyping of control systems for manufacturing systems, and optimal control of systems' response to discrete events.</p>

14.13 Rome

Institution:	Institute of Cognitive Sciences and Technology (ISTC)
Address:	Viale Marx, 15 00137 Roma Italy
Contact:	Prof. Stefano Nolfi
Phone:	+39 06 860 90231
Fax:	+39 06 824 737
Email:	nolfi@ip.rm.cnr.it
URL:	http://gral.ip.rm.cnr.it/ http://www.istc.ip.rm.cnr.it/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Institute of Cognitive Sciences and Technology (ISTC) of the National Research Council (CNR) conducts interdisciplinary research ranging from cognitive science, artificial intelligence and robotics to linguistics and primatology. The Laboratory of Artificial Life and Robotics is an internationally recognized research group that carries out pioneering research in the area of artificial life and evolutionary robotics. Our main research activity involves the study of artificial organisms that are embodied (i.e. that are controlled by an artificial neural network but that also have a body), situated (i.e. that interact with an external environment) and that evolve (i.e. that are part of a population that is subjected to an evolutionary process based on selective reproduction).</p> <p>Using this methodology we investigate research issues such as: the synthesis of autonomous and adaptive machines; the evolution of modularity, the synthesis of behaviors that emerge from interactions between different components (e.g. the organism and the environment or the brain and the body or different individuals of the population) or from the interaction between different processes (e.g. evolution, development and learning).</p> <p>Themes of interest include: neural networks, evolutionary algorithms, adaptive behavior, autonomous robots, collective robotics, social simulations, interaction between evolution learning and development, educational technologies. A major focus is the evolution of coordinated collective behaviour, where groups of physically-linked simulated robots cooperate in order to push and retrieve objects, or search for and approach a light in a maze.</p> <p>We have evolved the control system of a simulated robotic arm provided with a two-fingered hand, which has to reach and grasp objects in various locations and with various shapes and orientations, on the basis of simple tactile information. We also co-evolve predator and prey robots.</p>

Institution:	Department of Computer and System Sciences (DIS), University of Rome ‘La Sapienza’
Address:	Via Eudossiana 18 00184 Roma Italy
Contact:	Prof. Alessandro De Luca
Phone:	+39 06 44585 371
Fax:	+39 06 44585 367
Email:	deluca@dis.uniroma1.it
URL:	http://www.dis.uniroma1.it/
Faculty:	24 Professors, 18 Associate Professors, 19 Research Associates
Post-Docs:	
Students:	42 Ph.D. students
Projects	<p>The Department of Computer and System Sciences (DIS) of the University of Roma “La Sapienza” is devoted to research in computer, system, and management sciences. Robotics at DIS includes expertise in motion planning and control, sensor-based navigation, task planning, cognitive robotics, and real-time programming for service and industrial robotic systems (manipulators, wheeled and legged mobile robots), with a blend of theoretical developments and experimental verification.</p> <p>One research focus is the control of wheeled mobile robots. Our web site shows video of many experiments with our SuperMARIO robot. Currently we are particularly interested in the exploration of unknown environments and in the control of under-actuated robots.</p> <p>The Butterfly is a particular kind of underactuated robot, consisting of a single motor driving a link shaped like a butterfly. A ball can freely roll on its edge: one objective is to execute a 180 degrees rotation of the link without losing contact with the ball, and to stabilize the ball position on the opposite side of the Butterfly. To this end, the contour of the link has been studied in order to avoid singularities, and a polynomial profile has been chosen. We are currently studying the possibility of including visual feedback to improve the robustness of the controller.</p> <p>We are also keen to promote web-based study and experimentation in control theory. To this end we have developed the Remote Experiments for Active Learning (REAL) lab, which gives direct access to our robots and returns real-time images as feedback. DIS also participates in Robocup.</p>

Institution:	Robotics Lab, University of Rome Tor Vergata
Address:	DISP Via del Politecnico 1 00133 Roma Italy
Contact:	Prof. Salvatore Nicosia
Phone:	+39 6 7259 7433
Fax:	+39 6 7259 7427
Email:	nicosia@disp.uniroma2.it
URL:	http://robot2.disp.uniroma2.it/
Faculty:	3 Professors, 1 Associate Professor, 2 Assistant Professors
Post-Docs:	1 person
Students:	3 Ph.D. students
Projects	The research of the Robotics Lab at the Department of Computer Science and Control Engineering of the University of 'Rome Tor Vergata' is devoted to mobile robot indoor/outdoor navigation, localization and motion planning problems, to flexible and rigid manipulator motion control including medical applications and involving image processing and the study of anti-windup techniques.
Institution:	CAMPUS Bio-medico University, Rome
Address:	Facoltà di Ingegneria Via Emilio Longoni 83 00155 Roma Italy
Contact:	Roberto Setola
Phone:	+39 06 22 54 11
Fax:	+39 06 22 54 1456
Email:	r.setola@unicampus.it
URL:	http://www.unicampus.it/
Faculty:	16 Professors, 14 Associate Professors, 27 Researchers
Post-Docs:	
Students:	
Projects	The University CAMPUS Biomedico di Roma, is a private university devoted to higher education/training, R&D in the medical and bio-engineering fields and into health care structure. We conduct research on most aspects of medicine, including biochemistry, molecular biology, and the use of information technology in medicine. We use IT to model different pathologies for both education and research purposes, and were also active on the collaborative HERMES project for tele-medicine and tele-education. Robot-related research lines are devoted to the introduction of bio-mechatronic and robotic systems into surgery and into rehabilitation processes. The main field of activity on these topics are related to: active vibration control, network control (remote monitor and control via wired and wireless network), modeling and control of complex networks (critical infrastructure protection), humanoid robotics, and the introduction of fuzzy logic and innovative schemes to control bio-medical apparatus.

14.14 Siena

Institution:	Robotics Lab, University of Siena
Address:	Dipartimento di Ingegneria dell'Informazione Via Roma 56 53100 Siena Italy
Contact:	Prof. Domenico Prattichizzo
Phone:	+39 0577 234609
Fax:	+39 0577 23602
Email:	prattichizzo@ing.unisi.it
URL:	http://www.ing.unisi.it/control/
Faculty:	1 Professor, 2 Associate Professors, 4 Assistant Professors
Post-Docs:	2 persons
Students:	6 Ph.D. students
Projects	<p>The Robotics Lab of the Systems and Control Group of the University of Siena is devoted to research in haptic interfaces with special attention to medical applications, mobile robotics, visual servoing, cooperation and control of multi robots systems, robotic manipulation and grasping. Part of the laboratory is available on the Internet at www.dii.unisi.it/ACT.</p> <p>The FeTouch (Fetus-Touch) Project uses fetal models obtained from US images acquired by echographic instruments to generate a 3D graphic model of the fetus. This visio-haptic model can be viewed, and can also be used for kineasthetic and tactile interaction creating a realistic sensation of physical contact.</p> <p>A geometric approach, using mathematical concepts developed to analyze the most salient features of multivariable linear dynamical systems in the state space domain, has been applied to some interesting control problems for linear time invariant systems, particularly discrete time systems.</p> <p>Research on path planning problems for mobile robots concentrates on paths with minimum uncertainty about the robot's pose, using a potential field approach based on the landmarks in the scene and on the particular kind of measurements. We consider a set membership framework without any statistical a priori knowledge.</p> <p>Visual servo control research interests focus on: planar and tridimensional visual-servoing algorithms using an estimated trifocal tensor; visual servoing and formation control for a robot team; epipolar visual servoing for a non-holonimic robot. We are also interested in flexible and extendable generation of the visual stimulus for eye tracking experiments.</p>

14.15 Turin

Institution:	Robotics Laboratory (LabRob), Politecnico di Torino
Address:	Corso Duca degli Abruzzi 24 10129 Torino Italy
Contact:	Prof. Basilio Bona
Phone:	+39 0115647023
Fax:	+39 0115647099
Email:	bona@polito.it
URL:	http://www.ladispe.polito.it/robotica/Labrob/indexen.htm
Faculty:	1 Professor, 1 Associate Professor, 3 Research Assistants
Post-Docs:	
Students:	2 Ph.D. students
Projects	<p>LabRob, the Robotics Laboratory in the Control and Computer Science Department of Turin Politechnic is a teaching and research facility devoted to the study of industrial robotics, including software and hardware architectures for control prototyping, vision, flexible manipulators, mobile robotics and real-time operating systems. It has strong connections with the Mechatronics Laboratory at Turin Polytechnic.</p> <p>We are involved in the research projects RAMSETE (Articulated and Mobile Robots for Services and Technology), MATRICS (Methodologies Applications and Technologies for Robot Interaction Cooperation and Supervision), and MISTRAL (Methodologies and Integration of Subsystems and Technologies for Anthropic Robotics and Locomotion).</p> <p>One research focus is the construction of a flexible robot arm and the various matters related to its intelligent control. A complete simulator and a physical prototype have been produced.</p> <p>Another research area is on methods, architectures and devices for the interaction of fixed and mobile robots with the environment, with particular focus on impact and contact force control, and on general motion planning. The problem of impact control is still open, although we are in the process of proposing mathematical models to represent and analyse the actual impact, the transition phase from the free-motion state to the condition where the robot is in contact with external bodies, taking into account the discontinuity of the equations of motion of the systems involved (the manipulator and the external environment) at the time of impact.</p>

14.16 Verona

Institution:	Laboratory for Teleoperation and Autonomous Intelligent Robots (ALTAIR), University of Verona
Address:	Dipartimento di Informatica Strada le Grazie 15 37134 Verona Italy
Contact:	Prof. Paolo Fiorini
Phone:	+39 0458 027963
Fax:	+39 0458 027928
Email:	paolo.fiorini@univr.it
URL:	http://metropolis.sci.univr.it/
Faculty:	1 Associate Professor, 3 Research Assistants
Post-Docs:	
Students:	7 Ph.D. students
Projects	<p>The Robotics Laboratory at the Department of Computer Science of the University of Verona is dedicated to the analysis and development of teleoperated and autonomous robotic systems. The laboratory works on projects ranging from tele-medicine, to logistics, to space exploration and robotics education. The aim of our laboratory is to lead research and development into unconventional robotic systems that can interact with the surrounding environment in multiple ways, from tele-operation to autonomous behaviours.</p> <p>Our research focuses mainly on applications for service robotics and field robotics, in fact it includes all those robotic systems that do not involve manufacturing. Areas of particular interest are robotic surgery, exploration, elderly and disabled care, moving goods and countermeasure against disaster and terrorism.</p> <p>We have a mobile robot Nomad 200, useful for studying motion planning algorithms and two robotic arms, Puma 200 and Puma 500, that in conjunction with two six degrees of freedom joysticks (developed by NASA - JPL), are the hardware for research in teleoperation system. Other projects in teleoperation use a benchmark to analyze performance in control architectures.</p> <p>Current projects include: adding a stereoscopic omnidirectional camera to the NOMAD in order to study visual based navigation in an indoor environment, installing a multi axis motion controller card on our PUMA 200 arm, and adding a force/torque sensor to the PUMA 500 arm. We are also developing the software to handle joysticks with six degrees of freedom and force feedback. These will become the master part of our teleoperation system with force feedback. Then we will develop the teleoperation system of our lab so that it is usable over the Internet for research and didactic applications.</p> <p>We also own a Mars surface simulation (carpet and basalt stones), which we use to study the parabolic trajectories of a hopping robot, and localization using stones as landmarks.</p>

15 Netherlands

15.1 Amsterdam

Institution:	Intelligent Autonomous Systems Group (IAS), University of Amsterdam
Address:	Informatics Institute Faculty of Science Kruislaan 403 1098 SJ Amsterdam The Netherlands
Contact:	Prof. Frans C. A. Groen
Phone:	+31 20 5257461
Fax:	+31 20 5257490
Email:	groen@science.uva.nl
URL:	http://www.science.uva.nl/research/ias/
Faculty:	2 Professors, 1 Associate Professor, 3 Assistant Professors
Post-Docs:	6 persons
Students:	9 Ph.D. students
Projects	<p>In the Informatics Institute of the University of Amsterdam robotics research takes place in the Intelligent Autonomous Systems Group (IAS). The group studies methods of creating Intelligent Autonomous systems, which may be single entities or cooperating multi-agent systems, which operate in a real world inhabited by humans and other agents. In the field of intelligent robots, IAS works on service robots, multi-robots within the RoboCup frame work, and intelligent vehicles. Research focusses on perception, learning, and the geometric principles of autonomous systems.</p> <p>Current perception projects are environment representation for autonomous vehicles, and the fusion of visual, range, and audible information for security and surveillance. Previous projects included motion estimation and interpretation with mobile vision systems, wavelet-based analysis, and sound understanding for autonomous systems. Learning research originally focussed on neural networks, now we tend to use probabilistic methods. Finished robot-related projects include robot arm control, and sensor data fusion. Current projects include: personal robots in intelligent environments, and learning concepts in real world embodied agents.</p> <p>Real world multi-agent systems research is focussed on different aspects of distributed cooperating systems, such as fusing distributed sensor information, representation issues such as shared dynamic world models, and the optimization of action planning. Methods used must cope with the noise, uncertainty and time dependency of real sensor information.</p> <p>We contribute to the Dutch team in the Robocup middle-size league, focusing particularly on maintaining a coherent distributed world model and deriving useful team behaviour from it. We are developing software to enable coordination between all the various hardware and software architectures used by the members of the Dutch team. We also participate in the Robocup simulation league.</p>

15.2 Eindhoven

Institution:	Control Systems Group, Eindhoven University of Technology
Address:	Electrical Engineering PO Box 513, 5600 MB Eindhoven The Netherlands
Contact:	Prof. Paul van den Bosch
Phone:	+31 40 247 3760
Fax:	+31 40 243 4582
Email:	p.p.j.v.d.bosch@tue.nl
URL:	http://www.cs.ele.tue.nl/
Faculty:	1 Professor, 8 Researchers
Post-Docs:	
Students:	≈ 15 Ph.D. students
Projects	<p>Eindhoven University of Technology (EUT) focusses on fundamental and strategic technological research that is relevant for industrial or other applications. EUT holds a prominent position in the research fields of communication technology, materials technology, and catalysis. Moreover, EUT wishes to strengthen the field of bio-engineering.</p> <p>The Control Systems group at EUT is active in the robotic research area with focus on automotive applications and hybrid systems. Automotive research is concentrated on guiding and controlling multiple-articulated public transport vehicles. A stabilising controller with feedback linearisation and backstepping has been designed for all 4 independent controllable axles of the articulated bus, and performed well in early tests. We are also interested in scanner control, in cooperation between autonomous guided vehicles for transporting unique and heavy objects, and car navigation.</p> <p>In the area of hybrid systems we study non-linear complementarity systems, the influence of asynchronous control software on the stability and performance of computer-controlled processes, and control of and fault detection in continuous systems for which only partial measurement information is available (so-called quantised systems).</p> <p>Collaborative projects include: model predictive control for hybrid systems; analysis and synthesis of embedded systems with discrete and continuous controllers; a model-based controller for diesel and lean-burn engines, to optimize both emissions and fuel consumptions; Cooperative transportation of a large object by multiple automatically guided vehicles; contactless multi-dimensional actuator technology; intelligence in power nets; design of embedded real-time control; the development of an energy and power management system for conventional and future vehicle power nets; control in glass melting ovens; L1 optimal control; and dynamics and complementarity.</p>

15.3 Twente

Institution:	Drebbel Institute for Mechatronics, University of Twente
Address:	P.O. Box 217 7500 AE Enschede The Netherlands
Contact:	Stefano Stramigioli
Phone:	+31 53 489 2794
Fax:	+31 53 489 2223
Email:	S.Stramigioli@ieee.org
URL:	http://www.drebbel.utwente.nl/
Faculty:	8 Professors, 5 Lecturers, 11 Research Assistants
Post-Docs:	2 persons
Students:	31 Ph.D. students
Projects	<p>The Drebbel Insitute for Mechatronics in the University of Twente is a collaboration between the faculty of Electrical Engineering, Math and Computer Science and the faculty of Mechanical Engineering. One of the main interests is Mechatronics and Robotics from a fundamental and application point of view. The field of Robotics is mostly concentrated in haptics, tele-manipulation and walking locomotion.</p> <p>The research topics of the Drebbel Institute include: mechatronic design projects and tools, control theory and control engineering, mechatronic measuring systems, and embedded control systems.</p> <p>Within the Drebbel Institute about 30 PhD students are working on various research projects, including: control of laser welding and control of laser welding robots, vibration control with a smart disc, learning feed-forward control of linear motors, surface acoustic wave motors, micro scanning probe array memory (mSpam), embedded control systems, stability aspects of learning feed-forward control, hybrid systems, non-linear control, adaptive control, infinite dimensional systems, measurements of micro wear, hybrid isolation of construction sound, micro flow measurement, and measurements of body dynamics.</p>

15.4 Utrecht

Institution:	Institute of Information and Computing Sciences, Utrecht University
Address:	PO Box 80.089 3508 TB Utrecht The Netherlands
Contact:	Prof. Dr. Mark H. Overmars
Phone:	+31 30 2533736
Fax:	+31 30 2513791
Email:	markov@cs.uu.nl
URL:	http://www.cs.uu.nl/centers/give/
Faculty:	2 Professors, 8 Research Assistants
Post-Docs:	
Students:	16 Ph.D. students
Projects	<p>The Institute of Information and Computing Sciences (ICS) at Utrecht University contains several research institutes including: the Center for Geometry, Imaging and Virtual Environments (GIVE), the Institute for Programming research and Algorithmics (IPA), the Dutch research school for Information and Knowledge Systems (SIKS), the Helmholtz Institute for Autonomous Systems Research, and the Advanced School for Computing and Imaging.</p> <p>The Center for Geometry, Imaging and Virtual Environments studies techniques for the creation, storage, analysis and manipulation of spatial data and objects. Within the field of robotics its emphasis is on motion planning in virtual environments and manipulation in industrial settings.</p> <p>The Helmholtz Institute is an interfaculty research collaboration of the departments Behavioural Biology (Faculty of Biology), Experimental Audiology (Faculty of Medicine), Functional Neurobiology (Faculty of Biology), Human Perception (Faculty of Physics and Astronomy), Perception Motor Integration (Faculty of Physics and Astronomy), and Psychonomics (Faculty of Social Sciences)</p> <p>The Helmholtz Institute aims to stimulate and coordinate scientific research in the field of perception and motor behaviour at the intersections of biology, medicine, physics and psychology.</p> <p>SIKS research foci are: agent technology, computational intelligence, knowledge representation and reasoning, web-based information systems, e-business systems, human computer interaction, data management, data storage and retrieval, and architecture-driven system development. Agent technology is the most relevant to robotics, with applications ranging from intelligent personal assistants in various environments to cognitive robots, with software agents such as trading agents in e-commerce settings also providing many similar research issues.</p>

16 Poland

16.1 Lodz

Institution:	Robotics Group, Technical University of Lodz
Address:	Institute of Automatic Control ul Stefanowskiego 18/22 90-924 Lodz Poland
Contact:	Prof. Edward Jezierski
Phone:	+48 42 6367644
Fax:	+48 42 6312551
Email:	edjez@p.lodz.pl
URL:	http://www.p.lodz.pl/I13/nowa/index.html
Faculty:	3 Professors, 4 Senior Researchers
Post-Docs:	
Students:	4 Ph.D. students
Projects	The Robotics Group of the Institute of Automatic Control at the Technical University of Lodz was created 12 years ago. The main research areas investigated are control of robots equipped with electric and pneumatic drives, control of robots that minimize consumption of energy, and impedance control of robots. Further interests are the utilization of information in robot steering, the coordination of cooperation of sub-assembly position, and the construction and steering of robots for special applications. The group was involved in the PECO - Telemat project. Themes for research include: educational robot programming; synthesis of optimal, adaptive and nonlinear control algorithms; construction of control system for RobIn Heart cardio-surgery robot; research on pneumatic robots with drives using artificial muscles; application of fuzzy controllers, artificial neural networks, and "neuro-fuzzy" methods for control of various dynamic objects; and design of electronic and microprocessor controllers for industrial applications.

16.2 Poznan

Institution:	Poznan University of Technology
Address:	Piotrowo 3A 60-965 Poznan Poland
Contact:	Waldemar Wroblewski
Phone:	+48 61 665 23 68
Fax:	+48 61 665 21 99
Email:	waldemar.wroblewski@put.poznan.pl
URL:	http://www.put.poznan.pl/Welcome.html
Faculty:	
Post-Docs:	
Students:	
Projects	<p>Poznan University of Technology contains a group of 20 people interested in different aspects of robotics and automation. Among them there are the following areas of interest:</p> <ul style="list-style-type: none"> • Trajectory tracking in unstructured and dynamically changing environments using sensory information, in particular vision systems. • Modular hardware and software control algorithms for holonomic and non-holonomic machines. • Multi-agent software systems for machines working in a cooperative manner in unstructured and dynamically changing environments. • mobile robot design, architecture, control and software. • climbing robot design, architecture, control and software.

16.3 Warsaw

Institution:	CATID, Warsaw University of Technology (WUT)
Address:	Institute of Control and Computation Engineering ul. Nowowiejska 15/19 00-665 Warszawa Poland
Contact:	Prof. Cezary Zielinski or W.Szynkiewicz
Phone:	+48 22 660 7750 or 7397
Fax:	+48 22 825 3719
Email:	C.Zielinski@ia.pw.edu.pl or W.Szynkiewicz@ia.pw.edu.pl
URL:	http://www.ia.pw.edu.pl/ , http://www.ia.pw.edu.pl/index.php?lang=en&MMenu=main
Faculty:	
Post-Docs:	
Students:	
Projects	<p>CATID (Centre for Automation, Information and Decision Technologies) is a young technology transfer centre that contains several research groups under the same umbrella. These groups come from four different faculties of the Warsaw University of Technology: the Faculty for Electronics and Information Technology, Electrical Engineering, Mechatronics Faculty and the Faculty for Mechanics and Aviation. The aim of this organization is to provide informational support for industrial and commercial institutions as well as to perform R&D cooperation projects with the private or public sector. The main topics of interest are: automatic control, signal analysis, decision support systems and computer vision.</p> <p>Recently CATID has extended its activities over the Polish border by opening a cooperation with the company Knowledge Support Systems (UK) and joining the European Association - Unmanned Vehicle Systems Thematic Network.</p>

Institution:	Industrial Research Institute for Automation and Measurements - PIAP
Address:	Al. Jerozolimskie 202 02-486 Warszawa Poland
Contact:	
Phone:	+48 22 874 0164
Fax:	+48 22 874 0221
Email:	piap@piap.pl
URL:	http://www.piap.pl/piap/english_version/contact.php/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Industrial Research Institute for Automation and Measurements (PIAP) in Warsaw was established in 1965 to solve technical problems in various sectors of the economy. The main area of activity is implementation of specialised tasks within the scope of widely understood automation, robotization and industrial test equipment. The scope of PIAP's competence includes: the development, implementation, start-up at user's site, and post-sales maintenance of: automated and robotized work centers and production lines; new generations of control systems and drives for modernized production installations; industrial measurement systems; stations for visual process inspection; monitoring and telemetry systems; intelligent systems and mobile robots for special applications; specialized test equipment; and installations for recycling of cars and household appliances (mechanization, automation, IT solutions).</p> <p>We specialize in the integration of large systems with components from various manufacturers.</p> <p>Moreover PIAP offers the following services to its clients: implementation of scientific and R&D works required for development of new methods and equipment in the fields of automation, robotics and industrial test equipment; testing components, equipment and systems at our certified Laboratory for Testing of Industrial Automation and Robotics (PIAP-LAB); and issuing product certificates according to Polish certification model by Product Certification Department.</p>

16.4 Wroclaw

Institution:	Department of Fundamental Cybernetics and Robotics, Wroclaw University of Technology
Address:	Institute of Engineering Cybernetics Wybrzeze Wyspianskiego 27 50-370 Wroclaw Poland
Contact:	Prof. Dr. Krzysztof Tchon
Phone:	+48 71 320 3271
Fax:	
Email:	tchon@ict.pwr.wroc.pl
URL:	http://www.zpcir.ict.pwr.wroc.pl/index.php?LANGUAGE=en
Faculty:	1 Professor, 12 Senior Researchers
Post-Docs:	
Students:	6 Ph.D. students
Projects	<p>The Department of Fundamental Cybernetics and Robotics is a part of the Institute of Engineering Cybernetics, Wroclaw University of Technology (WUT). The department owns a robotics laboratory, equipped with manipulation and mobile robots as well as with vision and sonar systems. It also has substantial computing facilities. Research work in robotics is focused on control and motion planning algorithms for manipulation and mobile robots (including singular tracking), mobile robot navigation, discrete event systems and AGV, sensor data processing, vision and sonar systems, medical applications (ultrasonic medical data processing, hand prosthesis), and control software and hardware design of robots.</p> <p>Further robot research takes place under the auspices of three separate faculties at WUT. The Faculty of Electrical Engineering researches Automation of machines, vehicles and apparatus.</p> <p>The Faculty of Electronics specialises in: automation of production processes; computer-based control networks; software engineering of control systems; and computer management systems for production processes.</p> <p>The Faculty of Mechanical Engineering specialises in: engineering machine and process automation, manufacturing systems, and biomedical engineering.</p> <p>Our student association is enthusiastic about the RoboCup Simulation League. Research concerns the possibility of simultaneous evolution of both structures and program parameters, from a specified starting state. They also build robots using LEGO Mindstorms.</p>

17 Portugal

17.1 Aveiro

Institution:	Aveiro University
Address:	Campus Universitário de Santiago 3810-193 Aveiro Portugal
Contact:	Prof. Luís Seabra Lopes
Phone:	+351 234 370200
Fax:	+351 234 370545
Email:	lsl@det.ua.pt
URL:	http://www.ieeta.pt/atri/
Faculty:	12 people
Post-Docs:	
Students:	3 Ph.D. students, 4 others
Projects	<p>Robotics research is carried out in two research units of the University of Aveiro, namely the Institute of Electronics Engineering and Telematics (IEETA) and the Center for Mechanical Technology and Automation (TEMA).</p> <p>Transverse Activity on Intelligent Robotics (ATRI), based at IEETA, is mainly concerned with human-robot interaction, robot learning, multi-robot systems, distributed control architectures and robots in education.</p> <p>The human-robot interaction project has resulted in several prototypes of a robot tour guide which can both listen and talk to visitors. “Carl” uses incremental learning to develop visual recognition of naturally-occurring landmarks, which requires considerable dimensionality reduction to be tractable. Multi-robot research focuses on FC Portugal, our RoboCup simulation league team, developed in cooperation with the University of Porto. In 2000, this team won the world championship. Research is currently focused on tactic representation, selection and tuning, on new strategies for vision synchronization and strategic looking, and on more reliable communication. Distributed real-time control research focuses on hardware architectures, special purpose hardware for motoring and sensory subsystems, and new real-time communication protocols.</p> <p>The Automation and Robotics group, based at TEMA, is focused on mobile robot navigation, system modelling and computer integrated manufacturing. We are also interested in developing a mission specification language for navigation. We have developed an autonomous mobile platform for indoor 3D environment reconstruction, and are currently developing navigation tools and solutions for robust and multi-purpose navigation of a mobile robot. We have improved the information extractable from ultrasonic sensors, to enable a mobile robot to pass through a narrow opening. Overcoming odometry errors using laser or gyroscope information is a particular research focus. We have also developed various prototypes including a device allowing people with upper limb disabilities to feed themselves, an automatic assembly line for a water sprinkler, a tree axis electro-hydraulic manipulator, a conceptual washing machine, a functional prototype of a tricycle, an ACV prototype, and a Cartesian manipulator.</p>

17.2 Coimbra

Institution:	Industrial Robotics Laboratory, University of Coimbra
Address:	Mechanical Engineering Department Polo II Campus 3030 Coimbra Portugal
Contact:	Prof. J. Norberto Pires
Phone:	+351 239 790712
Fax:	+351 239 790701
Email:	norberto@robotics.dem.uc.pt
URL:	http://robotics.dem.uc.pt/
Faculty:	1 Professor, 3 Associate Professors, 1 Research Assistant
Post-Docs:	
Students:	3 Ph.D. students
Projects	<p>The Industrial Robotics Laboratory of the Mechanical Engineering Department (University of Coimbra) is heavily involved in industrial robotics research and development, including an extensive collaboration with industry (national and international). Interests include human-machine interfaces, force control, application distributed software, and force-torque sensors. A few products actually in production were developed in this laboratory under contract with companies.</p> <p>Current research work is focused on:</p> <ul style="list-style-type: none"> • force control. Indirect and efficient force control approaches applied to current industrial robotic manipulators and control systems. • force feedback. To implement force control approaches we need a force/torque sensing device and maybe some means to the user/programmer to feel the current force/moment. • software for flexible manufacturing systems. Our FMC programming approach is distributed and object-oriented, including support for robots, CCD cameras, force-torque sensors, etc. <p>We have had great fun and success with ERIC, a robot arm that can play chess or do welding http://robotics.dem.uc.pt/norberto/eric/. Our Nicola Tesla robot http://robotics.dem.uc.pt/norberto/nicola/ encourages people to play and to learn with small mobile robots. The objective is to demonstrate what is involved in the construction of a robot of this type, to show that it is possible to play with science and technology, and in the process the child learns and has a fantastic time.</p>

Institution:	Institute of Systems and Robotics (ISR), Coimbra
Address:	Departamento de Engenharia Electronica University of Coimbra 3030 - 290 Coimbra Portugal
Contact:	Prof. Jorge Manuel Miranda Dias
Phone:	+351 239 796219
Fax:	+351 239 406672
Email:	jorge@isr.uc.pt
URL:	http://www.isr.uc.pt/ , and http://paginas.fe.up.pt/isrp/
Faculty:	3 Professors, 6 Associate Professors, 10 Assistant Professors plus 27 at Porto
Post-Docs:	
Students:	≈ 34 Ph.D. students at Coimbra and about 30 at Porto
Projects	<p>The Institute of Systems and Robotics (ISR) is a Portuguese private, non-profit research institution dedicated to research in the field of robotics. ISR was founded in 1992 and promotes advanced multidisciplinary R&D in the areas of Mobile Autonomous Robotics, Automation, Control, Computer Vision, Biomedical Engineering, Dynamic Systems, Signal and Image Processing, and Artificial Intelligence. ISR comprises three geographically distributed research institutes: Coimbra University, Technical University of Lisbon, and Porto University.</p> <p>ISR-Coimbra has three groups featuring strong synergies between them: Automation and Robotics which is the core group, Control Theory and Operations Management. The Automation and Robotics Group has activities in the areas of robotics vision, autonomous systems, multi-sensor fusion and integration, tele-operation, sensor development, soft-control and motors and drives. The key objective is to improve autonomy and robustness when the robotics systems is interacting with an unknown environment. These research results have strong application potential in factory environments, in assistive technologies for elderly and handicapped people, and in dangerous environments. Ongoing projects include the development of navigation systems for mobile robots, autonomous wheelchairs, high-performance man-machine interface for tele-operation, active vision systems for robotics applications, 3D reconstruction of the human eye, new sensors for robotics, vision-based robotic arc welding, development of neural and genetic controllers, and advanced motor drive systems. The group participates in projects and networks involving some of the most outstanding research centers in Europe.</p> <p>ISR-Porto has four research groups: Process System Engineering, Control Systems and Technology, Decision and Control Engineering, and Industrial Automation. Research areas focus on optimization and control theory, process systems and control engineering, manufacturing and robotics technologies, and industrial automation.</p> <p>For ISR-Lisbon, please see the separate entry.</p>

17.3 Guimaraes

Institution:	University of Minho
Address:	Department of Industrial Electronics Campus Azurem 4800 Guimaraes Portugal
Contact:	Prof. Estela Bicho
Phone:	+351 253 510181
Fax:	+351 253 510189
Email:	estela.bicho@dei.uminho.pt
URL:	http://www.robotica.dei.uminho.pt/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>In the University of Minho, robotics research is mostly carried out in the Departments of Industrial Electronics and of Mathematics for Science and Technology. Research in robotics is mainly devoted to the field of Cognitive Robotics (single and multi-robot systems). In our current EU and national funded projects we develop control architectures which implement intelligent behaviors such as learning through imitation, action understanding, and anticipation, in artifacts acting in realistic environments. These architectures are based on the sound mathematical framework of dynamical systems which is used in parallel to explain experimental data provided by several collaborators in the areas of Cognitive sciences and Neuro-sciences. Robotic hardware includes several mobile robots built by us, Kheperas and manipulators.</p> <p>Work in the area of industrial robotics is dedicated to robotic furniture, autonomous robotics, graphical simulation of robots, picture processing, and automation in general.</p> <p>A robot sport competition will be held in Minho on 22nd Dec 2004. Competitions include robot football and robot dance. Collect the poster on http://www.robotica.dei.uminho.pt/eventos/edr/edr.pdf!</p>

17.4 Lisbon

Institution:	IdMind - Engenharia de Sistemas, Lda
Address:	Polo tecnológico de Lisboa, Lote 1 1600-546 Lisbon Portugal
Contact:	Eng. Carlos Marques
Phone:	+351 21 710 11 00
Fax:	+351 21 710 11 03
Email:	info@idmind.pt
URL:	http://www.idmind.pt/English/index.htm
Faculty: Post-Docs: Students:	
Projects	<p>The company IdMind has developed a set of robotic kits that can be used as a test bed for several innovative projects in the robotics area. We design and sell small multi-purpose educational robots, which can be programmed using a PC using a user-friendly visual language, where the programmer just needs to implement a flowchart for the desired robot behaviour by inserting and linking blocks, allowing the robot to perform a set of tasks only limited by the programmer's imagination. Our robotic kits are based on the concept: "build it - wire it - program it"; we made a totally open product and through the robot assembly process the student acquires the perception of the different steps involving the robot's construction. The company has great experience in integrating complex systems, composed of different sensors and actuators, and has been involved in R&D projects concerning multi-purpose robots (services, search and rescue).</p> <p>The company IdMind is currently working on several collaborative projects aiming at technology development. From those, we pinpoint three:</p> <ul style="list-style-type: none"> • The RAPOSA project, whose goal is the development of a semi-autonomous search and rescue robot. We aim to build a real rescue robot to be used in hazardous environments, such as building sites. • The Rescue project will endow a team of outdoors robots with cooperative navigation capabilities, so as to demonstrate the ability of the robots to act individually and cooperatively in search and rescue-like operation scenarios. IdMind's contribution comprises sensor and actuator set-up, software development and hardware integration, blimp actuator set-up, and hardware and software development in order to control this device remotely. • ARTSBOT - ARTistic Swarm roBOTs project: a "robot swarm" able to paint and draw autonomously. IdMind's contribution was building the hardware, including sensors and special actuators.

Institution:	Institute of Systems and Robotics (ISR), Lisbon
Address:	Torre Norte - 7º Piso Av. Rovisco Pais, 1 1049 - 001 Lisboa Portugal
Contact:	Prof. João Sentieiro
Phone:	+351-218418289
Fax:	+351-218418291
Email:	jjss@isr.ist.utl.pt
URL:	http://www.isr.ist.utl.pt/
Faculty:	28 professors
Post-Docs:	
Students:	50 Ph.D. student and 20 undergraduates
Projects	<p>ISR-Lisbon works with ISR-Coimbra and ISR-Porto to research systems and robotics. ISR-Lisbon has six research laboratories: Intelligent Systems Lab (ISlab), Computer and Robot Vision Lab (VisLab), Evolutionary Systems and Biomedical Engineering Lab, Mobile Robotics Lab, Signal Processing Lab, and the Dynamical Systems and Ocean Robotics Lab.</p> <p>ISlab's driving theme is research and development on multi robotic agent systems, including modeling, working coherently as a group of agents, handling different and even opposite views of the world, allowing flexible communication among team members, evaluating the team performance, and implementing re-organization strategies to handle unexpected situations. Hybrid and discrete event systems, cooperative reinforcement learning, formation control, and emotion-based agents are also studied. The group is currently interested in applications to soccer robots, rescue robots, manufacturing systems, and satellite formations.</p> <p>VisLab focuses on the research and development of tools based on computer vision, as well as the application of computer vision in the context of robotics. We are particularly interested in the problems of active vision, visual based control, 3D-reconstruction, motion analysis and segmentation.</p> <p>The Mobile Robotics Laboratory is currently involved in the following projects: SACOR - Semi-autonomous cooperative robots, RAPOSA - Semi-autonomous robot for rescue operations, RESCUE - Cooperative navigation for rescue robots, POROBOT - Multi-purpose portuguese flexible mobile robot, COOPERA - Cooperation between robots in complex or dangerous environments, CAMERA - CAD modelling of built environments from range analysis, RESOLV - Reconstruction using scanned laser and video, and ITER - Conceptual study of flexible guidance, navigation and docking systems for the remote handling transport cask system.</p> <p>The Signal Processing lab reseaches, among less robot-related work, underwater communications, navigation, localization and tracking, and the detection of transient signals.</p> <p>Dynamical Systems and Ocean Robotics lab works in the general area of dynamical systems theory and applying it to the design and operation of autonomous marine and aerial robots. Theoretical areas of research include navigation, guidance, and control, mission control, and cooperative control of distributed autonomous vehicles. The lab is currently involved in a number of multidisciplinary projects using advanced robotic systems that include the Infante autonomous underwater vehicle, the Delfim autonomous surface craft, and the Caravela 2000 autonomous oceanographic vessel.</p>

18 Russia

18.1 St. Petersburg

Institution:	Laboratory of Cybernetics and Control Systems, Saint-Petersburg
Address:	Sablinskaya, 14 197101 St. Petersburg Russia
Contact:	Prof. Iliya Miroshnik
Phone:	+7 812 5954128
Fax:	+7 812 5954128
Email:	miro@beam.ifmo.ru
URL:	http://ccslab.nm.ru/cyberlab/
Faculty:	2 Professors, 3 Associate Professors
Post-Docs:	
Students:	2 Ph.D. students
Projects	<p>The Laboratory of Cybernetics and Control Systems (CCS Lab) is a research division of the Department of Control Systems and Informatics of the State Institute of Fine Mechanics and Optics - Technical University of St. Petersburg. The CCS Lab took active role in organising the 5th St. Petersburg Olympiad on cybernetics for schoolchildren in February 2004.</p> <p>Current research activity is centered around the following topics: Nonlinear control of complex systems; Adaptive, robust and learning control of uncertain systems; Coordinating control of multivariable systems and curve/surface following problems; Robotic systems including modeling and control of stationary, wheeled and mobile robots; and Multi-body mechanical systems, oscillating processes and problems of synchronization.</p> <p>Application research includes: Path-following control systems and high-precision interpolators, Autonomous systems, wheeled robots and mobile manipulators, Redundant and underactuated robot dynamics and control, and Sensor-based manipulation in complex, dynamic and uncertain environments.</p> <p>Main achievements: a coordinating control principle, a geometric theory of spatial motion control, partial stability and partial stabilization of nonlinear systems, active robotic control systems, a methodology of mobile robot control, the inter-university center “Mechatronic and Mobile Complexes” (in collaboration with the laboratory “Control Complex Systems” and Saint-Petersburg Electro-engineering University).</p> <p>Main projects: adaptive trajectory control systems for mechatronic modules, dynamic stabilization of movement control systems, techniques for coordinating control of robotic manipulators, techniques for nonlinear and adaptive control of complex dynamical systems, control of active robotic systems, methodologies of nonlinear and adaptive control for complex mechanical systems, intelligent control of mobile robots, and partial stabilization and motion control of nonlinear systems.</p>

19 Slovenia

19.1 Ljubljana

Institution:	Department for Automatics, Biocybernetics and Robotics
Address:	Jozef Stefan Institute, Jamova 39 1111 Ljubljana Slovenia
Contact:	Prof. Jadran Lenarcic
Phone:	+386 61 4773 900
Fax:	+386 61 219 385
Email:	Jadran.Lenarcic@ijs.si
URL:	http://www2.ijs.si/ruzic/e1/
Faculty:	2 Professors, 8 Research Assistants
Post-Docs:	
Students:	4 Ph.D. students
Projects	<p>The Department of Automatics, Biocybernetics and Robotics at the Jozef Stefan Institute, Ljubljana, Slovenia, has been active in basic research and development in the field of robotics since the late seventies.</p> <p>The basic impetus of the group is to study the properties of human motion in solving different tasks of manipulation and locomotion. This also includes studies of factors that influence human behaviour in extreme situations. The basic goal is to develop humanoid systems (for instance - humanoid 2-arm systems) and to use these new results in various industrial, as well as non-industrial applications, especially in medicine and sports. The group is an integration of specialists in automatics and robotics, biocybernetics and biomechanics, computer science and mathematics, physiology and biomechanics.</p> <p>In the mid-eighties, the Robotics Laboratory was established as a Department entity. In more recent years the Laboratory also started research in the biorobotics area. Robotics research includes: robot kinematics, workspace analysis, path computation for redundant robots, robot control, adaptive control, force control, control of redundant manipulators, motion planning, computation of free ranges for path planning, simulation systems, biorobotics and human body motion, synthesis of the human arm kinematic model, and force analysis in alpine skiing.</p>

20 Spain

20.1 Barcelona

Institution:	Automatic Control Department, Technical University of Catalonia
Address:	Edifici U (Campus Sud) Pau Gargallo, 5 08028 Barcelona Spain
Contact:	Prof. Alicia Casals
Phone:	+34 93 401 6971
Fax:	+34 93 401 7045
Email:	casals@esaii.upc.es
URL:	http://webesaii.upc.es/index.php?idioma=ANG
Faculty:	2 Professors, 5 Associate Professors, 1 Assistant Professor
Post-Docs:	
Students:	8 Ph.D. students
Projects	<p>The Automatic Control Department of the Polytechnic University of Catalunya (UPC) carries out both fundamental research and technology transfer in the fields of geometric modelling, robotics and control. The robotics activities are grouped into two areas: autonomous robots, and geometry and kinematics.</p> <p>The objective of our robotics research is the study and development of advanced robotic systems. In this environment, our main topics are: development of specific robots in industrial and non industrial environments, robot control and planning based on sensors and perception systems, and human-machine interfaces for robot control in special environments. Within this context, the research going on is addressed to three very different application fields: medical robotics, underwater robotics, and mobile robotics.</p> <p>Medical robotics research falls into two main areas. The surgical applications research goal is to provide the surgeon with robotic aids and precise sensory information not available in conventional surgical procedures. Assistant technology research aims at providing disabled people with a higher autonomy level, either using robotic systems that act as an extension of the user's own motion capabilities, or to substitute somehow for the user's loss of mobility.</p> <p>Current research using the underwater robot Garbi is oriented to the intelligent manipulation of objects based on teleoperation. Since the speed at which the operator can work is much higher than that attainable by the robotic arms, the work going on is based on the generation of a model of the arms to track their movements and to provide the user with augmented images (including superimposed information) to facilitate interactive operation.</p> <p>Mobile robot research focuses on assisted navigation systems for autonomous vehicles, and particularly perception systems and control algorithms in real environments.</p> <p>Projects and collaborations with companies include: a wheelchair rover; a robotic kitchen for older and disabled people; development of a robot control environment for surgical applications; mobile robot STAFF; a robotic system for the automatic guidance of the camera, the laparoscope, in laparoscopic surgery; and Tou, an assistant robot arm.</p> <p>The Biomedical Engineering Research Centre (CREB) at UPC also has a robotics and vision division.</p>

Institution:	Institute of Robotics and Industrial Informatics (IRI)
Address:	Technology Park of Barcelona, U Building St. Llorens i Artigas 4-6 2nd Floor 08028 Barcelona Spain
Contact:	Prof. Carme Torras
Phone:	+34 93 401 57 51
Fax:	+34 93 401 57 50
Email:	ctorras@iri.upc.es
URL:	http://www-iri.upc.es/
Faculty: Post-Docs: Students:	
Projects	<p>The Institute of Robotics and Industrial Informatics (IRI) carries out both fundamental research and technology transfer in the fields of geometric modelling, robotics, and control. The robotics activities are grouped into two main areas: autonomous robots, and geometry and kinematics.</p> <p>Both wheeled and legged autonomous robots are objects of research. Ongoing projects include:</p> <ul style="list-style-type: none"> • ANNA, supervised learning of industrial scenes using a wheeled mobile robot equipped with an active vision system. Object characterization for this project involves using the on-board camera to capture invariant appearance and geometric object features, and linking these with acoustic signatures. • SIRVENT, a reconfigurable system for the vision based navigation of robots in unmodified natural surroundings, using self-determined natural landmarks for navigation, building topological maps, and reaching their target. A six-legged walking robot is the test platform for this project. • DIST, the design and implementation of efficient parallelizable algorithms with applications to robotics and proteomics; <p>Our learning and vision mobile robotics group researches colour invariance, geometric computer vision, segmentation, tracking, recognition of faces and other objects, and robot localization, where robots are given tools to learn a map of the environment and to afterwards localize itself in this learned area. Visual landmark detection (and tracking) and depth information from lasers are combined to achieve these objectives. Computer graphics group research sometimes has robotic content, for example in the planning and robotization of maxillofacial surgery. Precise 3D planning is required since the face contains so many structures that must not be damaged during the surgery. A human surgeon will generate the trajectory of incision with reference to the reconstructed model, and decide on the correct end-tools. A robot surgeon should then be able to operate by precisely following the given trajectory.</p>

20.2 Cartagena

Institution:	Division of Systems and Electronics Engineering (DSIE), Technical University of Cartagena
Address:	Escuela Técnica Superior de Ingeniería Industrial C/ Doctor Fleming, s/n 30202 Cartagena Spain
Contact:	Prof. Andrés Iborra García
Phone:	+34 968 325654
Fax:	+34 968 325345
Email:	Andres.Iborra@upct.es
URL:	http://www.dte.upct.es/eng/index.html
Faculty:	1 Professor, 5 Associate Professors
Post-Docs:	
Students:	
Projects	<p>The Division of Systems and Electronics Engineering (DSIE) in the Department of Electronic Technology at the Technical University of Cartagena (UPCT) focuses its research interests on robotics and computer vision. Research activities are centred in the design and realisation of industrial applications of advanced production technologies, and transferring technology to the industrial world. The group has a multidisciplinary character putting together three areas of knowledge: electronics, computer and control engineering.</p> <p>Group objectives are two-fold: on the one hand a technological investigation at a basic level is made, and on the other hand the technological results obtained are used to solve industrial problems.</p> <p>Lines of research include: Control systems for production processes, Robotics for industrial applications, Automated systems of visual inspection, Robotics and artificial vision for surgical applications, Electronic technology for robotics and artificial vision, and Robotics during maintenance services in nuclear PWR power plants.</p> <p>We are involved in the EFTCoR project, which aims to solve the problem facing ship building and maintenance companies concerning hull surface preparation before painting. Traditional methods are environmentally damaging, and becoming illegal in many European lands. The main objective of the EFTCoR Project is to develop reliable and cost effective technologies for coating removal resulting in high quality surface preparation together with dramatic reduction in waste and zero environmental emissions. To reach this objective, it will be necessary to develop new coating removal technologies and materials, new cleaning heads with the necessary robotized systems to cover the surface to be cleaned efficiently, and original waste dealing and recycling systems.</p> <p>We were also involved in the previous GOYA project, which succeeded in developing a full-automated and low-cost blasting system for cleaning hulls based on a tele-operation platform.</p>

20.3 Castelló

Institution:	Robotic Intelligence Lab, Jaume-I University in Castelló
Address:	Campus Riu Sec, Edificio TI E-12080 Castelló Spain
Contact:	Prof. Angel Pasqual del Pobil
Phone:	+34 964 728344
Fax:	+34 964 728435
Email:	pobil@ieee.org
URL:	http://robot.act.uji.es/
Faculty:	1 Professor, 5 Associate Professors
Post-Docs:	
Students:	10 Ph.D. students
Projects	<p>The Robotic Intelligence Lab at Jaume-I University in Castelló is a research and education facility on robotics and artificial intelligence, with interests in reasoning about space, manipulation, perception, and motion in the framework of robotic systems, and keeping an applied viewpoint always in mind.</p> <p>Current research projects include:</p> <ul style="list-style-type: none"> • Verification and validation in knowledge based systems, an application in the framework of the automatic supervision of perception tasks for autonomous systems. Several Knowledge representations co-exist and the coherence of the whole system must be guaranteed. • Learning for sensorimotor coordination in robot manipulation, which aims to design and implement a full mobile manipulator system for service robotic tasks. Three main sublines can be distinguished: Perception-based learning for robot manipulation tasks under uncertainty, Intelligent motion for a robot arm with uncertainty based on computer vision and sensors, and Connectionist reinforcement learning techniques for motion planning of robot manipulators. • Visually guided grasping using inexpensive equipment. Experimentally validated results show that an inexpensive robot arm can stably grasp unknown everyday objects in real time by means of visual information and visual feedback provided by an ordinary camera and PC. Until now we have focused our research in static 2D scenarios. Two different approaches are considered in order to get the grasp determination. (A1) follows a heuristic procedure to determine an optimal grip within a gravitational field. And (A2) seeks to locate all the grips according to certain contact stability criteria, ignoring the gravitational field assumption. • Spatial representations and collision detection for practical motion planning aims to improve computational geometry and heuristic search techniques by using adequate spatial representations and reasoning as a way to expedite and simplify the process. The object representation will be capable of accepting input from a vision system. Different reasoning paradigms are used for gross motion planning and efficient collision detection. • Stereo visual servoing.

20.4 Girona

Institution:	Computer Vision and Robotics Group (VICOROB), University of Girona
Address:	Institut d'Informàtica i Aplicacions Campus Montilivi E-17071 Girona Spain
Contact:	Prof. Joan Batlle
Phone:	+34 972 41 89 56
Fax:	+34 972 41 87 67
Email:	jbattle@eia.udg.es
URL:	http://mosaic.udg.es/VICOROB/index1.php?lang=EN http://iiaa.udg.es/English/VICOROB_english.html
Faculty:	2 Professors, 6 Associate Professors
Post-Docs:	2 persons
Students:	11 Ph.D. students
Projects	<p>The Computer Vision and Robotics Group is part of the Institute of Informatics and Applications at the University of Girona in Spain. The group is active in basic and applied research. Research interests include mobile and underwater robotics, with special emphasis in control architectures for autonomous vehicles, computer vision and image processing systems for real time applications, object recognition and classification, development of hardware for image processing, etc.</p> <p>At present time, our group has two functional underwater research vehicles: URIS and GARBI.</p> <p>The Computer Vision and Robotics Group develops real time computer vision and image processing systems for recognition of object pattern, color, and shape, and tracking of mobile objects. One of the main application areas is the control quality of industrial products. Some of our robots aim to improve the autonomy and mobility of disabled people, while others are autonomous and teleoperated vehicles with industrial and research applications, such as security-related systems.</p> <p>The URIS (Underwater Robotic Intelligent System) vehicle is still under development. It was designed as a small, light weight, low cost AUV to be used as a research testbed in a water tank testing facility. This spherical vehicle incorporates a magnetic compass, a pressure sensor, water speed sensors, differential GPS, water leakage sensors, computer vision and a laser-based 3D computer vision system (still under development).</p> <p>GARBI was first conceived as a Remotely Operated Vehicle (ROV) for exploration in waters up to 200 meters in depth. Currently, a control architecture is being implemented to transform this vehicle into an Autonomous Underwater Vehicle. This vehicle can also be equipped with two arms, allowing the vehicle to perform object manipulation tasks through tele-operation. The vehicle incorporates 4 thrusters: two for performing horizontal movements (Yaw motion) and two for vertical movements (Z axis). The even weight distribution makes the vehicle completely stable in pitch and roll, meaning that vertical and horizontal movements are totally independent. The robot has several sensors including a colour camera fixed to its prow.</p>

20.5 Las Palmas

Institution:	Division of Intelligent Systems (DIS), University of Las Palmas
Address:	Computer Science and Systems Department University of Las Palmas de Gran Canaria 35017-Las Palmas Spain
Contact:	Jorge Cabrera Gámez
Phone:	+34 28 458747
Fax:	+34 28 458711
Email:	jcabrera@dis.ulpgc.es
URL:	http://www.dis.ulpgc.es/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>The Division of Intelligent Systems (DIS) is part of the Institute of Intelligent Systems and Numerical Applications in Engineering at the University of Las Palmas de Gran Canaria (Canary Islands, Spain). DIS' research focus is on system integration in robotics, museum robots, computer vision, visual learning, and multi-modal interfaces for perception-action systems.</p> <p>The group is involved in several projects related to motion detection, tracking and quantitative motion estimation working with active vision systems. It also has interests in parallel and distributed computing systems applied to computer vision problems and in the design of computer vision systems.</p>

20.6 Madrid

Institution:	Robotics Lab, Carlos III University, Madrid
Address:	Escuela Politécnica Superior Butarque, 15. Leganés 28911 Madrid Spain
Contact:	Prof. Miguel Angel Salichs
Phone:	+34 91 6249495
Fax:	+34 91 6249430
Email:	salichs@ing.uc3m.es
URL:	http://www.uc3m.es/uc3m/eng/index-eng.html
Faculty:	2 Professors, 3 Associate Professors, 3 Assistant Professors
Post-Docs:	
Students:	16 Ph.D. students
Projects	The Robotics laboratory in the Systems Engineering lab at Carlos III University in Madrid focuses its research interests on advanced robotics. Current research projects are related to personal robots, humanoids, climbing robots and mobile robots. The main application sectors involved in the research projects are edutainment, construction, assistance, industry and aerospace. Research topics include mechatronics, multi-modal human-robot interaction, topological navigation, multi-sensor perception, hybrid architectures, learning, tele-operation, application oriented problems, etc.

Institution:	Systems Engineering and Automatic Control Group (UPM-DISAM), Politechnical University of Madrid
Address:	Escuela Tecnica Superior de Ingenieros Industriales c/ José Gutiérrez Abascal, 2 E-28006 Madrid Spain
Contact:	Prof. Rafael Aracil
Phone:	+34 91 745 4660
Fax:	+34 91 336 3010
Email:	aracil@etsii.upm.es
URL:	http://www.disam.upm.es/
Faculty:	3 Professors, 10 Associate Professors
Post-Docs:	
Students:	16 Ph.D. students
Projects	<p>DISAM - UPM is the Systems Engineering and Automatic Control Group of the Politechnical University of Madrid. DISAM has specific experience in control engineering, electric engineering, computer engineering and mechanical engineering. Its main interests are in telerobotics, micro-robotics, flying robots and other mobile robots, and the development of techniques and equipment for the treatment and integration of disabled people.</p> <p>The main objective of our research activities involves both pre-competitive technological research and application of these technological results to problems presented by industrial companies.</p> <p>Finished projects include: a manipulator prototype, a robot for maintenance of live electrical lines, a robot assembly system for computer integrated construction, a redundant control system for inspection of nuclear steam generators, the SIRO robotized inspection system, automation of a delivery warehouse, automatic manufacturing of GRC panels, and automatic microorganism inoculation.</p> <p>Current projects include the development of a teleoperated retro excavator with several automatic functions, including a bilateral control scheme with force reflection; the development of a robotic system for in situ concrete repair using specially developed sensors to guide a hydro-erosion technique; the development of a mini-helicopter with autonomous flying capacity for the inspection of live high voltage electrical lines; a modular robot simulator; and an open platform for telemanipulation.</p>

20.7 Malaga

Institution:	University of Malaga
Address:	Dpto. de Ingenieria de Sistemas y Automatica Complejo Politécnico, Campus de Teatinos 29071 Málaga Spain
Contact:	Prof. Alfonso García Cerezo
Phone:	+34 95 213 2775
Fax:	
Email:	agcerezo@ctima.uma.es
URL:	http://www.isa.uma.es/
Faculty:	2 Professors, 17 Associate Professors
Post-Docs:	
Students:	25 Ph.D. students
Projects	<p>The department of Systems and Automation Engineering at the University of Malaga, is devoted to research and development in Intelligent Control and Robotics, including mobile robots, surgical robotics, and robots for calibration and manufacturing. Our mobile robots include the caterpillar robot Auriga-a, AURORA for greenhouse operation, AURIGA-1 and AURIGA-2, for outdoor operations, a wheeled radio-controlled microcar with monocular vision, a hexapod microrobot, and an automated wheelchair.</p> <p>Research areas include position estimation using a radial laser scanner or vertical landmark extraction, active security in vehicles, control of traction, control of large towing vehicles, intervention in dangerous situations, motion recovery, path planning under speed constraints, map building using a laser range scanner, manipulator teleoperation, satellite teleoperation, remote visualisation, and a low-cost stereo visualisation system for mobile robots. We are also currently working on an automated goniophotometer application.</p> <p>One of our success stories to date is our robotic intelligent surgical assistant, which carries observation tools during minimally invasive techniques. In such operations, surgeons use both hands to manoeuvre surgical instruments, controlling robot movements by using oral commands. These robot movements are incremental: every command shifts the point of the tool along an arc of a circumference a centimetre long, in the direction ordered. The assistant was first designed to carry a laparoscope to help surgeons in laparoscopic interventions. This work has been extended to include a wireless laparoscopic robot and to allow teleoperation, and is currently being extended to cystoscopy and prostate operations.</p>

20.8 Palma de Mallorca

Institution:	Systems, Robotics and Vision Group (SRV), University of the Balearic Islands
Address:	Edif. Anselm Turmeda Cra. de Valldemossa, km 7.5 07122 - Palma de Mallorca Spain
Contact:	Dr. Gabriel Oliver Codina
Phone:	+34 971 173201
Fax:	+34 971 173003
Email:	goliver@uib.es
URL:	http://dmi.uib.es/research/SRV/
Faculty:	1 Assistant Professor, 2 Lecturers, 1 Research Assistant
Post-Docs:	
Students:	4 Ph.D. students
Projects	<p>The Systems, Robotics and Vision (SRV) group forms part of the Mathematics & Computer Science Department of the University of the Balearic Islands. The main objective of the group is the development of scientific and engineering solutions for real world problems related to dependable real-time control systems in general and to mobile robots in particular. The research of the group is now centered on hybrid control architectures for AUV, simultaneous localisation and mapping, and cooperative mobile robotics.</p> <p>Systems research centres on dependable and real-time distributed embedded systems, especially on problems related to the use of the Controller Area Network protocol in critical applications within the industrial automation and automotive fields.</p> <p>Service and field robot issues include the study and design of hybrid reactive/deliberative control architectures for mobile robots focusing on real-time, collaborative and learning capabilities, the development of prototypes for complete mobile robots, the design and development of mobile robot simulation environments specifically oriented to training and testing.</p> <p>Vision research mainly addresses the development of image processing and understanding algorithms to be used in visually guided mobile robots.</p> <p>The specific application area for much of this work has been underwater robotics. In particular, we have developed a visual guidance system for an autonomous underwater cable tracker, designed and constructed a test-bed underwater vehicle (RAO), designed a physics-based vision system for an underwater vehicle, and developed a hardware architecture for a fail-safe underwater vehicle.</p>

20.9 Seville

Institution:	AICIA, University of Seville
Address:	Dpto. de Ingeniería de Sistemas y Automática Escuela Superior de Ingenieros Camino de los Descubrimientos, sn Sevilla, 41092 Spain
Contact:	Prof. Anibal Ollero
Phone:	+34 95 448 7349
Fax:	+34 95 448 7340
Email:	aollero@cartuja.us.es
URL:	http://www.aicia.es/
Faculty:	6 Professors
Post-Docs:	
Students:	
Projects	<p>AICIA is a public interest non-profit association linked to the School of Engineering, University of Seville. The Robotics group developed prototypes and working systems of ground (outdoor and indoor) and aerial robots for many applications. The activities of AICIA are set out in a long list of research and development projects, engineering works, tests, evaluations, reports, analysis and consultations.</p> <p>Currently AICIA is the scientific coordinator of the COMETS IST 5FP project on multiple heterogeneous UAVs. COMETS' main objective is to design and implement a distributed control system for multiple heterogeneous Unmanned Aerial Vehicles (UAVs) performing tasks such as cooperative detection and monitoring. Particularly, both helicopters and airships will be included. In order to achieve this general objective, the project involves the design and implementation of a new control architecture, the development of a control center with monitoring and planning functions, the development of autonomous helicopters and airships, new control and fault detection techniques, and new real-time aerial image processing. In order to test and validate these concepts and systems, COMETS will demonstrate the system in forest fire applications. This is a very challenging mission in which the cooperation of the UAVs is very valuable.</p> <p>Another current project focuses on prevention and mitigation of forest fires, building on earlier work on forest fire detection.</p>

20.10 Valencia

Institution:	Computer Engineering Department, Polytechnical University of Valencia
Address:	School of Design Engineering Camino de Vera, s/n 46022 Valencia Spain
Contact:	Prof. Houcine Hassan
Phone:	+34 9638 75724
Fax:	+34 9638 77579
Email:	husein@disca.upv.es
URL:	http://www.upv.es/
Faculty:	1 Professor, 19 Associate Professors
Post-Docs:	
Students:	15 Ph.D. students
Projects	<p>The Computer Engineering Department of the Polytechnical University of Valencia comprises four research groups: Industrial Informatics, Computer Vision, Fault-tolerance and Parallel Architectures.</p> <p>The Industrial Informatics group focuses its research interest in two principal areas: autonomous mobile robotic systems and real-time systems. The main interest is centred in the design of real-time software architectures and real-time hardware platforms for intelligent mobile robotic systems and their application in service and field robotics. Currently active projects include:</p> <ul style="list-style-type: none"> • Improving the perceptual functionality and reducing the development costs of mobile industrial robots, through establishing the appropriate synergy between the mobile robot's hardware and software by coordinating the physical and logical components. • Developing methods and tools for building distributed, embedded real-time systems with a high level of reliability. The approach used is based on software component technologies integrating specification and analysis methods for system properties related to reliability, quality of service, and temporal behaviour. Three application domains will act as demonstrators: multimedia systems, ubiquitous systems, and industrial control systems. • Improving the performance of current embedded systems. • Designing and implementing a library of free software components for the design of embedded real-time systems. These components, designed to cover the widest application range including fully critical and semi-critical systems, will provide Linux with the new real-time functionalities and will be available to embedded system developers. <p>Other research includes parallel architecture development, prototype assembly and evaluation using real applications on a high performance and low cost network of workstations, design and evaluation of video coding techniques and transport protocols for wireless networks, and security on spontaneous networks.</p>

20.11 Zaragoza

Institution:	Robotics Perception and Real Time Group, University of Zaragoza
Address:	Department of Computer Science and Systems Engineering Centro Politécnico Superior María de Luna 3, E-50015 Zaragoza Spain
Contact:	Prof. Juan Domingo Tardós
Phone:	+34 976 76 19 49
Fax:	+34 976 76 19 14
Email:	tardos@unizar.es
URL:	http://webdiis.unizar.es/GRPTR/
Faculty:	9 Associate Professors, 2 Assistant Professors
Post-Docs:	
Students:	4 Ph.D. students
Projects	<p>The Robotics Perception and Real Time group of the University of Zaragoza has developed novel techniques for task coordination, robot navigation, simultaneous localization and mapping (SLAM) and automatic 3D model building. Currently the group is integrating these developments in a semi-automated wheel chair. The group has also experience in cooperation with industry in research and development projects within the areas of robotics, automation and real time systems.</p> <p>The objective of the electrical wheelchair project is to develop a prototype of a system to help handicapped persons drive it, based on information provided by the perception systems. The wheelchair should be able to drive in both supervised mode and autonomously, in unmodified environments. Obstacle detection and avoidance are obviously integral to the project, but special emphasis will also be placed on the security of the system.</p> <p>We are also implementing a multisensor system for automated 3D model acquisition for virtual reality and meterology applications. The system is a wheeled trolley, similar to a supermarket trolley, and pushed by a person. The trolley has on board: a range image sensor, a CCD colour camera, a SICK planar scan range finder, and a dead reckoning system implemented with encoders in the trolley wheels. The on board PC computer grabs a set of images of the relevant room or industrial part, and fuses the gathered sensorial information to obtain the 3D model.</p>

21 Sweden

21.1 ABB

Institution:	ABB/Robotics
Address:	Kopparbergsvägen 2 S-721 83 Västerås Sweden
Contact:	Hans Skoog
Phone:	+46 (0) 21 32 5000
Fax:	+46 (0) 21 13 4112
Email:	hans.skoog@se.abb.com
URL:	http://www.abb.se/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>ABB is a world leader in automation. We design, realize and install automation products, systems and services tailored to support different business segments. By continuously developing innovative new technologies and improving existing ones, we aim to provide our customers with products and services that help make them more competitive while minimizing environmental impact. In Robotics automation we mainly serve the needs of the Automotive, Manufacturing and Electronics Industries, but also work with others, such as machine builders and integrators. We address them with a constant focus on flexibility, reliability and quality.</p> <p>Research and development is essential to our success. We employ some 6,000 scientists and technology experts at our corporate research centers and R&D laboratories all over the world, and invest a significant part of our revenues each year in research, focusing particularly on automation technologies and power technologies. Today ABB is involved with around 70 of the world's leading technology institutes in Europe, North America and Asia.</p>

21.2 Lund

Institution:	Robotics Laboratory, Lund
Address:	Department of Automatic Control Lund Institute of Technology Lund University PO Box 118, S221 00 Lund Sweden
Contact:	Prof. Rolf Johansson
Phone:	+46 46 222 8791
Fax:	+46 46 138 118
Email:	Rolf.Johansson@control.lth.se
URL:	http://www.control.lth.se/%7Erobot/
Faculty:	1 Professor, 1 Associate Professor
Post-Docs:	1 persons
Students:	3 Ph.D. students
Projects	<p>Lund Institute of Technology (LTH) conducts high-quality research in a variety of core areas and integrated in a problem-oriented manner. Robotics is a thematic area with industrial focus and emphasis on system integration, control, robot vision and real-time software architectures.</p> <p>Several research interests are represented in the Robotics Lab, particularly open control software architectures, exteroceptive robots, force control, robot vision, sensor fusion, adaptive and iterative learning control, and task-level programming.</p> <p>Robot control systems and other manufacturing equipment are traditionally closed. This circumstance has hampered system integration of manipulators, sensors and other equipment and such system integration has often been made at an unsuitably high hierarchical level. The purpose of the present project is to show how to organize open robot control systems and to verify these ideas by means of experimental verification. As a part of this research, we have developed an experimental robot control system. The system is built around industrially available robots that have been reconfigured for experimental purposes. The developed specific robot interfaces and the integration of the robots into a complete system forms a unique environment for testing and development of algorithms for improvement of performance, programming and autonomous operation.</p>

Institution:	Division of Robotics, Lund
Address:	Department of Mechanical Engineering, Lund Institute of Technology Lund University PO Box 118, S221 00 Lund Sweden
Contact:	Giorgos Nikoleris
Phone:	+46 222 4406
Fax:	+46 222 4529
Email:	gnikoleris@robotics.lu.se
URL:	http://www.robotics.lu.se
Faculty:	1 Professor, 1 Associate Professor
Post-Docs:	1 persons
Students:	4 Ph.D. students
Projects	<p>Research in the Division of Robotics (DoR) in the Mechanical Engineering Department is focused on developing methods, knowledge and technology to improve the use and performance of robotic systems in industrial and service applications. The subject includes modelling and analysis of robots, general structure of robots and methods for using robots.</p> <p>Our research focusses on three applied areas; industrial robotics, manufacturing systems, and service robotics. Within these areas a fundamental technology is simulation that, together with modelling and optimization define attempts in most of our research. Simulation relates to time continuous simulation in robotics and discrete event simulation of manufacturing systems. Modelling is used for many purposes including systems, robots, application processes, etc. Finally, optimization relates to how to solve a task in an efficient way applying simulation and modelling. These tools are used in various ways for virtual scenarios, analysis, prototyping, validation, programming and control of complex systems.</p>

Institution:	Lund Cognitive Science
Address:	Lund Institute of Technology Kungshuset, Lundegård, S222 22 Lund Sweden
Contact:	Prof. Christian Balkenius
Phone:	+46 222 32 51
Fax:	+46 222 4529
Email:	Christian.Balkenius@lucs.lu.se
URL:	http://www.lucs.lu.se
Faculty:	1 Professor, 2 Associate Professors,
Post-Docs:	9 persons
Students:	12 Ph.D. students
Projects	<p>Lund University Cognitive Science department covers the following topics: concept formation, learning, language, vision and eye-movements, cognitive design, evolution, robotics, computer simulation, intentionality, and everyday cognition.</p> <p>The research in robotics is aimed at solving the problems facing an autonomous robot acting in real time in a realistic environment. The problems encountered are many, ranging from navigation to eye-hand coordination, and research is conducted in close collaboration with the work being done in vision and learning. By implementing computational models of such things as object learning and recognition, the research on robotics also functions as a testing ground for the theories being modeled.</p> <p>The Artificial Hand Project aims to develop a new strategy for motor control of functional hand prostheses based on electrical signals generated from multiple muscle electrodes or microchips implanted in the peripheral or central nervous system. The use of an Artificial Neural Network (ANN) is essential to fulfil this purpose. The purpose is also to develop artificial sensitivity to be applied to such hand prostheses and to patients with loss of sensory nerve function. The overall goal is to create new opportunities for the rehabilitation of amputees and paralysed patients. Experiments indicate that it is possible to create artificial sensitivity in a prosthesis or a hand with sensory dysfunction. In future experiments the influence of chip design on regeneration success will be determined.</p> <p>The research program of Epigenetic Robotics may be characterized through the following set of goals:</p> <ul style="list-style-type: none"> - To construct a humanoid robot that is able to interact with a human caregiver verbally and non-verbally in a series of simple language games, in a manner which is about as adequate as that of a two-year-old child. - To achieve this by letting the robot develop its knowledge through its own interaction with the physical and social environment from a relatively simple initial state (i.e. without programming in any Universal Grammar). - To attempt to model as closely as possible the relevant evidence from developmental psychology, e.g. invariant progressions through stages.

21.3 Stockholm

Institution:	Centre for Autonomous Systems, KTH
Address:	Kungl Tekniska Högskolan NADA, CVAP/CAS SE-100 44 Stockholm Sweden
Contact:	Prof. Henrik I Christensen
Phone:	+46 8 790 6792
Fax:	+46 8 723 0302
Email:	hic@nada.kth.se
URL:	http://www.cas.kth.se/
Faculty:	6 Professors, 3 Associate Professors
Post-Docs:	5 persons
Students:	≈ 30 Ph.D. students
Projects	<p>The Centre for Autonomous Systems at the Royal Institute of Technology integrates math, electrical engineering, mechatronics and computer science ideas in the research and development of fully operational service and field robotics systems for realistic environments.</p> <p>The research on service robotics emphasises personal assistance for elderly and handicapped. This involves basic research on navigation, object recognition, visual servoing, systems integration, human-robot interaction and grasping.</p> <p>The research on field robotics is directed at search and rescue systems, with particular attention to mapping, credible interfaces, control, hardware abstraction, and sensory fusion.</p> <p>The centre has built successful systems for companies including ABB, Electrolux, WEDA, and PerMobil.</p>

21.4 Örebro

Institution:	Center for Applied Autonomous Sensor Systems (AASS), Örebro
Address:	Department of Technology Örebro University SE-70182 Örebro Sweden
Contact:	Prof. Alessandro Saffiotti
Phone:	+46 19 301 332
Fax:	+46 19 303 463
Email:	asaffio@aass.oru.se
URL:	http://www.aass.oru.se
Faculty:	4 Professors, 1 Associate Professor, 3 Assistant Professors
Post-Docs:	3 persons
Students:	22 Ph.D. students
Projects	<p>The center for Applied Autonomous Sensor Systems (AASS) at Örebro is an interdisciplinary research center that integrates basic and applied research in the fields of mobile robotics, intelligent control, learning systems, and biologically inspired systems.</p> <p>Research at AASS focusses on perception and autonomy in diverse, un-structured or semi-structured environments. Our mission is to explore the applicability of new paradigms in the analysis and design of autonomous sensor systems. These are mobile as well as immobile systems that employ a vast array of sensors in order to analyze and/or influence highly dynamic environments. Examples of these systems include: autonomous robotic systems; complex process control systems; flexible manufacturing and inspection systems; automotive systems; and unmanned vehicles moving on land, on or in water, in air, or in space.</p> <p>Our research philosophy conceives of autonomous sensor systems as agents in a three-player game: the system, the environment, and the human user. The system must be autonomous in its interaction with the user and with the environment. To do this, the system must possess complex abilities, including the abilities to plan and schedule control and sensing actions; to acquire and integrate sensory information at different levels of abstraction; to adapt to an unknown or changing environment; to accept and deliver information in a form which is adequate for humans; to identify events that threaten the system's operation; and to react to these threats by reconfiguring its control and sensing routines.</p>

22 Switzerland

22.1 Lausanne

Institution:	Autonomous Systems Lab (ASL), Swiss Federal Institute of Technology Lausanne
Address:	EPFL-STI-I2S-LSA1 CH-1015 Lausanne Switzerland
Contact:	Prof. Roland Siegwart
Phone:	+41 21 693 78 06
Fax:	+41 21 693 78 07
Email:	roland.siegwart@epfl.ch
URL:	http://asl.epfl.ch/
Faculty:	3 Professors, 5 Senior Researchers, 6 Research Assistants
Post-Docs:	2 persons
Students:	26 Ph.D. students
Projects	<p>The Autonomous Systems Lab (ASL) at the Swiss Federal Institute of Technology Lausanne (EPFL) is the leading research center in mobile robotics and intelligent control in Switzerland. Our research focuses on integrated mechatronics design and autonomous navigation and interaction of mobile robots for real world environments. We recently developed SHRIMP, a high-mobility rover with extended climbing abilities. Shrimp is a wheeled robot able to overcome obstacles of twice its wheel size and can climb regular stairs.</p> <p>Our major goal in mechatronics is to find new ways of dealing with uncertainty and to enable the design of highly interactive and adaptive systems. This goal is driven by the vision that machines are getting closer and closer to human beings, as can be seen with autonomous robots, and in some cases they even merge with them.</p> <p>One research priority is the development of methods for evolving embedded intelligent systems, such as autonomous robots, capable of adapting to their physical environment. We are interested in artificial sensory-motor systems that display life-like properties and are based upon bio-inspired mechanisms (genetics, cellular biology, neural networks, bio-morphic engineering). Evolutionary Robotics is one of our major research directions whereby autonomous mobile robots equipped with artificial chromosomes evolve surprising abilities without human intervention while autonomously interacting with the environment.</p> <p>Another major theme is the design of natural means of human-robot interaction. We take inspiration from the cognitive and neural mechanisms behind imitation and language acquisition, building computational models to aid understanding of the underlying processes. We have a particular interest in humanoid platforms and investigate the use of a set of mini-humanoid robots named Robota in studies with normal and disabled children.</p>

22.2 Martigny

Institution:	Dalle Molle Institute for Perceptual Artificial Intelligence (IDIAP), Martigny
Address:	Rue du Simplon 4 Case Postale 592 CH-1920 Martigny Switzerland
Contact:	Jose del R. Millan
Phone:	+41 277 217 770
Fax:	+41 277 217 712
Email:	Jose.Millan@idiap.ch
URL:	http://www.idiap.ch
Faculty:	10 Senior Researchers
Post-Docs:	
Students:	≈ 50 Ph.D. students
Projects	<p>The Dalle Molle Institute for Perceptual Artificial Intelligence (IDIAP) is a not-for-profit research institute in the field of human-machine interaction and the underlying machine learning methods. IDIAP is the leading house of the National Centre of Competence in Research on Interactive Multi-modal Information Management. Research projects include work on EEG-based brain-computer interfaces and, in particular, the development of neuroprostheses.</p> <p>The computer vision group studies problems in machine visual perception, such as media annotation, people detection and human gesture tracking and recognition. Research activities center on multi-modal interpretation of visual and multimedia data, and improvement of basic detection and classification measures and algorithms.</p> <p>The statistical machine learning group aims to construct systems able to learn to solve tasks given a set of examples that were drawn from an unknown probability distribution, and given some a priori knowledge of the task; and to measure the expected performance of these systems on new examples drawn from the same probability distribution.</p>

22.3 Zurich

Institution:	Institute of Neuroinformatics (INI), University-ETH Zurich
Address:	Winterthurerstr. 190 CH-8057 Zurich Switzerland
Contact:	Paul Verschure
Phone:	+41 1 635 3031
Fax:	+41 1 635 30 53
Email:	pfmjv@ini.phys.ethz.ch
URL:	http://www.ini.unizh.ch/
Faculty:	3 Professors, 3 Research Assistants
Post-Docs:	3 persons
Students:	35 Ph.D. students
Projects	<p>The Institute of Neuroinformatics (INI) at ETH Zurich investigates the principles of neuronal and behavioral organization using synthetic methods in the context of the whole behaving system. We focus on the neuronal principles underlying perception, learning, cognition and motor control in invertebrates and vertebrates using both abstract and biophysically constrained neuronal models. This research is characterized by close collaboration with experimental neuroscientists in the development of large-scale real-time neuronal models that are interfaced to robotic devices. Applications of this work include flying and mobile vehicles and large-scale interactive spaces.</p> <p>Neuromorphic systems are designed and fabricated exploiting analog VLSI methods to construct electronic circuits that perform signal processing and computational functions similar to biological nervous systems. In particular, these projects develop single and multiple chip systems that perform early vision processing, circuits for dense analog memory for parameter and synaptic weight storage, and infrastructure for inter-chip communication. Projects include neuromorphic sensors for robots, silicon retinæ, motion sensors, fly visual processing, providing robots with joints and reflexes, optical flow computation in a VLSI, and sensor fusion for motor control.</p> <p>We aim to develop neuromorphic robots by exploring methods of implementing biological-like perception, learning, and behaviour in small autonomous mobile robots, ie, by constructing artificial behaving systems and their "brains". We combine computer simulations and robots to study the brain and how it relates to behavior. Our emphasis is on studying the behavior of artificial creatures in the real world, however, we also use simulated environments. In parallel with this we zoom in on particular components of the nervous system building models which are very closely based on our understanding of the anatomy and the physiology of the brain. At present we are developing our simulated environment IQR421 into a commercial product.</p> <p>Together with the Interdisciplinary Nucleus for Studies on Sound Communication of the University of Campinas in Brasil we have created the world's first autonomous real-world composition system, RoBoser. RoBoser creates music based on the experiences and "emotions" of a mobile robot as it explores its environment.</p>

23 United Kingdom

23.1 Aberystwyth

Institution:	Intelligent Robotics Group, University of Wales
Address:	Department of Computer Science Penglais Aberystwyth Ceredigion, SY23 3DB U.K.
Contact:	Dr. Myra Wilson
Phone:	+44 1970 622928
Fax:	+44 1970 622455
Email:	mxw@aber.ac.uk
URL:	http://www.aber.ac.uk/compsci/Research/robots/
Faculty:	1 Professor, 2 Senior Lecturers, 7 Lecturers
Post-Docs:	
Students:	11 Ph.D. students
Projects	<p>The Intelligent Robotics Group of the Computer Science department at Aberystwyth was established around 1980 and since that time the group has undertaken innovative research in collaboration with a variety of industrial and academic partners in the U.K. and overseas.</p> <p>Key areas include: innovative algorithms for dynamics and force control; autonomous operation for real world applications, including the food industry; mobile robotics, including space applications; skeletal kinematic modelling.</p> <p>Our work concentrates on intelligent systems techniques, kinematics and dynamics, applicable to industrial robotics, and more recently to mobile and space robotics. Our main areas of interest are: legged robots, cooperant mobile robots, robot airships, behaviour evolution, teaching by example in flexible automation (applied to food product assembly), haptic and tactile devices for robot teleoperation, autonomous grasping for product handling, software strategies for automated assembly, and kinematic modelling of the human skeleton for medical diagnosis.</p> <p>Aberystwyth Lighter Than Air Intelligent Robot ALTAIR-1 is a laboratory-based aerobot that is used as a test bed for developing hardware and software for planetary exploration. An aerobot can be used to explore any planet or moon with an atmosphere, for example; Venus, Mars, Jupiter or Titan. ALTAIR-2 will be a larger and more powerful version, which will have the ability to function outdoors. An autonomous version has also been proposed.</p>

23.2 Birmingham

Institution:	Intelligent Robotics Lab, University of Birmingham
Address:	School of Computer Science Edgbaston Birmingham B15 2TT U.K.
Contact:	Dr. Jeremy Wyatt
Phone:	+44 121 414 4782
Fax:	+44 121 414 4281
Email:	J.L.Wyatt@cs.bham.ac.uk
URL:	http://www.cs.bham.ac.uk/research/robotics/
Faculty:	1 Lecturer, 1 Research Assistant
Post-Docs:	
Students:	4 Ph.D. students
Projects	<p>The Intelligent Robotics Lab, Computer Science, Birmingham, researches techniques for the intelligent control of mobile robots. Our work is primarily on robot learning and evolutionary robotics, although we have also done original work in navigation. We also do basic research in the technologies that underpin certain types of adaptive robotics; notably reinforcement learning, neural networks and probabilistic graphical models.</p> <p>Current projects include work on: how an agent should act while it is learning; estimating variability in reinforcement learning; combining model, policy and perceptual learning in the face of hidden state; recombining process models for new tasks; continual robot learning; and robust mobile robot localisation from sparse and noisy proximity readings.</p> <p>Future work is expected to focus on: exploration using reinforcement learning, investigating transfer of skills between robot tasks, learning useful perceptual features such as natural regularities through robot interaction with the environment, and learning hidden structure in robot behaviours by putting together work on hidden Markov modelling with work on perceptual learning.</p>

23.3 Edinburgh

Institution:	Mobile Robotics Research Group, University of Edinburgh
Address:	Institute of Perception, Action, and Behaviour Division of Informatics James Clerk Maxwell Building, Mayfield Road Edinburgh, EH9 3JZ U.K.
Contact:	Dr. Gillian Hayes
Phone:	+44 (0) 131 651 3440
Fax:	+44 (0) 131 651 3435
Email:	gmh@inf.ed.ac.uk
URL:	http://www.dai.ed.ac.uk/groups/mrg/
Faculty:	1 Reader, 2 Senior Lecturers, 1 Research Fellow
Post-Docs:	
Students:	12 Ph.D. students
Projects	<p>The Mobile Robotics Group is part of the Institute of Perception, Action and Behaviour (IPAB), within the University of Edinburgh's School of Informatics. Our research focuses on biomimetic and biologically inspired robotics, including bat bio-sonar, cricket phonotaxis, artificial evolutionary systems, self-reconfigurability, learning by imitation and reinforcement learning. We also carry out research on software agent group behaviour for computer games.</p> <p>The collaborative CIRCE project aims to reproduce, at a functional level, the echolocation system of bats by constructing a bionic bat head that can then be used to systematically investigate how the world is not just perceived but actively explored by bats. This bionic bat head will be of similar size to a real bat head to reproduce the relevant physics and consist of an emission/reception system capable of generating/processing bat vocalisations in real-time, a multi-degree of freedom mechanical system to allow realistic pinnae movement and shape control. Constructing the bionic head itself is one objective but a second objective is to gain more insight into neural sensory-data encoding from using the head in echolocation tasks routinely executed by bats.</p> <p>Our cricket project is concerned with building a robot model of phonotaxis behaviour. It uses a specially designed electronic circuit to model the cricket ears and a simulated spiking neuron network to process the signal, and is mounted on a small mobile robot test platform. Current investigations are concerned with integrating additional sensorimotor systems to make a walking robot that can perform taxis outdoors.</p> <p>Also within IPAB, other groups research assembly robotics, learning and motor control, machine vision, and computer graphics. Assembly Robotics research concentrates on sensor fusion and the use of behaviour-based robotics in assembly work. Statistical (machine) learning and motor control research focuses on the further development of MAVERic, a versatile realistic robotic model of a human head. Machine Vision Unit research mostly concerns the transformation of raw range finder signals into a symbolic representation.</p>

23.4 Essex

Institution:	Robotics and Intelligent Machines Research Group, University of Essex
Address:	Department of Computer Science Wivenhoe Park Colchester CO4 3SQ U.K.
Contact:	Dr. Hani Hagaras
Phone:	+44 1206 873601
Fax:	+44 1206 872788
Email:	hani@essex.ac.uk
URL:	http://essexrobotics.essex.ac.uk/
Faculty:	1 Professor, 8 Lecturers, 4 Research Assistants
Post-Docs:	
Students:	≈ 30 Ph.D. students
Projects	<p>The Robotics and Intelligent Machines Research Group in the University of Essex concentrates on autonomous mobile robotics, and includes areas such as machine learning, cognitive robotics, sensor signal processing, modelling and simulation, behaviour-based robotics, robot navigation, collaborative robotics, robotics hardware, agricultural robotics and intelligent inhabited environments. The Brooker Lab for Intelligent Embedded Systems is the main Robotics research lab, it contains a variety of mobile, aerial and walking robots.</p> <p>Mobile robotics research emphasises novelty detection, addressing the question of how a mobile robot can be trained to differentiate between abnormal and common features in an environment. This ability is important for e.g. inspection tasks. A theory of robot-environment interaction is being developed. Evidence-based methods have been developed to determine robot location within an indoor environment using only natural landmarks. Subsymbolic and behaviour-based approaches to the control of autonomous mobile robots are also being investigated, as are sensor fusion and multiple-robot cooperation. Our research into collective robotics and swarm intelligence, biomimetic robots, and machine consciousness is well known. Further research foci include cooperation in multiple mobile robots, tele-robotics in various forms, and robot behaviour learning by demonstration, which has been shown to be more effective than direct programming of the robot.</p> <p>Vision research concentrates on omnidirectional vision, edge detection, general purpose recognition, and human face recognition. Parallel computing systems research focuses on its use in fault-tolerant and robotics applications. Associated with this is the development of distributed simulation systems to allow accurate modelling of robots prior to their construction. At present these concepts are being integrated in an application to underwater vehicles.</p> <p>Others at Essex conducting robot-relevant research include the human-computer interface group and the machine learning and intelligent agents group.</p>

23.5 Leeds

Institution:	Intelligent Systems Research Group, University of Leeds
Address:	School of Mechanical Engineering Woodhouse Lane Leeds LS2 9JT U.K.
Contact:	Prof. Gurvinder S. Virk
Phone:	+44 113 343 2156
Fax:	+44 113 343 2150
Email:	g.s.virk@leeds.ac.uk
URL:	http://leva.leeds.ac.uk/res-group/is/
Faculty:	3 Professors, 4 Lecturers, 10 Research Assistants
Post-Docs:	
Students:	
Projects	<p>The Intelligent Systems Research Group, School of Mechanical Engineering at Leeds has a wealth of experience in the solution of industrial dynamics and control problems by the application of advanced engineering science. In parallel, the group is active in extending the frontiers of knowledge and understanding in the field by fundamental research.</p> <p>Mobile robotics research involves a range of projects aimed at investigating different application sectors and in developing innovative machine designs. The work covers the entire process from requirement formulation, detailed machine design, to eventually building and testing the prototype systems.</p> <p>Particular aspects of the research focuses on locomotion, electronic sub-systems, mechanical design, sensor systems and sensor data fusion, intelligent decision making, and system integration. A specialist activity covers the area of climbing and walking robots, and we have also developed a range of mobile robots that can navigate by olfaction. Interesting applications are emerging in non-traditional sectors comprising edutainment, service sectors, underwater and humanoid robotics.</p> <p>Current research in mobile robotics includes: adhesion technologies allowing robots to climb different surfaces including glass, concrete, bricks and ferrous walls, the gait patterns of legged robots, navigational strategies based on olfaction, co-operative search, developing multi-wheeled robots to function in rough terrain such as volcanoes, and various improvements in motion control.</p> <p>New research in the area of biomedical and assistive robotic devices is being carried out. A range of actuation technologies and assistive devices are being investigated to help disabled people with spinal cord injuries to allow them to carry out normal functions such as standing, sitting, walking and ascending and descending stairs. We are currently developing a cardiac assist device, and are involved in a project to improve robotic walking aids for disabled and elderly people.</p>

23.6 London

Institution:	Intelligent and Interactive Systems Group (IIS), Imperial College London
Address:	Department of Electrical and Electronic Engineering Imperial College of Science, Technology and Medicine University of London, Exhibition Road SW7 2BT, London, U.K.
Contact:	Dr. Yiannis Demiris
Phone:	+44 (0) 20-759-46300
Fax:	+44 (0) 20-759-46274
Email:	y.demiris@imperial.ac.uk
URL:	http://www.iis.ee.imperial.ac.uk/
Faculty:	5 Professors, 1 Reader, 3 Lecturers, 2 Research Fellows, 2 Research Assistants
Post-Docs:	
Students:	16 Ph.D. students
Projects	<p>The robotics laboratory of the Department of Electrical and Electronic Engineering at Imperial College London is a research laboratory investigating issues related to cognitive robotics, biologically inspired algorithms, and robot-human interaction. The laboratory has facilities for research on robot vision, and mobile, walking and humanoid robots.</p> <p>Research in the Intelligent and Interactive Systems Section focuses on increasing the understanding of how machines may be made to be, or made to appear to be, intelligent. As machines become more complex we must find better and more effective ways of interacting with them, and ask new questions about how communities of autonomous or semi-autonomous intelligent agents will interact among themselves, and with people.</p> <p>The IIS-Cognitive Robotics Research Team applies methods of formal logic to real robots. It is currently establishing a new robot lab with a small fleet of mobile robots communicating over a wireless network. The robots are equipped with stereoscopic cameras, and the team is currently developing axiomatic descriptions of occlusion events between objects in a visual field.</p> <p>The IIS-Biologically Inspired Robotics Research Team develops computational models of human brain mechanisms and investigates their application to robotics, with a particular interest in Robot-Human Interaction. Current research investigates the neural mechanisms underlying imitation and action understanding in humans and primates, the role of attention in visually understanding movement, and the organization and function of the human motor control systems, particularly as they relate to bipedal robot walking. The research is carried out utilizing two humanoid robots, stereo vision cameras, and dynamical physics-based simulators.</p> <p>The IIS-Computational Intelligence and Multi-agent Systems Research Team investigates ways in which electronic Agents will interact with each other and with people.</p> <p>The IIS-Human-computer Interaction Research Team investigates novel ways by which information will be presented to users.</p> <p>The IIS-Neuromodelling Research Team investigates brain-inspired digital computation.</p>

Institution:	Centre for Mechatronics and Manufacturing Systems (CMMS), King's College London
Address:	Department of Mechanical Engineering Strand, London WC2R 2LS U.K.
Contact:	Prof. Lakmal D. Seneviratne
Phone:	+44 (0) 20 7848 2236
Fax:	+44 (0) 20 7848 2932
Email:	lakmal.seneviratne@kcl.ac.uk
URL:	http://www.kcl.ac.uk/mecheng/cmms/
Faculty:	1 Professor, 9 Lecturers, 4 Research Assistants
Post-Docs:	
Students:	11 Ph.D. students
Projects	<p>The main research interests of the Centre for Mechatronics and Manufacturing Systems, King's College London include robotics, automation, intelligent systems and mechatronics. Robotics areas of interest include robot motion planning, programming, modelling and control.</p> <p>Automation research includes automated assembly, intelligent screw insertion systems, automatic packaging of complex cartons, assembly of electronic devices, inspection of waste pipes, and conform extrusion systems.</p> <p>Algorithms for mobile robot motion planning have been developed which can cope with kinematically constrained non-holonomic robots working in cluttered environments and include reversal manoeuvres. We are currently extending these algorithms to a sensor guided mobile robot. In particular, uncertainty resolution and dynamic environments will be considered.</p> <p>Regarding manipulators, we have developed criteria for obstacle avoidance for both single and co-operating dual redundant arm systems. The research will test these criteria and extend them to deal with dynamic environments. Off line programming of robot manipulators using virtual reality tools, artificial intelligence methods and automated motion planning algorithms is being investigated.</p> <p>Current research projects include: A feasibility study into robotic ironing, a dextrous reconfigurable assembly and packaging technology project, stiffness-based dynamic modelling and motion control of a multi-fingered hand with passive joints, synthesis of orientation capability of serial robot manipulators, manipulation of complex and diverse cartons, massage finger development, and a multi-sensor system for sewer inspection.</p>

23.7 Manchester

Institution:	Robotics and Autonomous Systems Research Group, University of Manchester
Address:	Department of Computer Science Manchester M13 9PL U.K.
Contact:	Dr. R. C. Richardson
Phone:	+44 (0) 161 275 6169
Fax:	
Email:	R.C.Richardson@cs.man.ac.uk
URL:	http://www.cs.man.ac.uk/robotics/
Faculty:	1 Lecturer
Post-Docs:	1 person
Students:	2 Ph.D. students
Projects	<p>Manchester Robotics and Autonomous Systems Research Group are researching into the future of robotic systems, where robots are not hidden behind cages on manufacturing lines, but are a positive factor in our everyday lives. We are developing medical robots to administer robotic physiotherapy for conditions such as stroke and cerebral palsy. Furthermore we are researching into assisting a damaged human heart through a robotic device to squeeze the outside of the heart.</p> <p>If robots are to behave autonomously then they must have the capability of independent movement and 'intelligent' control strategies. Manchester robotics has a long history of developing adaptive 'intelligent' controllers for mobile robotic systems. These mobile robotic systems can be either locomoted by wheels, legs or alternative novel methods.</p> <p>Robots that are in everyday contact with humans must be designed and controlled in a suitable manner. Interaction control techniques are being developed to ensure robots are of no danger to humans. Moreover, on a more subtle level, these robots must reassure and not intimidate humans. Manchester robotics is investigating humanoid robots that exhibit body language.</p> <p>Over the last few years a whole new class of actuators has been developed. Polymer actuator technologies offer significant advantages over conventional actuator systems. Polymer actuators are under investigation for use in robotic systems.</p> <p>Currently Medical Robotics research is being performed in the following areas: Upper-limb robotic physiotherapy for stroke patients, Force-feedback home physiotherapy for children, and Development of a cardiac assist device.</p>

23.8 Oxford

Institution:	Robotics Research Group, University of Oxford
Address:	Ewert House, Ewert Place Summertown Oxford OX2 7BZ United Kingdom
Contact:	Dr. Penny Probert Smith
Phone:	+44 1865 2 73148
Fax:	+44 1865 2 73908
Email:	pjp@robots.ox.ac.uk
URL:	http://www.robots.ox.ac.uk/home.html
Faculty:	5 Professors, 3 Readers, 5 Lecturers, 22 Research Assistants
Post-Docs:	2 persons
Students:	65 Ph.D. students
Projects	<p>The Department of Engineering Science at the University of Oxford is one of the largest unified engineering departments in the UK. It includes a Robotics Research Group which works on a wide range of problems that typically involve systems that integrate sensing, control and planning and action. When necessary, we develop novel sensors (e.g., range motion, touch) and novel devices (eg, robot vehicles, robot arms, stereo vision camera platforms). We frequently make novel printed circuit boards, several of which have been made available commercially. Characteristic of our work is the use and development of parallel, often distributed, computer architectures to achieve real-time performance and robust operation.</p> <p>Individual Projects include: ultrasound to monitor fish growth, ultrasound with GPS for localisation based on techniques used by bats, improving accuracy in FM and swept spectrum sonar, planning for outdoor vehicles, adaptive framework for sensor integration, brain-computer interfacing using EEG signals, determining tissue composition from ultrasound images, image super-resolution, voice and speech processing, data fusion in dynamic multiagent environments, and construction of novel machine learning paradigms based on pigeon navigation strategies.</p> <p>We carry out some of these projects on the crop spraying tractor developed by Silose Research Institute, Bedford. It has a camera to follow rows of crops, and a number of sensors to detect and measure movement - odometry, gyros, GPS. GPS is very good when there is good coverage from satellites, but does not always cover all situations (e.g. tree cover in fields, high buildings in towns); hence the need for other sensors too. The work aims to improve the automatic control of the vehicle as it moves between rows of crops for spraying, through providing position estimation using statistical methods of sensor integration and an integrated control and measurement method.</p>

23.9 Plymouth

Institution:	University of Plymouth
Address:	Centre for Interactive Intelligent Systems School of Computing, Communications and Electronics University of Plymouth PSQ-309 Plymouth PL4 8AA United Kingdom
Contact:	Dr. Guido Bugmann
Phone:	+44 (0) 1752 23 25 66
Fax:	+44 (0) 1752 23 25 40
Email:	gbugmann@plymouth.ac.uk
URL:	http://www.plymouth.ac.uk/index.asp
Faculty:	4 Professors, 2 Readers, 8 Lecturers, 1 Research Assistant
Post-Docs:	1 person
Students:	14 Ph.D. students
Projects	<p>The University of Plymouth (UoP) has groups active in Robotic Intelligence (Guido Bugmann), Robotics Education (Paul Robinson) and Computational Neuroscience (Mike Denham). These groups collaborate on human-robot communication, robot vision, navigation, edutainment robotics and biologically-inspired robotics, and have been preparing a FP6 proposal on neuroscience-based approach to "Robotics Beyond Robotics" involving a number of European groups active in brain modelling, sensors and robotics.</p> <p>Work in the Robotic Intelligence Laboratory of the Centre for Interactive Intelligent Systems focuses on several key problems in the design of interactive domestic and helper robots. These include artificial vision for object recognition and vision for spatial navigation, actions planning and sequencing, and natural language instruction dialogues between the user and the robot. Thus the term "intelligence" covers perception, planning, learning and interaction.</p> <p>The Centre for Robotics and Intelligent Systems houses a multidisciplinary group with interests in both static and mobile robotics and their constituent technologies. Biologically inspired control and behaviour is a common theme in much of the group's work. Applications include the development and study of miniature robot 'bugs' and myoelectric tele-operation. Dynamic visual sensing is another common theme in many projects. These include applications as diverse as the identification of marine plankton and autonomous robot navigation. Intelligent, multi-agent behaviour, as applied to Mirosoft robot football, provides an interesting focus for group activities.</p> <p>The aim of the Centre for Neural and Adaptive Systems is to investigate and develop new computational theories and models of neural information processes and systems in the brain, in sensory perception, learning and memory, and action planning and control, and of the environments within which these processes develop. Our objective is to use these models: to aid in our understanding of the brain, its development, and its relationships with cognition and behaviour, and to provide the basis for novel computing and IT systems and applications which can behave in "brain-like" ways.</p>

23.10 QinetiQ

Institution:	QinetiQ
Address:	Bldg A5, Rm 2067 Cody Technology Park, Ively Rd. Farnborough Hampshire, GU14 0LX U.K.
Contact:	Mr H A (Bill) Warren
Phone:	+44 (0) 1252 393149
Fax:	+44 (0) 1252 393091
Email:	hawarren@qinetiq.com
URL:	http://www.qinetiq.com/
Faculty:	
Post-Docs:	
Students:	
Projects	<p>QinetiQ is Europe's largest science and technology organisation. Formerly an agency of the British Ministry of Defense, the company has a distinguished heritage as a leading provider of technology solutions and a supplier of impartial and trusted advice. QinetiQ's core business is providing scientific research, test and evaluation for military customers to give them leading edge competitive advantage. In many areas the problems posed by the defence environment require the creation of intellectual property well beyond the state of the art in commercial markets. QinetiQ's move into the private sector facilitates access to this treasure trove of technology by customers from fields as diverse as transport, health, energy and telecommunications.</p> <p>Manned or unmanned, civil or military, modern vehicles and machinery increasingly rely on intelligent computer-based systems for navigation, operation and control. Our expertise includes systems architecture and engineering, sensing and data-management, intelligent system control and actuation, and mechanics. We also have a detailed understanding of safety contingencies, decision aids, secure systems, reliability prediction, probabilistic design, and fault tolerance. All of this expertise applies to unmanned as well as manned vehicles.</p> <p>QinetiQ provides a complete installation kit for unmanned and autonomous land and air vehicles, including navigation, secure communications, sensing, control, and mechanical systems. Additional requirements can be fulfilled for military customers such as defensive aids, armour and weapons. Our expertise in control includes machinery, such as robotic systems for welding, and laser deposition.</p> <p>Increasingly, our technology has both military and non-military applications. For example, we are researching a new method of detecting dyslexia in young children using eye-tracking technology developed for fighter pilots. Some technologies - for example, speech-recognition technology, liquid crystal displays, holographic imaging and low-cost titanium extraction - are being exploited through joint-venture partnerships between QinetiQ and other organisations, and by "spinning off" companies.</p>

23.11 Reading

Institution:	Cybernetic Intelligence Research Group (CIRG), University of Reading
Address:	School of Systems Engineering Whiteknights 211 Portobello Street Reading Berkshire, RG6 6AY U.K.
Contact:	Dr. Victor Becerra
Phone:	+44 118 378 8210
Fax:	+44 118 378 8220
Email:	v.m.becerra@reading.ac.uk
URL:	http://www.cyber.rdg.ac.uk/CIRG/
Faculty:	1 Professor, 1 Senior Lecturer, 5 Lecturers
Post-Docs:	1 person
Students:	15 Ph.D. students
Projects	<p>The Department of Cybernetics in the School of Systems Engineering, Reading, comprises three research groups: Cybernetic Intelligence, Interactive Systems research group (ISRG), and Instrumentation & Signal Processing.</p> <p>Cybernetic intelligence is an approach characterised by its use of sub-symbolic knowledge representation and bottom-up (ie. data driven) problem solving to describe theoretical, mathematical and philosophical aspects of consciousness and intelligence and their application to the design of intelligent machines and the control of complex systems. It encompasses nonlinear, distributed and intelligent control; models of information processing in the brain; novel neural networks; pattern classification; image understanding and processing. The group has witnessed considerable success in the field of autonomous intelligent robotics. In collaboration with the bioengineering unit of the ISRG, pioneering research has been undertaken into human-computer implant technology, utilising a radical new direct interface to the nervous system.</p> <p>Current projects include: multi-agent learning, the effects of leadership in a group of reactive flocking robots, stochastic diffusion processes, social robots, and multi-modal agents and their communication.</p> <p>Interactive Systems research into systems that require ‘humans-in-the-loop’ has resulted in original contributions in the areas of consistency control and ameliorating the effects of latencies through, among others, the use of relativistic modeling of the synthetic landscape. Rehabilitation robotics research is centred on rehabilitation of a person following a stroke. Machine mediated physiotherapies have the potential to improve the outcome of a person recovering from a neurovascular accident and to reduce the cost of treatment. Research in the group has expanded to include related areas such as bioengineering, neuroscience and biofeedback interfaces. Projects include: haptic research, and the development of neural implants for advanced cybernetic interfaces.</p>

23.12 Shadow Robots

Institution:	Shadow Robot Company Ltd.
Address:	251 Liverpool Road London N1 1LX, UK
Contact:	Nick Singer
Phone:	+44 20 7700 2487
Fax:	
Email:	contact@shadow.org.uk
URL:	http://www.shadow.org.uk/index.shtml
Faculty:	
Post-Docs:	
Students:	
Projects	<p>Shadow is the award winning robotics company based in the UK. Founded by Richard Greenhill in 1987, Shadow has been making Robots and developing associated technologies ever since.</p> <p>Our aim was to build a useful general-purpose robot and so development of the Shadow biped began. A robot that can reach the cupboards, turn the taps, get up the stairs. A robot that can function in a human environment to do the repetitive things we need to do but do not want to do, and give us more independence, more time and more dignity. It is a truly worthwhile goal, and one to which we remain committed. But in pursuing it we have made technological breakthroughs, such as the Shadow Air Muscle, which have immediate commercial applications.</p> <p>The most visible (and appealing) piece of work in progress at the Shadow Project is the prototype bipedal robot, the Shadow Walker. The Walker is a wooden leg-skeleton, powered by Shadow air muscles. It stands 160 cm tall, its upper body currently consisting of the control valves, the various control electronics and computer interfaces. Its purpose is to permit us to research and develop the necessary designs and techniques of humanoid balancing and walking. The walker is a research prototype, and as such has undergone considerable refinement as control problems are discovered. One of our ongoing projects is the development of an “inner ear”, a sensitive 3-axis accelerometer and inclinometer.</p> <p>Providing a robot with the same locomotive structures as a human will ensure that it can certainly operate in any environment a human can operate in. The development of the robot is facilitated by the extensive knowledge base about human anatomy and physiology; it is hoped that eventually the work done by the Shadow Project can have some impact on further research and development in these and related fields, such as prosthetic design.</p> <p>Currently the Shadow Walker can balance despite being pushed, and can stagger forward a couple of steps. Scope for further research there ...</p>

23.13 Sheffield

Institution:	Neurocomputing and Robotics Group (NRG), University of Sheffield
Address:	Department of Computer Science Regent Court 211 Portobello Street Sheffield S1 4DP U.K.
Contact:	Prof. Noel Sharkey
Phone:	+44 114 22 21803
Fax:	
Email:	N.Sharkey@dcs.shef.ac.uk
URL:	http://www.dcs.shef.ac.uk/nrg/
Faculty:	1 Professor, 1 Lecturer, 2 Research Assistants
Post-Docs:	
Students:	6 Ph.D. students
Projects	<p>The Neurocomputing and Robotics Group (NRG) of the Department of Computer Science at Sheffield is concerned with the theory and practice of artificial adaptation using biologically inspired methods both at a general level, with network learning and genetic algorithms, and at the level of specific biological and psychological modelling. Currently the main applications are in robot control and the fault diagnosis of diesel engines. All of the research uses sensing and sensor fusion in some form: vision, sonar, infrared, laser, tactile, proprioception, cylinder pressure, acoustics, vibration. Most of the work is also about behaviour.</p> <p>The members of the group reject traditional disciplinary boundaries in an attempt to synthesise ideas from computer science, biology, engineering and psychology. The research projects are wide ranging, from the development of a hospital pharmacy robotic system to brain modelling; from the fault diagnosis of diesel engines to an understanding of biological adaptation and how notions of experiential representation (psychological) can be put to work in an engineering context.</p> <p>Two overarching theoretical themes of the group are (i) the development and integration of large scale ANN systems. We are investigating ways of combining different neural network modules trained with different methods and of decomposing systems into autonomous modular agents; (ii) making the computational processes of ANN transparent through visualisation and statistical techniques.</p> <p>The Adaptive Behaviour Research Group in the Psychology Department aims to form an understanding of animal and human behaviour by studying computer models of neural circuits and the behaviour patterns of robots driven by these models. For example, models of the basal ganglia have been embedded in a robot control architecture. The robot itself interacts with a real world environment and shows a variety of behaviours, including food-seeking and wall-following, which are analogous to rat behaviours. These behaviours are successfully selected and switched between by the embedded basal ganglia model and coherent sequences of behaviour are formed. This is the strongest evidence yet that the basal ganglia are directly involved in action selection.</p>

23.14 Southampton

Institution:	Intelligence, Agents, Multimedia (IAM) Group, University of Southampton
Address:	Electronics and Computer Science Highfield Southampton SO17 1BJ U.K.
Contact:	Prof. NR Jennings
Phone:	+44 23 8059 3255
Fax:	+44 23 8059 2865
Email:	nrj@ecs.soton.ac.uk
URL:	http://www.iam.ecs.soton.ac.uk/
Faculty:	6 Professors, 1 Reader, 2 Senior Lecturers, 7 Lecturers, 42 Research Assistants
Post-Docs:	
Students:	≈ 88 Postgraduates
Projects	<p>The Intelligence, Agents, Multimedia (IAM) Group of Electronics and Computer Science, Southampton is an international leader in the three major themes that converge in the Group's tripartite title:</p> <ul style="list-style-type: none"> • intelligence: examining the fundamental principles of intelligent and adaptive behaviour and developing methods and services for acquiring, using, and maintaining knowledge; • agents: devising new methods and models for inter-agent interactions such as cooperation, coordination and negotiation, developing novel real-world applications and pioneering work on agent-oriented software engineering; • multimedia: basic principles and applications in large scale open systems, context aware, personalised information management systems. <p>The goal of our biorobotics research is to seek inspiration from biological systems to build robots with a full range of adaptable behaviours in any given environmental niche. Most work to date has focused on building insect-like robots, although more ambitious programs of research employ human-like or anthropomorphic robots. We explore ways in which artificial nervous systems capable of learning and adaption could be constructed. Our neuronal control algorithms permit robots to learn sensory and motor maps, to represent how they and the external world are organised. Computer simulations and real robots are used to explore these and other issues. We draw inspiration from and contribute to developments in biological neuroscience. Current research areas include: the construction of robots that demonstrate robust, flexible and adaptive behaviour; outlining the stages through which adaptive systems pass as they attempt to acquire capabilities and behaviours; and development of synthetic nervous systems.</p>

23.15 Sunderland

Institution:	Centre for Hybrid Intelligent Systems, University of Sunderland
Address:	School of Computing and Technology St. Peters Way Sunderland SR6 0DD U.K.
Contact:	Prof. Stefan Wermter
Phone:	+44 (0) 191 515 3279
Fax:	+44 (0) 191 515 3553
Email:	stefan.wermter@sunderland.ac.uk
URL:	http://www.his.sunderland.ac.uk/
Faculty:	1 Professor, 7 Lecturers, 1 Research Assistant
Post-Docs:	
Students:	13 Ph.D. students
Projects	<p>The objective of the Centre for Hybrid Intelligent Systems at the University of Sunderland is to research into the theoretical foundations and application of intelligent behavior for building computational systems. We want to learn from nature and human performance in order to build such systems. We have used and developed a wide variety of techniques including techniques from neural networks, machine learning, natural language analysis, genetic algorithms, data mining, case-based reasoning, knowledge-based methods, fuzzy representations, Bayesian statistics and hybrid intelligent architectures. In particular, we are interested in building computational systems for learning about cognitive robotics, processing language/speech, analysing pictures and video sequences, monitoring machine conditions or simulating system dynamics. In general we want to learn from cognitive science, neuroscience, biology and linguistics and our focus is on building novel intelligent system architectures. The overall aim is to build more effective systems which integrate neural and symbolic concepts in hybrid systems.</p> <p>Current projects include: biomimetic multimodal learning in a mirror neuron-based robot, neural networks and a hybrid system for adaptive robotics and navigation, self organising feature maps for underwater robots, acoustic tracking of objects by robot, place recognition in robot navigation, and natural self organization for integrating verbal instruction into autonomous robot behaviour.</p>

23.16 Sussex

Institution:	Evolutionary and Adaptive Systems group, University of Sussex
Address:	School of Biological Sciences Faculty of Engineering BN1 9QG Brighton, U.K.
Contact:	Prof. Hilary Buxton
Phone:	+44 (0) 1273 872945
Fax:	+44 (0) 1273 678535
Email:	hilaryb@cogs.susx.uk.ac
URL:	http://www.cogs.susx.ac.uk/easy/ and http://www.cogs.susx.ac.uk/ccrn/
Faculty:	4 Professors, 4 Research fellows, 1 Senior Lecturer, 3 Lecturers, 2 Readers, 1 Research Fellow
Post-Docs:	
Students:	about 27 D.Phil. students
Projects	<p>The Department of Informatics (subsuming the former School of Cognitive and Computing Sciences, COGS) in the University of Sussex at Brighton is home to one of the world's largest groups of researchers studying artificial evolutionary and adaptive systems. Such work is often described using names such as Artificial Life, Evolutionary Computation, and Adaptive Behaviour research. Members of the Evolutionary and Adaptive Systems (EASy) group comprise research students and faculty from both Informatics and the School of Life Sciences, with very strong links to the interdisciplinary Centre for Computational Neuroscience and Robotics (CCNR). The main areas of research are autonomous robotics, biological modelling, evolvable hardware, evolutionary computation, artificial life, and art/science interfaces.</p> <p>Our group is one of the pioneers in evolutionary robotics, applying these techniques for more than 15 years. Current topics of research include: neural systems modelling, plasticity and adaptivity, GasNets: diffusion of chemical neuromodulators, spiking neural controllers and spike-timing-dependent plasticity, neural oscillators, neural homeostasis, growing neural controllers, minimally developmental systems, passive dynamic walkers, active vision, visually-guided arm movement, modular and hierarchical control, social robotics, team coordination, action selection, learning, path integration and landmark navigation, arbitrary evolved morphologies for locomotion, orientation and self-assembly.</p> <p>The central aim of CCNR is to exploit a two-way flow of ideas and methods between neuroscience and artificial intelligence in order to provide a new way of understanding behaviour-generating mechanisms in natural and artificial systems. This synergy is reflected in the approach taken in each project and the emphasis on exploiting the relationships between the projects.</p>

23.17 Ulster

Institution:	Intelligent Systems Engineering Laboratory (ISEL), University of Ulster
Address:	School of Computing and Intelligent Systems Faculty of Engineering University of Ulster, Magee campus Northland Road, Londonderry, Co. Londonderry BT48 7JL, Northern Ireland
Contact:	Prof. Martin Mc Ginnity
Phone:	+44 (0) 28 7137 5417
Fax:	+44 (0) 28 7137 5570
Email:	tm.mcginnity@ulst.ac.uk
URL:	http://isel.infm.ulst.ac.uk/
Faculty:	1 Professor, 9 Lecturers, 4 Research Assistants
Post-Docs:	
Students:	13 Ph.D. students
Projects	<p>The Intelligent Systems Engineering Laboratory (ISEL) is a research group in the School of Computing and Intelligent Systems within the Faculty of Informatics, University of Ulster, N. Ireland. The activities of the group encompass research into a range of intelligent and hybrid technologies, and includes work on neural networks, fuzzy systems, genetic/evolutionary algorithms, hybrid intelligent techniques, reasoning, self-organisation, multiple valued logic and model predictive control. The group has particular strengths in the design and creation of intelligent embedded systems, including ongoing work on self-repair and autonomous, self-organising intelligent systems. ISEL is particularly interested in developing and evaluating bio-inspired intelligent systems applications in advanced computational robotics.</p> <p>Broadly speaking, research into intelligent systems attempts to understand human reasoning, learning, analysis, and decision making processes and incorporate some elements of these (albeit currently very crudely) into systems engineered by humans. From its inception the Intelligent Systems Engineering Laboratory (ISEL) has embraced the topic of intelligent systems in the widest sense; the work of the group encompasses research into: neural networks, fuzzy logic and neuro-fuzzy systems, reconfigurable computing, embedded intelligent systems, genetic algorithms, hybrid intelligent systems, multiple valued logic, embedded model predictive control.</p> <p>The group also has an interest in developing systems to facilitate remote access to engineering educational opportunities. Current work in this area includes the development of a remote access electronic laboratory remotely accesable over the internet.</p>