Programs of Study
The robotics doctoral and master’s programs bring together areas of robotics research that would otherwise be spread across different departments or separate universities, preparing students to take a leading role in the research and development of future generations of integrated robotics technologies and systems. Requirements for the degree include course work and a research qualifier. The Ph.D. also requires the submission of a thesis that describes original, independent research.

Master’s students can typically complete the program in twelve to sixteen months of full-time, self-funded study or, if financial assistance is available, two years of study while working as a research assistant. Doctoral students are expected to complete their program in four to six years. All students are expected to split their time between research and course work during their first years in the program. Doctoral students, after completion of their course work, concentrate entirely on research. Students are involved in every aspect of research, from initial problem formulation to the final publication of results. Research is conducted in the laboratories of the Robotics Institute under the supervision of faculty advisers and in collaboration with student colleagues.

Research Facilities
Students in the robotics programs work in the Robotics Institute’s various research laboratories, including Advanced Mechatronics, Computer Graphics, Intelligent Coordination and Logistics, Interactive Systems, Manipulation, Medical Robotics, Microdynamic Systems, Microelectromechanical Systems, Mobile Robot, Neurobotics, Rapid Manufacturing, Reliable Autonomous Systems, Robot Learning, Robotics Sensor Based Planning, Shape Deposition, Tissue Engineering, and Virtualized Reality.

The institute’s research laboratories hold and maintain a unique collection of research equipment. In the area of mobile robots, Carnegie Mellon is known for the NavLab vehicles, Ambler, Dante, Demeter, Heli, and Uranus. Robotic manipulators include the Troikabot system, Pumas, Adepts, Robot World, IBM-RS, and others. Institute laboratories house numerous vision systems, a stereolithography machine, and numerous sensory systems, such as fast-range finders and olfactory and photometric sensors. Computer-controlled moving platforms, high-precision calibration equipment, and solid modeling systems are also used in the research. The Institute’s electronic labs, machine shops, and fabrication facilities support all of these activities.

The joint computing facility of the Robotics Institute and the School of Computer Science has more than 2,200 machines of a wide variety available for faculty members and graduate students. All new students in the robotics graduate programs are assigned personal workstations.

Financial Aid
All students in the Ph.D. program are supported by graduate fellowships during the academic year. Graduate fellowships may also be available for some students in the master’s program. This support is provided on the basis of the student’s participation in one or more of the ongoing robotics research projects. This participation is an integral part of the student’s education. In 2009–10, each funded student receives full tuition and fees plus a stipend of $2265 per month for the nine-month academic year. Students holding outside fellowships may be given supplementary stipends. A summer stipend after the first full year is available for most students.

Cost of Study
Tuition for 2009–10 is $35,000. Fellowships are available for all doctoral students.

Living and Housing Costs
The University does not provide housing for graduate students. Accommodations in the community are available at a variety of costs.

Student Group
Carnegie Mellon has a total enrollment of approximately 7,500 students, of whom about 2,700 are graduate students. Within the robotics programs there are approximately 55 faculty members and 130 students.

Student Outcomes
The goal of the robotics graduate programs is to prepare students to conduct independent research and become the future leaders formulating the ideas and building the systems that determine the basic understanding of robots and purposeful behavior in general. Graduates of the programs are in positions at top universities, research groups, and government research laboratories all over the world.

Location
Carnegie Mellon is located in Pittsburgh. The 90-acre campus is adjacent to Schenley Park, the largest city park. The campus is close to the many cultural and sports activities of the city and is only 4 miles from the downtown business district.

The University and The Programs
Founded in 1900 by Andrew Carnegie, the Carnegie Institute of Technology joined with the Mellon Institute (now the Carnegie Mellon Research Institute) in 1967 to become Carnegie Mellon University. Through this merger one of the nation’s leading research and education institutions was established.

The robotics programs are administered by the Robotics Institute, which is part of the School of Computer Science.

Applying
Application materials are available online at https://applyweb.cs.cmu.edu/apply/. The application, official transcripts, Graduate Record Examinations General Test scores, and three letters of recommendation must be received by December 15. The TOEFL is required for students whose native language is not English. While formal admission requirements are flexible, minimum preparation normally includes an undergraduate program in science or engineering and some experience in computer programming. Excellence and promise may balance a lack of formal preparation.

Correspondence and Information
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THE FACULTY AND THEIR RESEARCH

O. Amid, Senior Systems Scientist, Robotics. Aerial robotics, vision-based robot navigation, high-speed industrial inspection.

D. Adamchik, Senior Systems Scientist, Robotics. Space robotics; field robots for demanding applications and extreme environments; robotic mobility, mechanisms, and control; mechatronics; dynamics; robot design; rolling/walking/hopping robots.

C. Ciszek, Professor, Robotics and Human-Computer Interaction. Machine learning, humanoid robotics, intelligent environments.

J. Bagnell, Research Scientist, Robotics. Machine learning, reinforcement learning, automated decision making, learning control, outdoor and mobile robotics.

J. Bares, Research Professor, Robotics. Conception to testing of intelligent machines for hazardous environments, construction, and heavy industry; automated robot design and optimization; technology transfer to industry.

M. Bergerman, Systems Scientist, Robotics. Robot navigation, guidance, and control; unmanned aerial vehicles; dynamic modeling; innovation management.

D. A. Bourne, Principal Systems Scientist, Robotics. Expert systems, automated manufacturing, computer vision.

B. Browning, Systems Scientist, Robotics. Multirobot systems.

H. Choset, Associate Professor, Robotics. Path planning, motion planning, SLAM, mechanism design, snake robots, coverage, search and rescue, medical robotics, educational robotics.

F. De la Torre, Research Scientist, Robotics. Machine learning, computer vision, statistical signal processing, pattern recognition and image processing.

M. Dias, Assistant Research Professor, Robotics. Technology for developing communities, multirobot coordination, market-based team coordination, human-robot dynamic teams, dynamic path planning and navigation.

A. Dillig, Associate Research Professor, Robotics, and Orthopedic Surgeon. Clinical applications of medical robotics, image-guided surgical navigation, clinical outcomes database development.


A. Dubrawski, Systems Scientist, Robotics, and Director, Auton Lab. Data mining, applied machine learning, autonomous systems.

A. A. Efros, Assistant Professor, Robotics and Computer Science. Computer graphics, computer vision, image processing, machine learning, and object recognition.

M. Erdmann, Professor, Computer Science and Robotics. Mechanics of manipulation, planning, uncertainty, algebraic topology, shape sensing, protein structure.

G. K. Fedder, Howard M. Wilkoff Professor, Electrical and Computer Engineering and Robotics, and Director, Institute for Complex Engineered Systems. Microelectromechanical systems (MEMS), sensors, microbotics.

M. Hebert, Professor, Robotics. Computer vision, object recognition and scene analysis; model construction from 3-D data; mobile robotics, perception and autonomous mobility in unstructured environment, classification and recognition from sensor data.

J. Hodgins, Professor, Robotics and Computer Science. Computer graphics, computer animation, dynamic simulation, humanoid robotics.


D. Huber, Systems Scientist, Robotics. Computer vision, 3-D vision, object recognition, 3-D modeling.

B. Jaramaz, Associate Research Professor, Robotics. Surgical simulation, computational mechanics, medical robotics and computer-assisted surgery.


G. Kavraki, Systems Scientist, Robotics. Control, field robotics, range data, sensor fusion.

A. Kelly, Associate Research Professor, Robotics. Perception, planning, control, simulation, operator interfaces for mobile robots.

P. N. Khosla, Philip and Marsha Dowd Professor of Electrical and Computer Engineering and Dean. Distributed and reconfigurable robots, reconfigurable and adaptive embedded software, agent-based control, agent-based distributed information systems.

J. Aluffner, Associate Professor, Robotics. Humanoid robotics, motion planning, simulation, computer graphics and animation.

S. Lucey, Systems Scientist, Robotics. Artificial intelligence, computer vision, pattern recognition.

M. T. Mason, Director, Robotics. Manipulation, automatic planning of robot manipulator programs, mechanics of manipulation, mobile manipulation.

J. Mostow, Research Professor, Robotics, Language Technologies, Human-Computer Interaction, and Automated Learning and Discovery. Pro Jerkly, using speech recognition for literacy, intelligent tutors, educational data mining.

S. G. Narasimhan, Assistant Professor, Robotics. Computer vision, computer graphics, optics, image processing and sensors.

R. Nourbakhsh, Associate Professor, Robotics and Chair, Robotics Master’s Program. Robot architecture, robot communication and cooperation, nonprehensile manipulation, robot learning.

N. Pollard, Associate Professor, Robotics and Computer Science. Animation of human motion, humanoid robotics, grasp and manipulation planning.

R. Reddy, Simon University Professor of Computer Science and Robotics. Spoken language systems, multimedia/human-computer interaction, learning from example.

C. Riviere, Associate Research Professor, Robotics and Biomedical Engineering. Medical robotics, human-machine interfaces, signal processing, applied machine learning.


J. Schneider, Associate Research Professor, Robotics. Machine learning, reinforcement learning, optimization, scheduling, data mining.

M. Siegel, Associate Research Professor, Robotics. Sensors and sensor systems, mobile robots for difficult measurements in difficult environments, 3-D stereoscopic display systems, scaling issues in robot and robotic systems design, sensor fusion, confidence fusion.

R. Simmons, Associate Director for Education, Robotics, and Chair, Robotics Doctoral Program. AI, mobile robots, task-level control architectures, planning, reasoning under uncertainty, multirobot coordination, human-robot social interaction, indoor and outdoor robot navigation, formal verification of robot control programs.

S. Singh, Associate Research Professor, Robotics. Perception in natural environments, motion estimation, multiagent coordination, motion planning for air and ground vehicles and redundant mechanisms, sensor networks.

M. Sitti, Associate Professor, Robotics and Mechanical Engineering. Microbotics, nanorobotics, biomimetic miniature robots, medical microbots, nanotechnology, haptics.

S. F. Smith, Research Professor, Robotics. Artificial Intelligence, planning and scheduling, constraint-based search and optimization, distributed and dynamic problem solving, adaptive systems, human-computer interaction.


A. J. Stentz, Research Professor, Robotics. Robot planning, perception, and navigation; multirobot architecture: field robots; mobile robots; artificial intelligence.

G. Stetten, Research Professor, Robotics. Medical image analysis, visualization, and robotics.

K. P. Sycara, Research Professor, Robotics and Human-Computer Interaction. AI, multiagent systems, peer-to-peer systems, multiagent learning, Web semantics, Web services, e-commerce, coordination of robot agents and people teams.


A. Treuille, Assistant Professor, Computer Science and Robotics. Computer graphics, physical simulation, model reduction, computational biochemistry.

M. Veloso, Professor, Computer Science and Robotics. Artificial intelligence; Project RoboTutor, using speech recognition for literacy, intelligent tutors, educational data mining.

L. E. Weiss, Research Professor, Robotics. Tissue engineering, digital fabrication, implantable microsystems.

D. Wettergreen, Associate Professor, Robotics, Mobile robotics design and control, navigation and task autonomy, science data understanding, exploration in terrestrial and space applications.

W. L. Whittaker, University Professor, Robotics. Robots for unstructured environments, navigation and manipulation, integration of robot systems.

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