

# College of Engineering

A department does not live in a vacuum; its environment helps shape its approach to education and research. CS is in the Faculty of Computing and Information Sciences, but it is also an integral part of the College of Engineering and offers two undergrad degrees there: Computer Science and Information Science, Systems, & Technology. CS is heavily involved in educational initiatives with Engineering and has research and education ties to faculty in Biomedical Engineering, Civil & Environmental Engineering, Mechanical & Aerospace Engineering (MAE), Computer & Electrical Engineering (ECE), and others.

The Engineering College is second to none in the range and quality of its experiential learning opportunities, with over 15 project teams, undergraduate research, and ESW courses. Many teams are interdisciplinary in nature and actively recruit CS majors. Below, we highlight some of these opportunities.

## Robocup

Robocup designs and constructs autonomous robot soccer teams and competes in national and international competitions under the direction of Prof. Raffaello D'Andrea (MAE). The team, which first competed in 1999, has won the championship four times: 2003 in Italy, 2002 in Japan, 2000 in Australia, and 1999 in Sweden. The team takes pride in using a systems engineering approach. Contributions from students in CS, ECE, and MAE are equally important to the team's success.

## Underwater Autonomous Vehicle

Under the direction of Prof. Kevin Kornegay (ECE), this team designs, builds, and tests autonomous underwater vehicles. The team placed first or second in each of the past three years in an underwater vehicle competition, held in the Space and Naval Warfare Systems Center in San Diego. AI is an important element of this project.

## DARPA Grand Challenge

Cornell's entry was one of 40 from a field of 195 to advance to the semifinals in this DARPA-sponsored competition to have an autonomous vehicle race through the desert in Oct. 2005. Vision and AI are crucial to this project. Profs. Ephraim Garcia and

Hod Lipson of MAE and Dan Huttenlocher and Bart Selman of CS advise this team.

## Formula SAE

Each year, a group of undergrad and grad students design, build, test, and race a car in the Formula SAE competition under the direction of Prof. Al George of MAE. In May 2005, about 140 schools competed in Detroit; Cornell won—for the ninth time in the past 18 years!

## Engineers for a Sustainable World

ESW, a nonprofit organization founded in 2001 at Cornell under the inspiration of Regina Clewlow (CS '01), has expanded to chapters at 21 universities. Through domestic and international development work, education, and outreach, ESW "mobilizes engineers to address the challenges of global poverty and sustainability". An ESW course, offered by Civil & Environmental Engineering, teaches students design through projects that serve society in some way. Examples are vegetable oil as an alternative to diesel fuel, storm-water management in the Virgin Islands, and construction of a bridge here in Ithaca. CS professor Graeme Bailey is vice president of the board of directors.



CS student Dan Stowell did his MEng project in 2004-05 in connection with the ESW course. His team reduced the time and effort needed to survey, plan, and implement the design of viaducts, canals, and holding tanks for bringing water to villages. Their testbed was in Honduras. Using software that he and others wrote to use GPS in recording data, his team eliminated the need for traditional surveying equipment, reduced surveying time by 90%, and reduced construction costs considerably. Stowell learned valuable lessons in engineering design. Some trips to Honduras were an added bonus!



# College of Arts and Science



When Cornell created the CS Department, it had the foresight to place CS in both Engineering and Arts & Sciences. CS has elements of both engineering and science, and to place it in one college could have hampered development. The later placement of CS in the Faculty of Computing and Information Science (CIS) provides more flexibility in furthering interactions with Cornell's seven colleges.

A&S students can major in two computing-related degrees —CS and Information Science— and can minor in CS, Information Science, and Computing in the Arts.

Below, we summarize some of the excellent research ties that CS has with Arts & Sciences faculty.

## Astronomy

CS faculty Alan Demers, Johannes Gehrke, and Jai Shanmugasundaram, along with Jim Cordes of Astronomy, have an NSF grant for data management for large-scale astronomical surveys using the Cornell Arecibo radiotelescope, where astronomers are amassing a petabyte of data.

## Economics

CS faculty member Joe Halpern collaborates on research in decision theory with economics professors David Easley and Larry Blume. They co-teach the course Decision-Making in Complex Environments.

## Science & Technology Studies (S&TS)

Computer scientist and cultural theorist Phoebe Sengers has a joint appointment with S&TS and CIS. Several CS undergrads work in her Culturally Embedded Computing Group, which analyzes, designs, builds, and evaluates computing devices in cultural context. To illustrate the flexibility we have at Cornell, consider the case of Lucy Dunne. As a student in Textiles & Apparel Design in the College of Human Ecology, she did her Masters with Sengers and others on the design of wearable technology; she addressed the human-device interface through functional apparel design. She is now doing her PhD on this topic at the University College Dublin, Ireland.

## Cognitive studies program

In the early 1990s, CS professor Bob Constable was a founding member and one of the leaders of Cognitive Studies. CS professor Joe Halpern has been a co-director, and Claire Cardie, Dan Huttenlocher, Lillian Lee, Bart Selman, and Ramin Zabih are connected with the program. The program has almost 80 members representing 18 departments and schools, making Cornell an exciting environment for cognitive studies. Strengths in cognitive psychology, CS, theoretical and experimental linguistics, philosophy of mind and language, and logic lead to extensive interactions in teaching and research.

The logo of the Institute of Social Sciences. The institute brings together about a dozen faculty, mostly from Cornell, to work on a common theme, which is currently computational social science.

## Computational Biology

A year ago, CS faculty Ron Elber, Uri Keich, Jon Kleinberg, and David Shmoys were involved, along with 30-odd other faculty, in the creation of a PhD program in computational biology. Elber is on the executive committee of the new program, and CIS professor David Shalloway is the director. Shalloway and Kleinberg also headed the team to develop undergrad programs in computational biology.

## Institute for Social Sciences

In April 2005, Cornell's Social Science Advisory Council selected *Computational Social Science: Social and Information Networks* as the second Theme Project of Cornell's Institute for the Social Sciences. The project is led by Michael Macy (Sociology), David Easley (Economics), Geri Gay (Communication), Dan Huttenlocher (CS), and Jon Kleinberg (CS). The project "aims to advance the social sciences at Cornell by tapping the expertise, tools, and skills of network analysts across the university, from computer scientists archiving the Web to social psychologists studying adolescent behavior".

## Natural Language Processing Group

CS faculty Claire Cardie and Lillian Lee have teamed with faculty from Psychology, Linguistics, and Philosophy to form the Natural Language Processing Group.



Shih-Ping Han joins.

1974

Al Aho, John Hopcroft, and Jeff Ullman publish their classic text *The Design and Analysis of Computer Algorithms* (Addison-Wesley).

John Dennis and Jorge More publish their landmark paper *Quasi-Newton Methods, Motivation and Theory*. The nonlinear equation solving business has not been the same since they showed just how far you could go with approximate Jacobians.

Jim Donahue,  
Charlie Van Loan join.

1975

Gerry Salton's new book receives the Best Information Science Book of 1975 from ASIS: *Dynamic Information Library Processing* (Prentice Hall).

Bob Constable starts the development of PL/CV. Developed over nine years, PL/CV eventually resulted in Nuprl, a system for mathematical reasoning, which is in heavy use today. Thirty PhD students learned how to do research using PL/CV and Nuprl.

Corky Cartwright joins.

1976

Dick Conway becomes series editor for Winthrop Publishers.

Dick Conway and David Gries publish several variations of their intro to programming text.

John Dennis and Charlie Van Loan procure HP-67 programmable calculators. For the first time within the confines of the department, it was possible to execute a stored program.

Juris Hartmanis becomes Chair for the second time.

1977

CS acquires its first computer, a PDP 11/60.

David Gries and student Susan Owicki receive the ACM Programming Languages and Systems Award for their paper *An axiomatic proof technique for parallel programs*, *Acta Informatica* 6 (1976), 319-340. Based on Susan's PhD thesis, this paper introduces interference freedom as the basis for proving parallel programs correct.

Frank Luk, Fred Schneider join.

1978

CS introduces two undergrad degrees: BA in Arts & Sciences and BS in Engineering. CS started with just an MS/PhD program in order to produce PhDs to populate future CS departments.