CS&E Graduate Programs

CS&E has 51 faculty members who provide leadership and expertise to our 600 undergraduate majors, and nearly 400 graduate students.

Our faculty members are highly effective educators and prolific researchers. They are international leaders in their respective fields and authors of widely used software and textbooks. The distinction of our faculty locally and worldwide is confirmed by their long list of awards and honors in research and teaching.

MISSION
The mission of our graduate programs is to understand the current state of the art of research, to encourage each student’s capacity for original and creative thinking, and to assist him or her in producing innovative research. They are designed to produce scholars that are well prepared to excel in their future careers in industry, academia, and government. Our graduates are ready to address the increasing interdisciplinary nature of the computer science and engineering discipline and its role in advancing other disciplines in engineering, life sciences, physical sciences, social sciences, and humanities.

PROGRAMS

DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE (PH.D.)
This is a research degree which culminates in a dissertation that demonstrates original and creative research.

MASTER OF SCIENCE IN COMPUTER SCIENCE AND ENGINEERING (M.S.)
The M.S. program in the Computer Science & Engineering (CS&E) department has three tracks a student may choose to pursue: Plan A, a thesis-based degree, Plan B, a project-based degree, and Plan C, a course work-only M.S. Degree. Each track has a separate set of requirements though the general structure remains the same. All M.S. degrees in the Computer Science and Engineering Department require a total of 31 credit hours.

MASTERS DEGREE IN COMPUTER SCIENCE (M.C.S.)
A coursework-only degree for those students seeking to broaden their knowledge without doing research. It is designed to meet the needs of working professionals.

MS GRADUATE MINOR IN COMPUTER SCIENCE
A minor in computer science is also available to students outside the Department of Computer Science & Engineering.

ADMISSION REQUIREMENTS
1. A bachelor’s degree in computer science or a related field.
2. GPA of 3.25 for MS or 3.45 for Ph.D.
3. Minimum TOEFL score of 79, 21 in writing and 19 in reading.

Application information: cs.umn.edu/admissions/graduate
Contact: csgradmn@umn.edu
612-625-1592
GRADUATE RESEARCH AREAS

ARCHITECTURES, COMPILER OPTIMIZATION, & EMBEDDED SYSTEMS
This research area targets future generations of low-power multicore systems for data-intensive and high-performance computations, focusing on architectural and compiler support for speculative thread execution, high-performance memory systems, system virtualization for cloud computing, and on supporting domain experts to create applications for future exascale computers.

BIOINFORMATICS & COMPUTATIONAL BIOLOGY
Bioinformatics and computational biology research focuses on building predictive models for effective disease diagnoses, algorithms for sequence and structure analysis, protein structure and function prediction, virtual screening and lead discovery, data modeling, database and proteomics analyses, analysis and inference of genetic and protein-protein interaction networks, and the development of methods that bring precision medicine to the microbiome.

DATA MINING, DATABASES & GEOGRAPHICAL INFORMATION SYSTEMS
This area focuses on developing novel algorithms for anomaly and pattern detection, predictive modeling, query processing, and spatial data analysis. Research is conducted in the context of a variety of domains, such as: bioinformatics, life sciences, cyber security, e-commerce, social networks, education, healthcare, global climate, data analysis, sensor networks, transportation, and the Web.

GRAPHICS & VISUALIZATION
The Graphics and Visualization group conducts research across the broad areas of: computer graphics, gaming, and animation; data and information visualization; 3D user interaction; and virtual/augmented reality. Specific research topics include: crowd modeling; physics-based animation; color appearance, color synthesis, and color reproduction techniques; spatial perception and self-representation in immersive virtual environments; scientific visualization; and spatial/tangible user interfaces.

HIGH PERFORMANCE COMPUTING
The research areas the high-performance computing group pursues include: grid computing, parallel algorithm design, performance analysis, algorithms and runtime systems for Big Data computations, and sparse matrix algorithms for large-scale scientific and engineering simulations.

HUMAN COMPUTER INTERACTION (HCI)
The HCI group specializes in collaborative and social systems—computing systems that help people interact and work together, exploring the way computer tools enhance collective intelligence in groups as small as two users to as large as all of Wikipedia. HCI draws upon and conducts studies of individual and collective behavior to guide the creation of novel algorithms, interaction techniques, and user experiences.

NETWORKS, DISTRIBUTED SYSTEMS, SECURITY & CLOUD COMPUTING
Research thrusts in our Networks, Distributed Systems, Security and Cloud Computing group include integrating emerging technologies into computing, communications and storage platforms, efficient and scalable mechanisms and protocols, and novel network and systems architectures and services for enhancing a variety of communication networks and large-scale computing and storage systems.

ROBOTICS, ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
Research in this area explores a breadth of topics spanning from estimation theory, to mobility mechanisms, active computer vision, integration of visual and motor information in humans, cooperation of robots, and multi-agent systems. Research applications include reconnaissance tasks using miniature robots, search and rescue in urban environments, monitoring human activities for security and efficiency, multi-robot exploration, transportation systems, and environmental and agricultural robotics.

SOFTWARE ENGINEERING & PROGRAMMING LANGUAGES
Research in software engineering and programming languages focuses on two main thrusts: developing tools and techniques to enhance programmer productivity and ensure safe software deployment; and designing and implementing new languages, formalisms and frameworks for expressing solutions to computational problems. These two focus areas are synergistic, as new languages are usually oriented towards improving the productivity and software quality.

THEORETICAL FOUNDATIONS
Theoretical foundations research encompasses a broad range of foundational topics in computer science, including computational learning theory, complexity theory, algorithm and data structure design, geometric computing, cryptography, computational logic, and programming languages theory. Several of our group members are also actively engaged in leveraging their research into other research application areas.

More research information: cs.umn.edu/research/research_areas

All photos by Richard Anderson