Computer Science & Engineering Program Information Materials

UCONN | SCHOOL OF ENGINEERING

OPEN HOUSE

UCONN
UNIVERSITY OF CONNECTICUT

COMPUTER SCIENCE & ENGINEERING

Interim Leadership for Fall 2018

Reda Ammar, Ph.D.

Interim Department Head

Alexander Russell, Ph.D.

Interim Associate Department Head

CSE Welcomes New Faculty

Derek Aguiar, Ph.D.
Assistant Professor

Ph.D., Brown University, 2014
derek.aguiar@uconn.edu

- Probabilistic Modelling
- Computational Biology
- Machine Learning
- Algorithms

Qian Yang, Ph.D.
Assistant Professor

Ph.D., Stanford University, 2018
qyang@uconn.edu

- Machine Learning for Physical Science
- Computational Math
- Applied Algorithms

Ahmad Jbara, Ph.D.
Assistant Professor in Residence

Ph.D., The Hebrew University of Jerusalem, 2016
ahmad.jbara@uconn.edu

- Program Comprehension, Code Complexity Metrics
- Software Engineering
- Systems Engineering, Object-Process Methodology
- Secure Usability

UCONN
SCHOOL OF ENGINEERING

UNIVERSITY OF CONNECTICUT

COMPUTER SCIENCE & ENGINEERING

A NOTE FROM THE DEPARTMENT HEAD

The Department of Computer Science & Engineering (CSE) recently celebrated the 30th anniversary of our establishment as an academic department at the University of Connecticut. Yet the history of computer science at the University actually begins over half a century ago with the introduction of our first computing courses in the 1960's. The first defense of a Ph.D. in Computer Science was held in 1967. The Computer Science curriculum was established in 1970, and the program was accredited in 1972 among the very first undergraduate programs in the field of Computer Science. As we enter our next epoch, Computer Science & Engineering encompasses broad areas of intellectual discourse in informatics spanning a plethora of educational and research activities ranging from the very foundations of computability to the challenges of building dependable and secure computer and cyber-physical systems that underlie much of the modern society endeavors. The department is ever-growing; our undergraduate enrollment has doubled in the last four years and the number of doctoral students exceeds one hundred for the first time. Our faculty now includes more than thirty full-time members for the first time in our history. Since the start of the millennium, the department has experienced significant qualitative evolution, complementing our rigorous educational curricula with comprehensive research programs in several areas. Our department has excellent and diverse faculty with research and education expertise in the traditional and emerging fields of computer science and engineering. We continue to attract talented young faculty, with twelve of our faculty winning the prestigious National Science Foundation Career Awards since the turn of the century. Our presence remains strong in the community as we fulfill our mission of research, education, industrial and public outreach, and service to the profession. I invite you to browse our website at www.cse.uconn.edu where you will find detailed information on our academic programs at the undergraduate and graduate levels, research and teaching profiles of our faculty, and student societies. I am confident you will find a topic that sparks your interest. As you get to know us better do not hesitate to contact us. We will be happy to answer your questions.

Sincerely,
Alexander A. Schwarzmann
Department Head

CSE FACULTY

REDA A. AMMAR
Professor and Director of Engineering Global Programs
Ph.D., University of Connecticut, 1983
reda@engr.uconn.edu

- Performance Engineering
- Underwater Computer Systems
- Big Data Analytics
- Real-time Distributed Systems

MUKUL S. BANSAL
Assistant Professor
Ph.D., Iowa State University, 2009
mukul.bansal@uconn.edu

- Computational Biology and Bioinformatics
- Computational Molecular Evolution
- Combinatorial Optimization
- Algorithms

KEITH BARKER
Professor
University Teaching Fellow
Ph.D., Sheffield University, 1966
keith.barker@uconn.edu

- Computer Science Education
- Curriculum and Technology Development
- Instructional Design

JINBO BI
Associate Professor
Ph.D., Rensselaer Polytechnic Institute, 2003
jinbo@engr.uconn.edu

- Machine Learning
- Statistical Data Mining
- Large Scale Optimization
- Biomedical Informatics

PHILLIP BRADFORD
Associate Professor in-Residence
Director of Computer Science, Stamford Regional Campus
Ph.D., Indiana University, 1995
phillip.bradford@uconn.edu

- Applied Algorithms, Optimization and Machine Learning
- Security, Programming Languages, Data Analytics
- Computational Finance, Auctions, Bitcoin/Blockchain

C. AUGUSTO CASAS
Associate Professor in-Residence
Ph.D., Nova Southeastern University, 2002
augusto.casas@uconn.edu

- Computational Finance
- Financial Planning Informatics
- Legal Informatics

STEVEN A. DEMURJIAN
Professor
Ph.D., The Ohio State University, 1987
steve@engr.uconn.edu

- Role-based, Discretionary, and Mandatory Access Control
- Mobile and Cloud Computing with Access Control
- Secure Software Engineering
- Software Architectures for Biomedical Informatics

PARASARA SRIDHAR DUGGIRALA
Assistant Professor
Ph.D., University of Illinois, Urbana-Champaign, 2015
psd@engr.uconn.edu

- Verification of Cyber-Physical Systems
- Formal Methods and Verification
- Control Theory
- Software Verification

BENJAMIN FULLER
Assistant Professor
Ph.D., Boston University, 2015
benjamin.fuller@uconn.edu

- Cryptography
- Security
- Information-Theory
- Complexity

SWAPNA S. GOKHALE
Associate Professor
Ph.D., Duke University, 1998
ssg@engr.uconn.edu

- Social Media
- Software Engineering
- Performance and Dependability Analysis

SONG HAN
Assistant Professor
Ph.D., University of Texas, Austin, 2012
song@engr.uconn.edu

- Cyber-Physical Systems
- Real-Time and Embedded Systems
- Large-Scale Real-Time Data Management
- Wireless Networks and Mobile Computing

AMIR HERZBERG
Professor and Comcast Chair for Security Innovation
D.Sc., Technion-Israel Institute of Technology, 1991
amir.herzberg@uconn.edu

- Security and Privacy for Internet and beyond
- Applied Cryptography
- Secure Usability and Human-Computer Interaction

CHUN-HSI HUANG
Associate Professor
Ph.D., State University of New York at Buffalo, 2001
huang@engr.uconn.edu

- Graph Algorithms
- Parallel Computing
- Cluster/Grid Computing
- Bioinformatics

JOSEPH JOHNSON
Associate Professor in-Residence
Associate Director of Undergraduate Programs in Computing
Ph.D., Rensselaer Polytechnic Institute, 2016
joseph.2.johnson@uconn.edu

- Computational Semantics
- Knowledge Representation and Reasoning
- Natural Language Processing, Machine Learning

MOHAMMAD MAIFI HASAN KHAN
Assistant Professor
Ph.D., University of Illinois, Urbana-Champaign, 2011
maifi.khan@engr.uconn.edu

- Performance Analysis of Large Scale Systems
- Design of Dynamic Data Driven Application Systems
- Human-Machine Interaction

WALTER O. KRAWEC
Assistant Professor
Ph.D., Stevens Institute of Technology, 2015
walter.krawec@uconn.edu

- Quantum Cryptography and Communication
- Computer Security
- Information Theory

ION MANDOIU
Professor
Ph.D., Georgia Institute of Technology, 2000
ion@engr.uconn.edu

- Approximation Algorithms
- Combinatorial Optimization
- Bioinformatics
- Computational Genomics

ROBERT MCCARTNEY
Associate Professor and Director of Undergraduate Computing Education
Ph.D., Brown University, 1988
robert@engr.uconn.edu

- Computing Education
- Informal and Self-directed Learning
- Commonsense Computing
- Artificial Intelligence

JEFFREY A. MEUNIER
Lecturer and Coordinator of Freshman Computing Education
M.S., University of Connecticut, 1999
jeffm@cse.uconn.edu

- Computer Science Education
- Microcontrollers, Automation, Robotics
- Programming Languages and Abstract Machines

FEI MIAO
Assistant Professor
Ph.D., University of Pennsylvania, 2016
fei.miao@uconn.edu

- Cyber-Physical Systems
- Autonomous Transportation Systems
- Optimization and Control

LAURENT MICHEL
Professor and Associate Department Head
Ph.D., Brown University, 1999
ldm@engr.uconn.edu

- Combinatorial Optimization
- Constraint Programming/Local Search
- Security/Voting
- Programming Languages
- Artificial Intelligence

SHEIDA NABAVI
Assistant Professor
Ph.D., Carnegie Mellon University, 2008
nabavi@engr.uconn.edu

- Statistical Machine Learning
- Computational Genomics
- Signal/Image Processing
- Translational Bioinformatics

TOM PETERS
Professor
Ph.D., Wesleyan University, 1982
tpeters@engr.uconn.edu

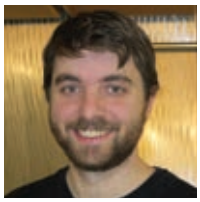
- Computational Topology
- Computer Aided Geometric Design
- Computational Geometry
- Design Theory

SANGUTHEVAR RAJASEKARAN
The UTC Chair Professor, BECAT Director
Ph.D., Harvard University, 1988
rajasek@engr.uconn.edu

- Applied Algorithms
- Bioinformatics and Computational Biology
- Big Data Analytics
- High Performance and Parallel Computing

ALEXANDER C. RUSSELL
Professor and Director of the Graduate Program
Ph.D., Massachusetts Institute of Technology, 1996
acr@cse.uconn.edu

- Computational Complexity
- Cryptography
- Distributed Computing



DONALD SHEEHY
Assistant Professor
Ph.D., Carnegie Mellon University, 2011
donald@engr.uconn.edu

- Computational Geometry
- Mesh Generation
- Topological Data Analysis

ZHIJIE "JERRY" SHI
Associate Professor
Ph.D., Princeton University, 2004
zshi@engr.uconn.edu

- Computer Security
- Sensor Networks
- Computer Architecture
- Embedded Systems

DONG-GUK SHIN
Professor
Ph.D., University of Michigan, 1985
shin@engr.uconn.edu

- Bioinformatics
- Visual User Interfaces
- Biomedical Big Data Analysis
- Intelligent Software Agents
- Database Interoperation

ALEXANDER A. SCHWARZMANN
Professor and Department Head
Ph.D., Brown University, 1992
aas@cse.uconn.edu

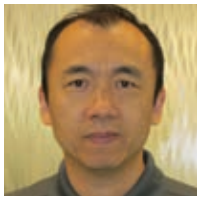
- Distributed Computing and Fault Tolerance
- Electronic Voting Systems and Security
- Parallel and Distributed Algorithms
- Formal Specification and Modeling

BING WANG
Professor
Ph.D., University of Massachusetts, 2005
bing@engr.uconn.edu

- Computer Networks
- Multimedia
- Distributed Systems

WEI WEI
Assistant Professor in-Residence
Ph.D., University of Massachusetts, 2006
wei.wei@uconn.edu

- Computer Networks
- Social Networks
- Performance Evaluation



YUFENG WU
Associate Professor
Ph.D., University of California, Davis, 2007
ywu@engr.uconn.edu

- Computational Biology
- Bioinformatics
- Algorithms

OUR PROGRAMS

UNDERGRADUATE DEGREE

Our undergraduate program provides a breadth of instruction in computer science and engineering, while allowing the students to gain a depth of knowledge in particular technical areas of interest. The curriculum provides sufficient work in mathematics, science, and engineering allowing students to design solutions to a wide variety of problems. Coursework in the humanities and social sciences are an integral part of the engineering program to make students aware of their social responsibility and to consider non-technical factors in the practice of engineering.

AT THE UNDERGRADUATE LEVEL WE OFFER:

- B.S. in Engineering with a major in Computer Science and Engineering *+
- B.S. with a major in Computer Science +
- B.S. in Engineering with a major in Computer Engineering*, offered jointly with the Electrical and Computer Engineering Department

** Accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.*
+ Accredited by the Computing Accreditation Commission of ABET, http://www.abet.org

As part of the Bachelor's Degrees in Computer Science and Engineering and Computer Science, students complete a concentration in one of the following areas: Theory and Algorithms, Systems and Networks, Cybersecurity, Bioinformatics, Software Design and Development, Computational Data Analytics, Unspecialized or Individually Designed.

GRADUATE DEGREES

Our graduate program is a flourishing international community of scholars, consisting of faculty and students from around the world. Graduate degrees prepare students for advanced work or research careers in academia or industry.

AT THE GRADUATE LEVEL WE OFFER:

- Master of Science in Computer Science and Engineering, with both course and thesis options. The course-based program is intended as either a terminal degree which prepares students for advanced work in industry, or as preparation for Ph.D. studies. The thesis-based program is specifically intended to prepare students for research and Ph.D. studies.
- Doctor of Philosophy in Computer Science and Engineering. The Ph.D. degree prepares students for a career in research, either in industry or academia.

Our graduate students are routinely supported by fellowships, research assistantships, or teaching assistantships. Our graduates are in constant demand, both by academia and industry.

The Information Technologies Engineering (ITE) Building

is home to the Computer Science & Engineering and Electrical & Computer Engineering departments. This 110,000 square foot high-tech gem houses a 350-seat auditorium, classrooms, an extensive learning center, specialty training facilities and some of the most innovative research labs in the country for advancing cutting-edge engineering technology. CSE research labs located in the ITE building cover a broad spectrum of research activities. This includes Artificial Intelligence, Bioinformatics, Big Data, Computer Systems, Cyber-Security, Distributed Computing, Machine Learning, Software Engineering, Theoretical Foundations, and Voting Technology.

ADJUNCT FACULTY

TERRY G. GLAGOWSKI
Adjunct Faculty
Ph.D., University of Connecticut, 1984
glagowski@engr.uconn.edu

- Software Methodology
- Software Tools
- Embedded Systems

DINA GOLDIN
Associate Professor in-Residence
Ph.D., Brown University, 1996
dina.goldin@uconn.edu

- Efficient Querying of Non-Traditional Data
- Models of Interactive Computation
- Software Architecture for Online and Sensor-based Systems

GREGORY JOHNSON, JR.
Visiting Instructor
M.S., University of Connecticut, 2003
greg.johnson@uconn.edu

- Constraint Programming
- Discrete Optimization
- Computer Security

Alexander A. Schwarzmann
Department Head

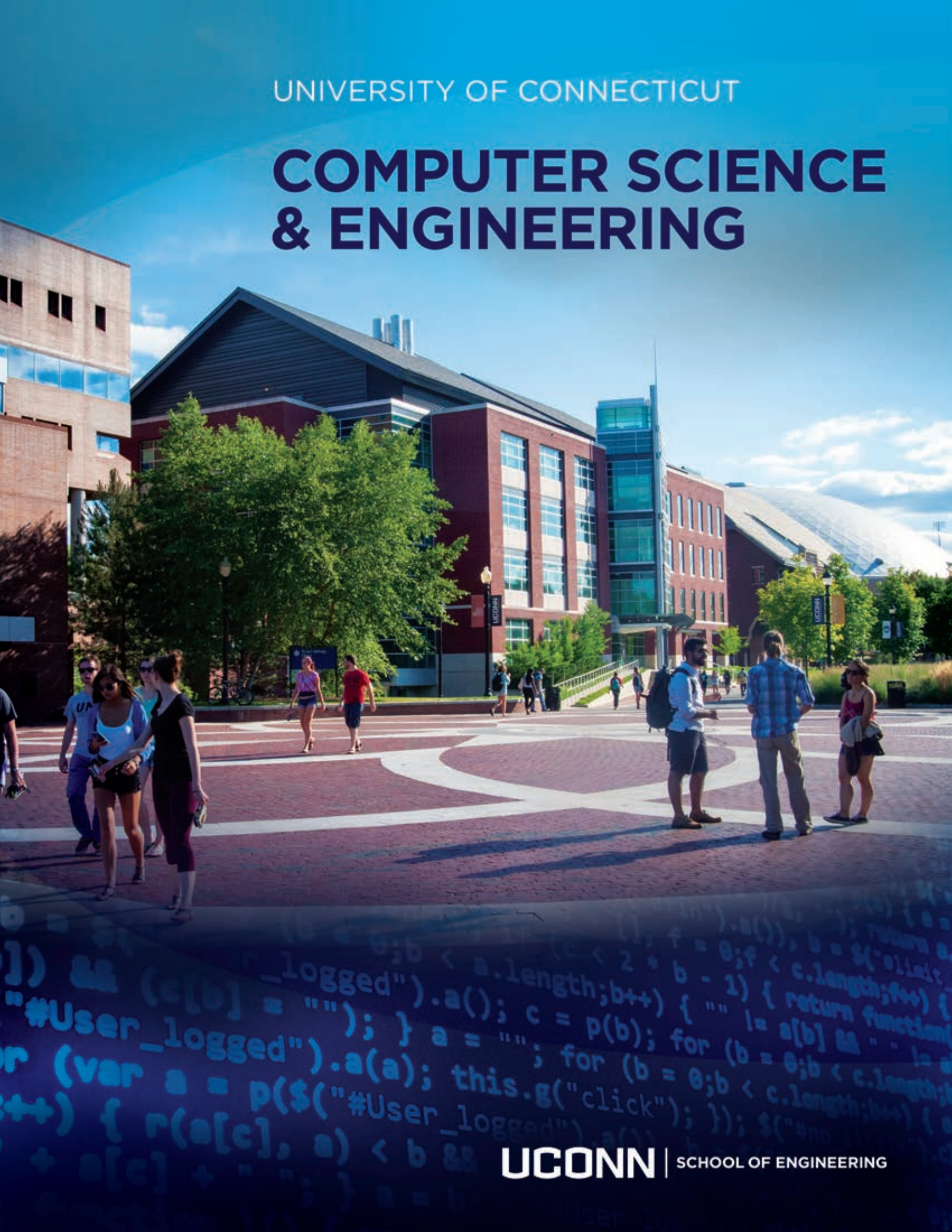
Laurent Michel
Associate Department Head

Computer Science & Engineering
University of Connecticut
371 Fairfield Way, Unit 4155
Storrs, CT 06269-4155
Phone: (860) 486-3719
Email: engr-csoffice@uconn.edu

UCONN
SCHOOL OF ENGINEERING
COMPUTER SCIENCE & ENGINEERING

UNIVERSITY OF CONNECTICUT

COMPUTER SCIENCE & ENGINEERING



UCONN | SCHOOL OF ENGINEERING

A NOTE FROM THE DEPARTMENT HEAD

The Department of Computer Science & Engineering (CSE) recently celebrated the 30th anniversary of our establishment as an academic department at the University of Connecticut. Yet the history of computer science at the University actually begins over half a century ago with the introduction of our first computing courses in the 1960's. The first defense of a Ph.D. in Computer Science was held in 1967. The Computer Science curriculum was established in 1970, and the program was accredited in 1972 among the very first undergraduate programs in the field of Computer Science. As we enter our next epoch, Computer Science & Engineering encompasses broad areas of intellectual discourse in informatics spanning a plethora of educational and research activities ranging from the very foundations of computability to the challenges of building dependable and secure computer and cyber-physical systems that underlie much of the modern society endeavors. The department is ever-growing; our undergraduate enrollment has doubled in the last four years and the number of doctoral students exceeds one hundred for the first time. Our faculty now includes more than thirty full-time members for the first time in our history. Since the start of the millennium, the department has experienced significant qualitative evolution, complementing our rigorous educational curricula with comprehensive research programs in several areas. Our department has excellent and diverse faculty with research and education expertise in the traditional and emerging fields of computer science and engineering. We continue to attract talented young faculty, with eleven of our faculty winning the prestigious National Science Foundation Career Awards since the turn of the century. Our presence remains strong in the community as we fulfill our mission of research, education, industrial and public outreach, and service to the profession. I invite you to browse our website at www.cse.uconn.edu where you will find detailed information on our academic programs at the undergraduate and graduate levels, research and teaching profiles of our faculty, and student societies. I am confident you will find a topic that sparks your interest. As you get to know us better do not hesitate to contact us. We will be happy to answer your questions.

Sincerely,
Alexander A. Schwarzmann
Department Head

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

UCONN
SCHOOL OF ENGINEERING

COMPUTER SCIENCE & ENGINEERING

Alexander A. Schwarzmann
Department Head

Laurent Michel
Associate Department Head

Robert McCartney
Director of Undergraduate Computing Education

Alexander C. Russell
Director of the Graduate Program

Joy Billion
Lara Chiaverini
Josh Garvey
Writers

Christopher LaRosa
Design

This brochure is published for the alumni, faculty, students, corporate supporters and friends of the Department of Computer Science & Engineering at the University of Connecticut. Suggestions and information are always welcome. Please send correspondence and address corrections to the address below or email aas@engr.uconn.edu.

Computer Science & Engineering
University of Connecticut
371 Fairfield Way, Unit 4155
Storrs, CT 06269-4155
P: (860) 486-3719
F: (860) 486-4817

FEATURES

ABOUT US

THE INFORMATION TECHNOLOGIES ENGINEERING (ITE) BUILDING is home to the Computer Science & Engineering and Electrical & Computer Engineering departments. ITE houses an extensive learning center, specialty training facilities and some of the most innovative research labs in the country for advancing cutting-edge engineering technology.

This 110,000 sq. ft. high-tech gem is situated between the Homer Babbidge Library and School of Business building at central campus. The concourse level holds teaching labs, along with a 350-seat auditorium. Classrooms and a large computing learning center are found on the ground-level first floor. Administrative offices, faculty offices and research labs of the Computer Science & Engineering Department occupy the second floor. Similarly, the fourth floor is occupied by the Electrical & Computer Engineering Department. The intervening third floor boasts an executive conference room, research labs, spillover faculty offices and a faculty lounge.

CSE research labs located in the ITE building cover a broad spectrum of research activities. This includes Artificial Intelligence, Bioinformatics, Distributed Computing, Computer Systems, Security, Software Engineering, Theoretical Foundations and Voting Technology.

THE COMPUTER SCIENCE & ENGINEERING DEPARTMENT

has a long tradition of being at the forefront of computing education at the University of Connecticut. During the 1960's, computer science emerged as an increasingly vibrant and important area within the Electrical Engineering Department. The computer science curriculum was established in 1970, culminating the efforts of many faculty members led by Dr. Taylor L. Booth (1933-1986), a renowned pioneer in computer science education who is rightly considered to be the founder of our department. In 1972, the Accrediting Board for Engineering and Technology (ABET) reviewed UConn's program and designated it as one of the very first accredited programs in the field of Computer Science. In the early 1980's, the major was renamed Computer Science and Engineering. Growth in the number of Computer Science and Engineering majors and faculty, and the success of our educational and research programs, led to the establishment of a separate Computer Science & Engineering Department in the School of Engineering in 1986. This made 2016 an important anniversary for CSE, as the Department celebrated its 30th anniversary and the larger School of Engineering celebrated its centennial anniversary.

The CSE program was the second program to receive dual accreditation from the Engineering Accreditation Commission (EAC) of ABET and Computer Science Accreditation Commission (CSAC) of the Computer Science Accrediting Board (CSAB) in 1993. Two undergraduate programs were added in 1999, a B.S. with a major in Computer Science and a B.S. in Engineering with a major in Computer Engineering. The B.S. with major in Computer Science was accredited by the Computing Accreditation Commission of ABET in 2000, the B.S. in Engineering with a major in Computer Engineering was accredited by the EAC of ABET in 2006. Since the merger of CSAB and ABET in the early 2000's, the CSE degree has been jointly accredited by the Engineering and Computing Accreditation Commissions of ABET.

CSE continues to grow and establish itself with national and international visibility in education and research. During the 21st century, we have seen continued success with a number of National Science Foundation Early Career Development (CAREER) Awards for CSE faculty, and collaborations with government and industry partners in a variety of laboratories and centers. Along with successful faculty research and partnerships, the department attracts a strong interest from incoming students looking to pursue computer science and engineering careers.

OUR PROGRAMS

UNDERGRADUATE DEGREE

Our undergraduate program provides a breadth of instruction in computer science and engineering, while allowing the students to gain a depth of knowledge in particular technical areas of interest. The curriculum provides sufficient work in mathematics, science, and engineering allowing students to design solutions to a wide variety of problems. Coursework in the humanities and social sciences are an integral part of the engineering program to make students aware of their social responsibility and to consider non-technical factors in the practice of engineering.

AT THE UNDERGRADUATE LEVEL WE OFFER:

- B.S. in Engineering with a major in Computer Science and Engineering *+
- B.S. with a major in Computer Science +
- B.S. in Engineering with a major in Computer Engineering *, offered jointly with the Electrical and Computer Engineering Department

  * Accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.
  + Accredited by the Computing Accreditation Commission of ABET, http://www.abet.org

As part of the Bachelor's Degrees in Computer Science and Engineering and Computer Science, students complete a concentration in one of the following areas: Theory and Algorithms, Systems and Networks, Cybersecurity, Bioinformatics, Software Design and Development, Computational Data Analytics, Unspecialized or Individually Designed.

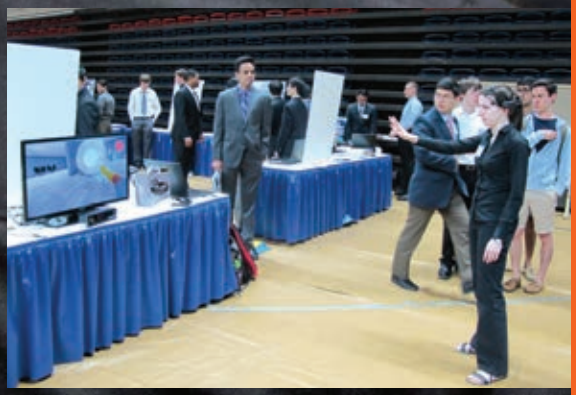
GRADUATE DEGREES

Our graduate program is a flourishing international community of scholars, consisting of faculty and students from around the world. Graduate degrees prepare students for advanced work or research careers in academia or industry.

AT THE GRADUATE LEVEL WE OFFER:

- Master of Science in Computer Science and Engineering, with both course and thesis options. The course-based program is intended as either a terminal degree which prepares students for advanced work in industry, or as preparation for Ph.D. studies. The thesis-based program is specifically intended to prepare students for research and Ph.D. studies.
- Doctor of Philosophy in Computer Science and Engineering. The Ph.D. degree prepares students for a career in research, either in industry or academia.

Our graduate students are routinely supported by fellowships, research assistantships, or teaching assistantships. Our graduates are in constant demand, both by academia and industry.



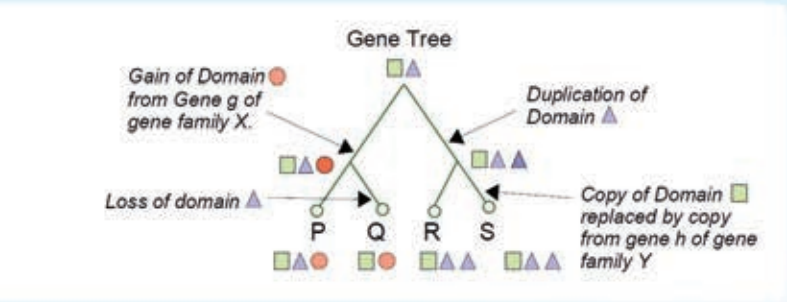
Photos: Ashley Dumaine demonstrates a mind-controlled project with an EEG headset during Senior Design Demonstration Day. *Read more about Ashley on page 15.*

Bansal Honored with NSF CAREER Award

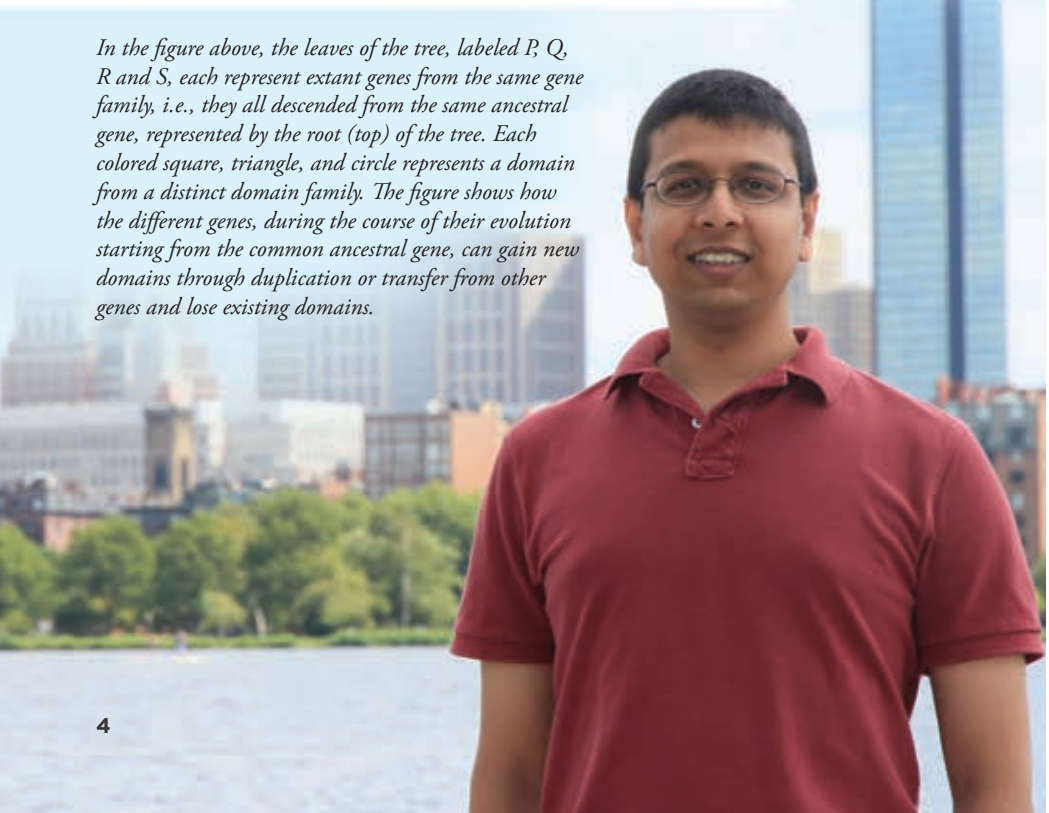
Assistant Professor **Mukul Bansal's** research interests are in computational biology and bioinformatics, with a focus on computational molecular evolution. He specializes in the development of sophisticated computational methods, efficient algorithms, and powerful software tools that can make use of large genomic datasets to understand the evolution of genes, genomes and species. Evolution is fundamental to our modern understanding of biology and an improved understanding of evolution is crucial for deciphering how genes and genomes function.

The Computational Biology research lab led by Dr. Bansal, is currently engaging in the development of new computational algorithms for inferring the evolution of microbial genomes and gene families to understand how microbes evolve and adapt. This research has important implications for downstream comparative and functional genomic analyses of microbes.

Dr. Bansal was recently awarded the prestigious NSF CAREER award for research on protein domains. Protein domains are well-characterized functional constituents of genes that can be independently lost or gained during evolution. Domain shuffling is one of the primary mechanisms through which genes evolve and gain new functions. Proper inference and accounting of domain-level evolutionary events is crucial to understanding how genes evolve and function, but existing approaches for studying gene evolution ignore domain-level events. The newly funded research will form the methodological and algorithmic foundations for a novel computational framework that will address this critical problem and benefit almost all areas of biology.



In the figure above, the leaves of the tree, labeled P, Q, R and S, each represent extant genes from the same gene family, i.e., they all descended from the same ancestral gene, represented by the root (top) of the tree. Each colored square, triangle, and circle represents a domain from a distinct domain family. The figure shows how the different genes, during the course of their evolution starting from the common ancestral gene, can gain new domains through duplication or transfer from other genes and lose existing domains.



ALUMNI UPDATE

Brittany Nkounkou

Brittany Nkounkou, B.S.E. in Computer Science and Engineering, graduated from UConn in 2012, Summa Cum Laude with honors. A Day of Pride Scholar, Brittany was also named a Babbidge Scholar, awarded the School of Engineering (SoE) Outstanding Senior Women Academic Achievement Award, and was recognized by the Connecticut General Assembly for her scholarship.

MY LIFE AS AN UNDERGRADUATE ENGINEERING STUDENT AT UCONN WAS GENUINELY GREAT.

Brittany is now pursuing a Ph.D. in Computer Science from Cornell University, concentrating on Programming Languages and minoring in Electrical Engineering.

During Brittany's years at UConn, she participated in the SoE BRIDGE program, tutored at the Undergraduate Tutoring Center, graded coursework for the CSE Department and published research through the Bio-Grid Research Experience for Undergraduates program. She also played flag football and volleyball intramural sports.

"My life as an undergraduate engineering student at UConn was genuinely great. I grew so much as an individual, both academically and beyond, and had a lot of fun along the way. While the list goes on, my most meaningful experiences include long nights at the tutoring center helping students with homework, traveling to Hong Kong to present a research paper I helped publish, and obtaining a paid summer internship directly related to my major. I enjoyed study breaks on Horsebarn Hill, delicious Dairy Bar ice cream, karaoke at the Student Union every Friday night, and going snowboarding for the first time at a great rate. All of this was made possible by UConn. Students Today, Huskies Forever!"

DNA SEQUENCING TECHNOLOGY

Recent advances in genomics research have been heralding the arrival of personalized medicine. The cost for DNA sequencing technology will soon be affordable enough for hospitals and clinics to use patient's genomic information to diagnose diseases and tailor treatment options for individual patients. Applying the sequencing technology for human health is a transformative information science.

There is one clear challenge facing the technology's future advancement; how to analyze and interpret the massive amount of data contained within our genomes, each with 3 billion base units of DNA. Unless the data is properly organized, digested and presented in a manner that becomes clear to health care providers, insurance companies and the general public, the anticipated sweeping changes may not occur.

Dr. Dong-Guk Shin's research focuses on multiple aspects of solving this genomics big data problem. The research includes how to identify structural variations within an individual's whole genome sequences, how to interpret gene expression patterns obtainable from the patient's RNA Sequencing data, and how to help scientists and practitioners conveniently use the digested information with user-friendly software.

Dr. Shin had an opportunity to spend a one year sabbatical leave during 2015 at JAX Genomic Medicine (JAX GM) in Farmington, Connecticut, working with the internationally renowned human geneticist Dr. Charles Lee. One of Dr. Shin's accomplishments during his sabbatical leave included developing an automated structural variation discovery pipeline, called fusorSV, and a visual pathway analysis system, called TOPAS. The former systematically combines decisions from multiple structural variations, calling methods into a cohesive set of structural variation calls, exploiting the strengths of each caller. The latter is a biological pathway visualization system which enables genome scientists to analyze newly acquired experimental data against gene regulatory data, curated and organized into a topology of interacting gene/protein networks.

A future direction of Dr. Shin's research is studying how the functionalities of the two systems, fusorSV and TOPAS, can be combined so that scientists and practitioners can examine genomics-based human health monitoring in a speedy and seamless manner.

Dr. Espy Anguiano explains the capabilities of the PAC Bio Sequencing Machine operating at JAX Genomic Medicine, which is known as one of the most powerful commercially available DNA sequencers to Dr. Shin.

STUDENT GROUPS

Association for Computing Machinery

The UConn Association for Computing Machinery (ACM) chapter provides a voice for student concerns about computer-related issues and a venue for educational enrichment. While membership primarily consists of students who will go on to be computer science professionals after graduation, membership is open to anyone with an interest in computer science. The chapter organizes and promotes group activities, such as visits to computer-related businesses, conferences and museums. These activities are intended not only to further the groups knowledge of computer systems, but also to help build a cohesive community of computing enthusiasts. Additionally, the group periodically invites guest speakers to host presentations at UConn for collective enrichment. Members are encouraged to attend these presentations along with others in the University community.

The chapter, which was founded in 2008, has hosted robotics challenges in which students spend a semester collaborating to design, build and program a robot to complete a specific task. The challenges for these competitions have included a maze for a robot to run and the creation of a remote-controlled boat. Chapter students also participate in annual hackathons organized in concert with Cigna as well as the annual ACM Collegiate Programming Contest, a multi-tiered, team-based competitive programming competition involving students from thousands of universities around the world.

Above: Participants at the 2013 World Finals of the ACM Collegiate Programming Contest prepare for the competition which was held in the Main Arena of Yubileyny Sports Palace in St. Petersburg, Russia. UConn was one of only 120 teams selected from 2,322 universities worldwide to participate in the World Finals.

At left: Robotics Challenge Team members are testing their robotics and listening to the rules of the competition.

CSE External Advisory Board

The Computer Science & Engineering External Advisory Board (EAB) consists of leaders from industry, government and academia. The board provides input about how the department can grow, improve, and refine its educational programs. The board members also serve as a link between the department and their organizations to help stimulate interactions and collaboration. The board periodically meets with the department head and the faculty to be updated on the activities of the department and to provide counsel to the faculty. The CSE EAB consists of the following members:

SCOTT BEECHER (Chairman) Software Engineering Fellow, Pratt & Whitney, East Hartford, CT

GREGORY ANGELINI Director/Combat Weapons Systems, General Dynamics Electric Boat, Groton, CT

DAVID BARRINGTON Professor, University of Massachusetts, Amherst, MA

MICHAEL BENAVIDES Executive Director, JPMorgan Chase & Co., New York, NY

MICHAEL BENDER Professor, Stonybrook University, Stonybrook, NY

SORIN ISTRAIL Julie Nguyen Brown Professor of Computational and Mathematical Sciences, Professor of Computer Science, Brown University, Providence, RI

KIRK JORDAN IBM Distinguished Engineer, Chief Science Officer IBM Research UK, Computational Science Center, IBM Thomas J. Watson Research Center, Cambridge, MA

RICHARD NAROWSKI President, R.E. Narowski and Associates, LLC, North Canton, CT

ROBERT MADONNA President, RacePoint Energy, LLC, Osterville, MA

SALLY MAHONEY Manager Service Systems Engineering, Otis Elevator Company, Farmington, CT

DEAN MYSHRALL Director of Data Services, DAS/BEST, State of Connecticut

RICHARD TEHRANI CEO and Group Editor in Chief, TMCnet, Norwalk, CT

PEYMAN ZAMANI Founder and CEO, Logicbroker, Inc., Shelton, CT

UNDERSTANDING ADDICTION

A GENETIC APPROACH TO CLINICAL SYMPTOMS

When it comes to diagnosing substance abuse, health care professionals are mainly limited to relying on patient honesty. But a new study aims to find the genetic causes of addiction, which could lead to a more nuanced way of treating complex medical and social problems.

The study, led by **Jinbo Bi,** Associate Professor of Computer Science & Engineering, recently received a $1.12 million grant from the National Institutes of Health (NIH). Dr. Bi and her fellow researchers aim to develop new statistical tools and techniques to better classify the many variations of substance dependence. The hope is that a better understanding of the role genes play in these disorders will lead to more effective treatment.

Researchers have made great progress in using genetic information to diagnose and treat other diseases in patients. Genome sequencing, for instance, is leading to customized treatment for certain cancers. Substance addiction, with its multiple causes, has been a dilemma for genetics researchers. Currently doctors rely on the symptoms listed in the Diagnostic and Statistical Manual (DSM) of Mental Disorders. The current edition provides several criteria, based mostly on behavior. Examples include whether a patient worries about stopping, or spends a lot of time trying to obtain drugs or alcohol.

While previous studies have looked at the genes associated with the diagnoses of substance abuse, Dr. Bi's study will take a more specific approach by looking at the genes associated with the clinical symptoms that lead to abuse.

For instance, two people diagnosed with alcohol dependence can have different symptoms. Perhaps only one has trouble sleeping, or one cites a diminished social life, while the other goes to so many parties that it is affecting their work. Dr. Bi says the study will look at whether genetic variances can account for these differences.

To integrate multiple clinical symptoms with multiple genetic variants, however, requires more sophisticated algorithms than what researchers have now. Developing new ones is the first task in the four-year study. The study will make use of a database of more than 11,000 subjects who were identically assessed in genetic studies of cocaine, opioid and alcohol dependence. It is the largest sample of its kind.

With such a robust sample, the researchers expect to put a much finer point on diagnosing different addictions. For instance, the criteria provided in the DSM does not discern between different types of cocaine dependence. Preliminary studies by Bi's team show that a variant in what is known as the CLOCK gene could be the difference between addicts who inject the drug and those who consume it in other ways. The more that is known about which genes are associated with specific subtypes of drug dependence, the closer it brings researchers to developing more effective treatments. The fact that the CLOCK gene regulates our circadian rhythms, for instance, could be significant.

"Maybe then we can design something to control the circadian rhythm," Bi says. "If we know a specific property of a particular sub-population of the patients, then we can design something to target it."

Dr. Bi's collaborators include Victor Hesselbrock of UConn Health, Henry R. Kranzler of the University of Pennsylvania, and Joel Gelernter of Yale University.

ALUMNUS SCOTT CASE INSPIRES GRADUATES

Timothy "Scott" Case, an alumnus and Connecticut native, is an innovative entrepreneur, humanitarian and technology pioneer.

Scott graduated from UConn with a bachelor's degree in Computer Science and Engineering in 1992. It was here where his entrepreneurial days began. As a senior, Scott co-founded Precision Training Software, which launched the world's first PC-based simulated flight instructor and photo-realistic flight simulator.

In 1996, he became the founding CTO of Priceline, popularly known as the "Name Your Own Price" company. It was one of only a handful of startups in U.S. history to reach a billion dollars in annual sales in less than 24 months. As Chief Technology Officer, Scott was responsible for building the technology that drove Priceline's incredibly fast growth as a business.

In 2006, he joined the Malaria No More team to inspire individuals and institutions to end deaths caused by malaria. The nonprofit organization has distributed malaria nets—the surest way to prevent malaria—to more than 5 million people in 17 African countries. It has also launched a campaign to deploy rapid diagnostic tests and artemisinin-based combination treatments to reduce malaria deaths in children.

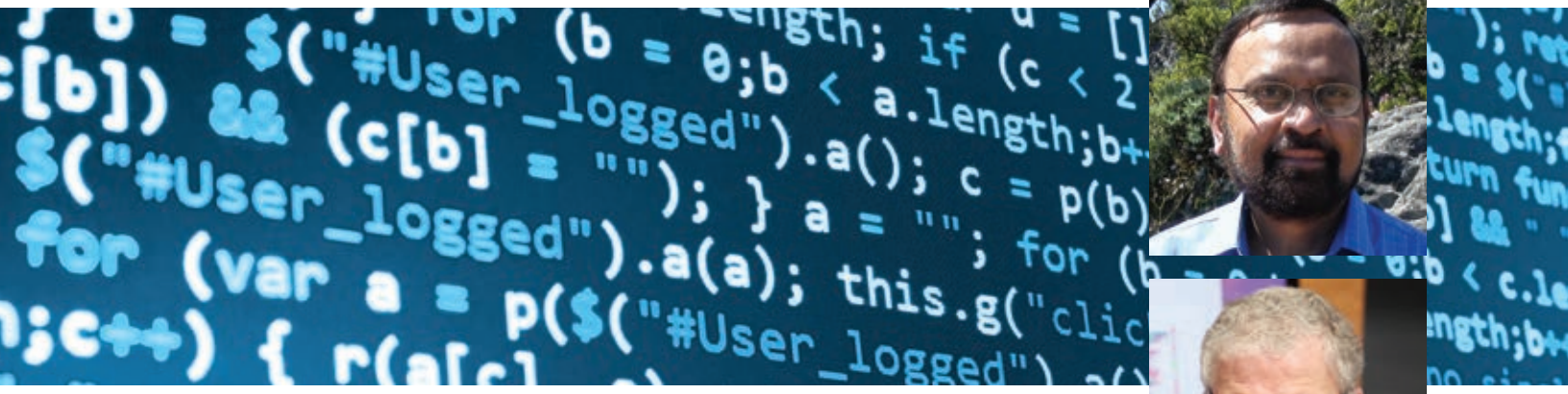
In 2011, Scott was named founding CEO of the Startup America Partnership, an independent alliance of entrepreneurs, corporations, universities, foundations, and other leaders who work together to fuel innovative, high-growth U.S. startups. It now operates as Up Global, where Scott invests his energy to support high-growth startup communities in the U.S. and around the world. Celebrating entrepreneurship as a core American value, the organization gives startup companies access to valuable relationships, opportunities and information.

In 2013, Scott co-founded Main Street Genome, a startup focused on developing a software representation of the entire Main Street Economy. It is a first-of-its-kind simulation of the 'main street' economy, designed to provide insight on how owners and their businesses truly function.

Most recently, Scott rejoined Priceline founder Jay Walker to create a new travel site to transform the way people buy business travel called Upside, where Scott serves as President and Chief Operating Officer.

Scott also serves as the Chairman of Network for Good, a national nonprofit that has distributed more than $475 million to 60,000 nonprofits and provides online fundraising and communications services to over 5,000 nonprofit organizations.

The University's honorary degrees are bestowed in "recognition of extraordinary and lasting distinction," representing the "highest intellectual and moral values." Scott embodies these qualities in a way that few do, having spent his career proving that entrepreneurship—combined with working for social good—can be a powerful force to improve our world. He can motivate, inspire and challenge the students and is a model for the entire UConn community.



Making Sense of Big Data

PROJECT TO DRAW INSIGHTS FROM GENOME

Advances in technology have allowed researchers to produce a huge amount of data in a short amount of time. Making any meaningful sense of this information in a timely manner is the next step in "big data."

With a $1.2 million NSF grant, **Sanguthevar Rajasekaran,** Director of the Booth Engineering Center for Advanced Technologies, and a team of researchers will devise new algorithms that can efficiently make use of an almost inconceivably large set of information. It is the first NSF-funded grant for a big data research project in the state. "People end up generating so much data, and it's a big challenge to process the humongous data sets," said Dr. Rajasekaran, who will work on the project with researchers from the University of Florida and the Jackson Laboratory for Genomic Medicine on the UConn Health campus in Farmington, CT. The team includes Reda Ammar, Jinbo Bi, Joerg Graf (MCB), Sartaj Sahni (University of Florida), George Weinstock (JAX), and Yufeng Wu.

RESEARCHERS CAN GENERATE TERABYTES OF DATA ON A DAILY BASIS, BUT THE ALGORITHMS THEY CURRENTLY HAVE TO PROCESS THIS DATA CAN'T KEEP UP.

According to Dr. Rajasekaran, "In biology, researchers can generate terabytes of data on a daily basis, but the algorithms they currently have to process this data cannot keep up. The algorithms take up too much space, as well as too much time. If we want to advance science, we have to have that information quickly. If a dataset is too large to fit onto the core memory of a computer, it must be placed in a secondary storage location, such as a disc or a solid state drive. That greatly increases the time it takes to gain access to the data."

Dr. Rajasekaran said his project is to develop more efficient algorithms to process these data sets by developing out-of-core algorithms as well as parallel algorithms. Out-of-core algorithms process data too large for a computer's main memory and are designed to efficiently retrieve information stored in hard drives or tape drives. Work has been done in this area, but very little has been done in regard to biological big data. "Not many people are doing the parallel algorithms and even fewer are doing the out-of-core ones," he said.

The project will also include the work of **George Weinstock,** Associate Director for Microbial Genomics at the Jackson Laboratory, who will supply Dr. Rajasekaran with datasets from their research to test the algorithms.

"It's now possible to produce amazing amounts of data," Dr. Weinstock said. "But the data does not do you any good unless you can manage it very efficiently and extract actual results from it. This is one of the very large and unmet needs right now in research."

Dr. Weinstock's work on the genome of the African green monkey will figure into the project. "We are very interested in what quantitative traits we can find—those are things like height, blood pressure, or more complex things like the concentration of neurotransmitters in blood," he said. "To figure out what the genes are that might have different mutations in them in high blood pressure, or height, or bad behavior, you have to do a genetic analysis of the entire genome in many subjects—sometimes thousands of them. For example, some place in the genome there are particular variants in the genomic sequence that only tall people have."

Rooting out that particular variant, though, means finding an extremely small deviation in a mountain of data—a single DNA letter difference among 6 billion. It's possible to do that today, but it can take weeks or months. Getting that time down to a day or two would make a huge difference. It would not just make researchers' lives easier—it could revolutionize science and medicine.

"The Holy Grail in all this is to apply it clinically in medicine," Dr. Weinstock said. "When you go to the doctor now you get the results of a blood test back in a day or so. Having the technology to analyze a genomic sequence at the same time could greatly advance treatment for cancer and personalized medicine. If you could do those genetic computations in just days, now it becomes a clinical tool that helps in medical care, and that would be huge."

As Dr. Rajasekaran envisions it, the results will have a far-reaching impact. The algorithms will be disseminated widely as a software library, and incorporated in undergraduate and graduate courses.

Photos from top: Sanguthevar Rajasekaran and George Weinstock.

COMPUTER SCIENCE
& ENGINEERING

Faculty Profiles

REDA A. AMMAR
Professor and Director of Engineering Global Programs
Ph.D., University of Connecticut, 1983
reda@engr.uconn.edu

- Performance Engineering
- Underwater Computer Systems
- Big Data Analytics
- Real-time Distributed Systems

MUKUL S. BANSAL
Assistant Professor
Ph.D., Iowa State University, 2009
mukul@engr.uconn.edu

- Computational Biology and Bioinformatics
- Computational Molecular Evolution
- Combinatorial Optimization
- Algorithms

KEITH BARKER
Professor
University Teaching Fellow
Ph.D., Sheffield University, 1966
keith.barker@uconn.edu

- Computer Science Education
- Curriculum and Technology Development
- Instructional Design

JINBO BI
Associate Professor
Ph.D., Rensselaer Polytechnic Institute, 2003
jinbo@engr.uconn.edu

- Machine Learning
- Statistical Data Mining
- Convex Optimization
- Biomedical Informatics

PHILLIP BRADFORD
Associate Professor in Residence
Director of Computer Science,
Stamford Regional Campus
Ph.D., Indiana University, 1995
phillip.bradford@uconn.edu

- Applied Algorithms, Optimization and Machine Learning
- Security, Programming Languages, Data Analytics
- Computational Finance, Auctions, Bitcoin/Blockchain

JUN-HONG "JUNE" CUI
Professor
Ph.D., University of California, Los Angeles, 2003
jcui@engr.uconn.edu

- Computer Networks
- Embedded and Cyber-Physical Systems
- Underwater Networks and Smart Ocean Technology

STEVEN DEMURJIAN
Professor
Ph.D., The Ohio State University, 1987
steve@engr.uconn.edu

- Access Control for Secure Software
- Biomedical Informatics
- Ontology Design

PARASARA SRIDHAR DUGGIRALA
Assistant Professor
Ph.D., University of Illinois,
Urbana-Champaign, 2015
psd@engr.uconn.edu

- Verification of Cyber-Physical Systems
- Formal Methods and Verification
- Control Theory
- Software Verification

BENJAMIN FULLER
Assistant Professor
Ph.D., Boston University, 2015
benjamin.fuller@uconn.edu

- Cryptography
- Security
- Information-Theory
- Complexity

SWAPNA S. GOKHALE
Associate Professor
Ph.D., Duke University, 1998
ssg@engr.uconn.edu

- Social Media
- Software Engineering
- Performance and Dependability Analysis

SONG HAN
Assistant Professor
Ph.D., University of Texas, Austin, 2012
song@engr.uconn.edu

- Cyber-Physical Systems
- Real-Time and Embedded Systems
- Large-Scale Real-Time Data Management
- Wireless Networks and Mobile Computing

CHUN-HSI HUANG
Associate Professor
Ph.D., State University of New York
at Buffalo, 2001
huang@engr.uconn.edu

- Graph Algorithms
- Parallel Computing
- Cluster/Grid Computing
- Bioinformatics

MOHAMMAD MAIFI HASAN KHAN
Assistant Professor
Ph.D., University of Illinois,
Urbana-Champaign, 2011
maifi.khan@engr.uconn.edu

- Performance Analysis of Large Scale Systems
- Design of Dynamic Data Driven Application Systems
- Human-Machine Interaction

ION MANDOIU
Associate Professor
Ph.D., Georgia Institute of Technology, 2000
ion@engr.uconn.edu

- Approximation Algorithms
- Combinatorial Optimization
- Bioinformatics
- Computational Genomics

ROBERT MCCARTNEY
Associate Professor and Director of Undergraduate Computing Education
Ph.D., Brown University, 1988
robert@engr.uconn.edu

- Computing Education
- Informal and Self-directed Learning
- Commonsense Computing
- Artificial Intelligence

JEFFREY A. MEUNIER
Lecturer and Associate Director of Undergraduate Computing Education
M.S., University of Connecticut, 1999
jeffm@cse.uconn.edu

- Computer Science Education
- Microcontrollers, Automation, Robotics
- Programming Languages and Abstract Machines

LAURENT MICHEL
Associate Professor and Associate Department Head
Ph.D., Brown University, 1999
ldm@engr.uconn.edu

- Combinatorial Optimization
- Constraint Programming/Local Search
- Security/Voting
- Programming Languages
- Artificial Intelligence

SHEIDA NABAVI
Assistant Professor
Ph.D., Carnegie Mellon University, 2008
nabavi@engr.uconn.edu

- Statistical Machine Learning
- Computational Genomics
- Signal/Image Processing
- Translational Bioinformatics

TOM PETERS
Professor
Ph.D., Wesleyan University, 1982
tpeters@engr.uconn.edu

- Computational Topology
- Computer Aided Geometric Design
- Computational Geometry
- Design Theory

SANGUTHEVAR RAJASEKARAN
The UTC Chair Professor, BECAT Director
Ph.D., Harvard University, 1988
rajasek@engr.uconn.edu

- Applied Algorithms
- Bioinformatics and Computational Biology
- Big Data Analytics
- High Performance and Parallel Computing

ALEXANDER C. RUSSELL
Professor and Director of the Graduate Program
Ph.D., Massachusetts Institute of Technology, 1996
acr@cse.uconn.edu

- Computational Complexity
- Cryptography
- Distributed Computing

DONALD SHEEHY
Assistant Professor
Ph.D., Carnegie Mellon University, 2011
donald@engr.uconn.edu

- Computational Geometry
- Mesh Generation
- Topological Data Analysis

ZHIJIE "JERRY" SHI
Associate Professor
Ph.D., Princeton University, 2004
zshi@engr.uconn.edu

- Computer Security
- Sensor Networks
- Computer Architecture
- Embedded Systems

DONG-GUK SHIN
Professor
Ph.D., University of Michigan, 1985
shin@engr.uconn.edu

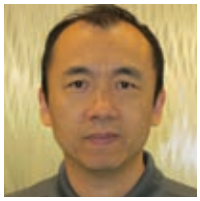
- Bioinformatics
- Visual User Interfaces
- Intelligent Software Agents
- Semantic Data Modeling
- Scientific Databases
- Database Interoperation

ALEXANDER A. SCHWARZMANN
Professor and Department Head
Ph.D., Brown University, 1992
aas@cse.uconn.edu

- Distributed Computing and Fault Tolerance
- Electronic Voting Systems and Security
- Parallel and Distributed Algorithms
- Formal Specification and Modeling

BING WANG
Associate Professor
Ph.D., University of Massachusetts, 2005
bing@engr.uconn.edu

- Computer Networks
- Multimedia
- Distributed Systems



YUFENG WU
Associate Professor
Ph.D., University of California, Davis, 2007
ywu@engr.uconn.edu

- Computational Biology
- Bioinformatics
- Algorithms

ACADEMIC ADVISING

Dana Ziter

Dana holds a Bachelor's degree in Business Administration from Mount Ida College and a Master's degree in Higher Education Administration from Bay Path University. She is currently working on an Ed.D. in Educational Leadership here at UConn. Dana has been with the School of Engineering since 2014, previously as the Fiscal Officer and Student Employee Manager for Engineering Technical Services. Prior to her employment at UConn, she was at the University of Saint Joseph in the School of Education as a Program Assistant. Her main duties were assisting with accreditation preparation, course scheduling, and preliminary advisement of incoming graduate students.

In her current role as Academic Advisor for the Computer Science & Engineering Department, she advises students in planning an academic program, course registration, changing majors, creating planned programs of study, managing academic difficulties, new student orientation and other student academic related matters. Additionally, Dana teaches a First Year Experience course and assists with the coordination and execution of events for the Engineering Learning Community.

On the weekends and during off time, Dana enjoys caring for and riding her rescued Standardbred horse named Hot Rod.

Photo courtesy of Keystone Photography

Lecturers & In-Residence Faculty

UCONN SCHOOL OF ENGINEERING
COMPUTER SCIENCE & ENGINEERING

TERRY G. GLAGOWSKI

Adjunct Faculty
Ph.D., University of Connecticut, 1984
glagowski@engr.uconn.edu

- Software Methodology
- Software Tools
- Embedded Systems

DINA GOLDIN

Associate Professor in Residence
Ph.D., Brown University, 1996
dina.goldin@uconn.edu

- Efficient Querying of Non-Traditional Data
- Models of Interactive Computation
- Software Architecture for Online and Sensor-based Systems

GREGORY JOHNSON, JR.

Visiting Instructor
M.S., University of Connecticut, 2003
greg.johnson@uconn.edu

- Constraint Programming
- Discrete Optimization
- Computer Security

WEI WEI

Assistant Professor in Residence
Ph.D., University of Massachusetts, Amherst, 2006
wei.wei@uconn.edu

- Computer Networks
- Social Networks
- Performance Evaluation

Our Mission

The mission of the Department of Computer Science & Engineering is to support both educational and research programs to respond to the pressing computing and information technology needs of society. The department strives to instill excellence in scholarship and educate a diverse group on the theoretical, technical, social and ethical facets of the field. We cultivate diverse and strong research programs with significant impacts on our society, economy and environment. Finally, we serve the state, country and its public and private sectors through active engagement, outreach and direct services.

ALUMNI UPDATE

Carleton Coffrin

Carleton Coffrin, B.S., Computer Science, graduated from UConn in 2006 as a University and Honors Scholar. He was also a speaker at the Honors Medal Ceremony and the recipient of the Victor Gant Scholarship. Carleton received his Ph.D. in Computer Science from Brown University. His research is focused on how computer science can help society build a sustainable future, with a concentration in power network design and operations. He is currently a Staff Scientist at Los Alamos National Laboratory in New Mexico.

According to Carlton, "UConn had an endless pool of opportunities for those who are scholastically inclined. The Honors and University Scholars program really defined my UConn experience and opened up great opportunities for me, including support for a study abroad trip to Russia.

"When I was in high school one of my greatest life mentors gave me some very wise advice, 'A great college experience is less about the course topics and more about the professors who teach them.' Nothing could be more true about my experience at UConn. To this day I still think back to fantastic courses in Discrete Mathematics (Professor Russell), Data Structures and Algorithms (Professor Michel), and Digital Logic (Adjunct Lecturer Mapen). These professors really honed my core CS skills and gave me the foundation I needed to excel.

"The advice I would give to current and incoming students is that there are many scholastic opportunities to explore at UConn. Seize those opportunities, get the most out of a highly valuable university experience, and let your passion guide you. There are few things more inspirational to a professor than a highly motivated and enthusiastic undergraduate student."

COMPUTING COURSES

New Curricular Structure for Computing Majors

In Fall 2016, the Computer Science & Engineering Department introduced the new "core plus concentration" curriculum for students majoring in Computer Science (CS) and Computer Science and Engineering (CSE). The curriculum combines a common core of computing courses with a set of courses chosen from a specific concentration area. This ensures that all students are grounded in the fundamentals of computing while gaining specialized knowledge and experience in a specific area of their choice.

The core consists of courses in software design, discrete mathematics, algorithms and complexity, computer architecture, and systems programming - the fundamentals on which computer science is built. The difference between the CSE and CS program requirements is that in addition to the CS requirements, CSE students must take four additional courses: two in Computing, one in Math, and one in Electrical and Computer Engineering.

Each student also completes a concentration consisting of four courses in a particular area. The currently defined concentration areas are Theory and Algorithms, Systems and Networks, Cybersecurity, Bioinformatics, Software Design and Development and Computational Data Analytics, with additional concentrations to be added over time.

There are two additional options available for students looking to take a different approach to their concentration. The first is an "Unspecialized" concentration that requires students to take a range of courses across the concentration areas, opting for breadth over depth. The second is an Individually Designed concentration, allowing students and their advisors to design a specialized concentration to meet the individual student's interests and plans. As before, each student completes a year-long design project while working on a team.

Our new approach to structuring curricula in computing better serves the diverse interests of the students and the faculty, and allows students to tailor their education to specific career goals.

For more details, consult the **Guide to Course Selection** for the specific degree program, available at the Department's web page under Undergraduate Studies-Major Programs tabs.

CYBER SECURITY UC@NN

In 2015, 288,012 complaints of internet crime resulting in $1,070,711,522 in financial losses were reported to the Internet Crime Complaint Center of the Federal Bureau of Investigation[i]. A staggering 80% of the claims came from the United States. The daunting task of staying ahead of hackers has led to a full-on cyber war across hardware and software battlefields. The good guys - collectively referred to as "ethical hackers"- **Dr. John Chandy** and **Dr. Laurent Michel** lead a team of undergraduate and graduate students at UConn's Comcast Center of Excellence for Security Innovation. These cyber sleuths are equipped with high-tech tools to attack computing systems and identify and expose potential vulnerabilities. Dr. Michel clarifies the scientific process of protecting hardware in the 21st century by explaining, "It's not like we try something just to find out if it works or not. As we attempt an attack, we gather evidence along the way. That evidence may betray something about the platform, the device, the software we are trying to test. Once we have that information, we regroup and discuss what we have learned and its implications, and then we try to develop more experiments and high-end scenarios so we can learn more."

[i]U.S. Department of Justice Federal Bureau of Investigation, *2015 Internet Crime Report*

Dr. Laurent Michel, Co-Director, Comcast Center of Excellence for Security Innovation.

Information technology continues to evolve at a breakneck pace and affects many aspects of business and personal lives. Information systems are traditionally responsible for operating stock markets, running companies, scheduling activities and supporting design processes (e.g., microchip, automobile and airplane designs to name just a few). What is rapidly evolving, however, is cloud computing and the internet-of-things. That brings a plethora of interconnected devices with rich user-oriented services focused on health, personal medicine, productivity and gaming all running on platforms that can be used both for work-related and personal endeavors. Consider smartphones and smart watches, which collect a large volume of information-tracking a web of geo-locations, purchases, email interactions, audio and video recording, health data and pictures taken then exchanged with peers over social and professional networks. The automotive industry promises smart vehicles capable of taxiing around, interacting with other vehicles and road networks to automatically navigate complex and evolving environments, relying both on their direct sensing and indirect data acquisition. The future is right around the corner and it offers a compelling vision of convenience and automation that relies on a fabric of inter-connected and inter-dependent devices and services.

Yet, one must acknowledge the sharp rise in novel forms of criminality in cyberspace. Not a week goes by without a press release reporting on large-scale identity theft, massive credit card fraud, or health records being stolen. Cyber-crime pays, and it pays handsomely. Criminals exploit a young and easily manipulated infrastructure that was not designed from the ground up for resilience against cyberattacks. Services and devices expose large attack surfaces that can be exploited at low cost. The continued rise of technology and the economic model it supports is strongly contingent on adopting a resilient and forward looking security stance that stays ahead of attackers and voids the financial motivation they might have.

UConn is at the forefront of multiple cybersecurity initiatives through various Centers. The Voting Technology Research (VoTeR) Center ($500,000 annually, Director: Dr. Schwarzmann) focuses on digital technologies used throughout the electoral process to preserve the integrity of elections threatened by equipment failures or fraud. The Center for Hardware Assurance Security and Engineering (CHASE) Center ($200,000 annually, Director: Dr. Chandy) addresses concerns arising at the hardware level and covers topics such as counterfeits, tamper-resistance and hardware-Trojan. The Comcast Center of Excellence for Security Innovation (CSI) ($2M annually, Co-Directors: Dr. Michel and Dr. Chandy) covers issues pertaining to the Internet of Things devices deployed on customer premises to protect privacy, provide quality services to users and prevent theft of content, identity or attacks against the provider's infrastructure.

The recently minted Connecticut Cybersecurity Center (C3) is designed to host these activities under one roof and provide additional key capabilities. Expertise in cloud security and privacy along with know-how of mobile platform are examples of what C3 will cover. Indeed, cloud computing no longer limits itself to storage, but is now the platform of choice to sidestep costly data-centers and provide users-facing services at a fraction of the cost. Yet, their adoption mandates stronger mechanisms for authentication of users and devices (e.g., physically unclonable functions), encryption of data at rest, privacy-preserving computations and sound engineering practices to avoid vulnerabilities. The new center is designed to serve Connecticut-based industries who wish to overhaul their technological operation and build resilience through a more pro-active cyber-security strategy. The creation of C3 is supported by the hiring of two additional faculty members in cryptography and security. These faculty members will engage in research with industry partners and collaborate with schools throughout UConn, in addition to their teaching responsibilities. The educational objective is to develop programs that create an agile workforce well-versed in contemporary security issues touching technological, business and legal aspects of the field.

Source: U.S. Department of Justice Federal Bureau of Investigation, 2015 Internet Crime Report

REGIONAL CAMPUSES

Digital Logic Design

The Computer Science & Engineering Department has a long-standing relationship with our regional campuses providing students with computer-related courses and curricula. As part of the current School of Engineering goal to provide more opportunities at regional campuses, CSE initiated an expansion with the introduction of a hybrid course in Digital Logic Design. This sophomore-level course was created and successfully tested over two semesters by Professor Keith Barker. It is available at the regional campuses at Avery Point, Waterbury, Hartford, and Stamford, as well as at the main campus at Storrs.

This hybrid course design uses *'Quality Matters'* standards and provides most of the learning material online through HuskyCT. It consists of over 20 modules from basic number systems and logic functions to sequential circuits and computer architecture. The weekly laboratory work provides an opportunity for the students to solve digital logic problems using a software simulator and build solutions in hardware on a protoboard.

Laboratory sections encourage students to learn together while being assessed individually. The Storrs teaching assistants and regional campus instructors are well qualified to provide excellent support for this course. Professor Barker continues to provide academic supervision throughout the semester in a synchronous manner.

With the introduction of this course and others to follow, students at the regional campuses are able to complete more computer science courses before transferring to Storrs, which provides all students with a wider range of academic and learning experiences.

UConn Waterbury Campus

ALUMNI UPDATE

Ashley Dumaine

Ashley Dumaine, B.S.E., in Computer Science and Engineering, graduated from UConn in May 2016 as an Honors Scholar and University Scholar. Currently, she is working at Datto, Inc. as a Full Stack Engineer.

Ashley initially entered UConn as a mechanical engineering major with no experience in programming. She enjoyed the introductory computer science and engineering course, and switched majors her second semester. In her sophomore year, she created a mind-controlled drone project with an EEG headset as part of an independent study. She gave dozens of drone demonstrations at UConn's Open Houses, the annual Connecticut Invention Convention and her project was even featured on the cover of the Multi-Rotor Pilot Magazine. She continued using brain-computer interfaces in her University Scholar project and honors thesis, creating an API and general protocol for communication between wireless Emotiv EEGs and software, as well as researching different machine learning algorithms for pattern recognition of raw EEG data.

During Ashley's time at UConn, she had two internships, the last of which was at Google New York. While interning at Google, she worked with the Tech Infrastructure team on software responsible for restarting relatively poor-performing tasks within jobs sent to run on Borg, Google's large-scale cluster management system.

"I thank UConn and the CSE Department for helping me succeed in my academic and professional endeavors. I went from never having written a line of code before college, to landing an internship at a tech giant 3 years later. I secured a job before my final semester and attribute it to the support and education I received at the University."

ACADEMY OF DISTINGUISHED ENGINEERS AND HALL OF FAME

Each year, the School of Engineering honors exceptional engineering alumni and friends who have helped us in countless ways. The UConn Academy of Distinguished Engineers, founded in 2003, honors School of Engineering alumni or friends whose careers are characterized by their sustained and exemplary contributions to the engineering profession through research, practice, education, policy or service. Members are individuals who bring enduring honor to the community as practitioners and as citizens.

Above:
INDUCTED 2014
MARTHA C. POULTER
B.S. Computer Science and Engineering '88
Executive VP and CIO, Starwood Hotels and Resorts Worldwide, Inc.

INDUCTED 2006
DEREK J. BLAZENSKY
B.S. Computer Science and Engineering '81
Founding Partner/General Partner, Cardinal Venture Capital

INDUCTED 2006
TIMOTHY 'SCOTT' CASE
B.S. Computer Science and Engineering '92
Doctor of Science (Honorary) '15
President and Chief Operating Officer, Upside

INDUCTED 2005
FERDINAND R. ENGEL
M.S. Computer Science and Engineering '72
Executive Partner, President, Bulger Partners, Westerly Consulting

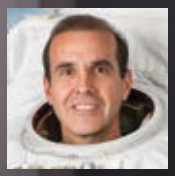
INDUCTED 2015
BERNARD "BERNIE" E. GRACY, JR.
B.S. Computer Science and Engineering '85
Senior Vice President Global Products, Cimpress, N.V.

INDUCTED 2012
RONALD JACOBY
B.S. Computer Science and Engineering '87
Electrical Engineering 1987
Vice President and Chief Architect, Connected TV at Yahoo, Inc.

INDUCTED 2014
D. BRITTON JOHNSTON
B.S. Computer Science and Engineering '85
Chief Technology Officer, Microsoft Corporation

INDUCTED 2014
JEFFREY P. KUBALA
B.S. Computer Science and Engineering '81
System z Distinguished Engineer, International Business Machines Corporation (IBM)

INDUCTED 2005
FRED MARYANSKI
Ph.D. Computer Science '74
Past President, Nevada State College

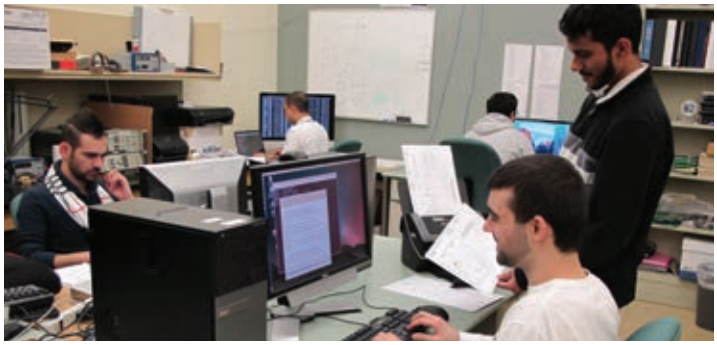


INDUCTED 2003
RICHARD A. MASTRACCHIO
B.S. Computer Science and Engineering and Electrical Engineering '82
Doctor of Science (Honorary) '14
Astronaut, NASA

INDUCTED 2008
JOSÉ L. MUÑOZ
Ph.D. Computer Science and Engineering '86
Chief Technology Officer, National Science Foundation

Voting Technology Research

Elections form the foundation of any successful democracy. Safeguarding their integrity is of paramount importance to the electorate. Thus, a principal cause of concern is the accuracy, security, integrity, and effectiveness of the electoral apparatus used to conduct elections. After the problematic presidential election in 2000, the role of technology in the voting process has attracted much attention. *Electronic Voting Machines* (EVMs) have since been touted as the much needed replacement of older, inadequate voting technologies such as punch cards and lever machines. The 2002 Help America Vote Act (HAVA) spurred the upgrade of voting equipment nation-wide with more than $3.5 billion appropriated through 2014 for election reform. By 2010 more than 120 million voters cast their votes using EVMs. While EVMs offer improved performance in terms of reducing residual vote rates, and they provide more flexible human interfaces, they are the subject of intense scrutiny from a computer security viewpoint. Numerous studies, including several by the University of Connecticut researchers, investigated the competence of EVMs in use and performed security assessments and evaluations. The results were alarming. Evidently, there are significant design challenges to be overcome before EVMs can be considered satisfactory election instruments. To gain the trust of the electorate and maintain the integrity of the electoral process, the need for a thorough security evaluation of these devices and the procedures in place for their use cannot be understated.



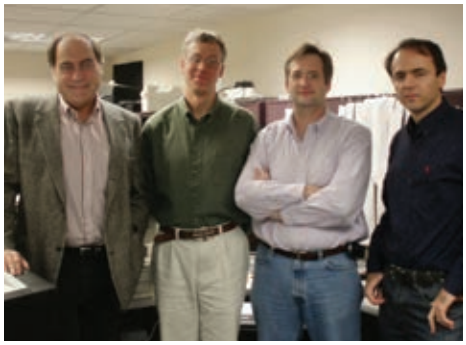
In 2006 the State of Connecticut faced the challenge of selecting an EVM to replace lever machines. The Connecticut Secretary of the State (SOTS) partnered with the University of Connecticut to provide technological expertise to the State in making a decision and perform security and integrity analysis of EVMs proposed to the State. This was the beginning of the UConn Center for Voting Technology Research – VoTeR Center – formed by a team of Computer Science & Engineering faculty.

There are two major types of electronic voting equipment: Direct Recording Electronic (DRE) machines and Optical-Scan (OS) ballot tabulators. From a security assessment point of view, DRE's have attracted most of the criticism, while OS technology is viewed by experts as the safer alternative. Indeed, an important benefit of the OS technology is the voter-verified paper audit trail (VVPAT)—the actual "bubble sheet" ballots marked by voters that enables hand-counted audits and recounts without the reliance on technology. For these reasons OS tabulators were chosen by Connecticut and endorsed by the VoTeR Center.

WORKING TOGETHER WITH THE VOTER CENTER, CONNECTICUT EMERGED AS ONE OF THE LEADING STATES IN THE NATION IN ITS DILIGENT AND JUDICIOUS USE OF TECHNOLOGY IN ELECTIONS.

The mission of the Center then expanded to advise state agencies in the use of electronic election technologies, to investigate voting solutions and equipment, and to recommend safe-use procedures for election systems. Working in partnership with the Connecticut SOTS Office, the Center substantially contributes to increasing the confidence of citizens that their votes are recorded correctly. The Center continuously evaluates electronic election systems and develops methodology and tools for performing technological audits of voting machines. The faculty team consists of Profs. Alexander Schwarzmann, Laurent Michel, and Alexander Russell at UConn, and Prof. Aggelos Kiayias, an affiliate of the Center and an expert in cyber security at the University of Edinburgh (UK). Together with Research Engineer Matthew Desmarais, they lead a team of graduate and undergraduate students in providing technological advice and assistance to the State in all aspects of electronic systems used in the elections, including electronic voting machines and electronic poll-book systems.

Since 2007 the Center has performed technological audits in Connecticut before and after each state-wide election. The audits include pre-election analysis of removable memory cards from voting machines, and a post-election audit of cards used in the elections. The cards are subjected to integrity testing, including the presence of correct programs and data, and absence of any extraneous or malicious code. In the past these audits also identified problems with one type of memory cards that could lead to the loss of data. As the result new dependable memory cards were introduced. Additionally, in conjunction with Public Act 07-194, An Act Concerning the Integrity and Security of the Voting Process, the State randomly selects and hand counts ballots from districts chosen in a public lottery. The Center analyzes the audit returns and assists the State in interpreting the results. This helps the State fine-tune the use of voting machines in the elections.



Dr. Schwarzmann offered Connecticut voters reassuring comments about the integrity of the elections: "Working together with the VoTeR Center, Connecticut emerged as one of the leading states in the Nation in its diligent and judicious use of technology in elections."

Above left: Graduate and undergraduate research assistants work to ensure the integrity of Connecticut's elections.

Above right: (l-r) Alex Schwarzmann, Alex Russell, Laurent Michel, and Aggelos Kiayias.

UCONN
SCHOOL OF ENGINEERING

Computer Science & Engineering Department
371 Fairfield Way, Unit 4155
University of Connecticut
Storrs, CT 06269-4155

ADDRESS SERVICE REQUESTED

NON-PROFIT
ORG.
US POSTAGE
PAID
STORRS, CT
PERMIT NO.3

HONOR SOCIETY FOR COMPUTING DISCIPLINES

Upsilon Pi Epsilon

Upsilon Pi Epsilon (UPE) is an international honor society for the computing and information disciplines. UPE was founded at Texas A&M University, College Station, in 1967. The international organization now consists of chapters in many colleges and universities in North America and overseas. The University of Connecticut chapter of UPE is now in its 29th year, being chartered in 1987. UPE is the first and only international honor society in the Computing and Information disciplines. The society has received endorsements from the two largest computer organizations in the world, the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers Computer Society (IEEE-CS).

UPE is also a charter member of The International Federation of Engineering Education Societies (IFEES). They sponsor scholarships, and provides a forum in which excellent students can work together on projects, hear inspiring speakers and visit companies carrying on significant activities in computer related fields.

The University of Connecticut chapter of UPE won an honorable mention chapter award at the 2016 UPE National Convention. The group is active in reaching out to computer science students- from those just starting in CS to those graduating and searching for jobs. Over the last few years, UPE has organized an active tutoring program for introductory level courses. These one-on-one sessions are complemented by group discussions on technical topics such as Java workshop and an introduction to the git version control system. Some other popular events include game nights (co-organized with HKN, the ECE honors society), a series of popular lectures by faculty, and presentations by tech companies looking to hire UConn students for internships and full-time jobs.

COMPUTER SCIENCE & ENGINEERING DEPARTMENT

September 24, 2018

Current Faculty

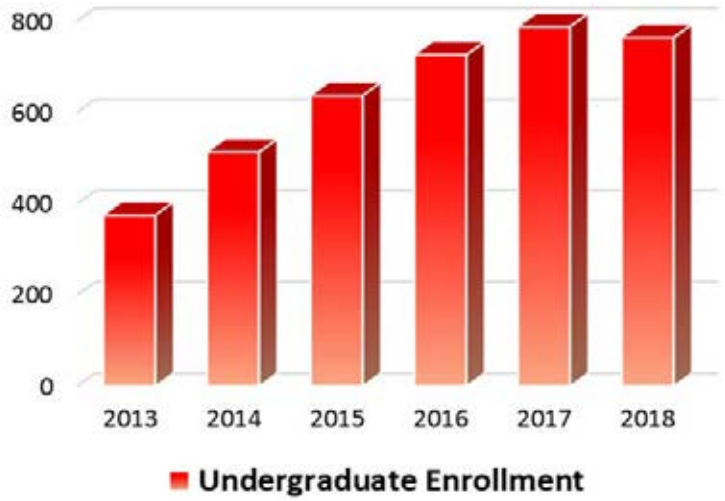
- ★26 Tenured/tenure Track Faculty
- ★6 Teaching Faculty
- ★2 Assistant Research Professors

AY 17-18 Graduates

- ★188 B.S./B.S.E., 27 M.S. 9 Ph.D. 48 Minors

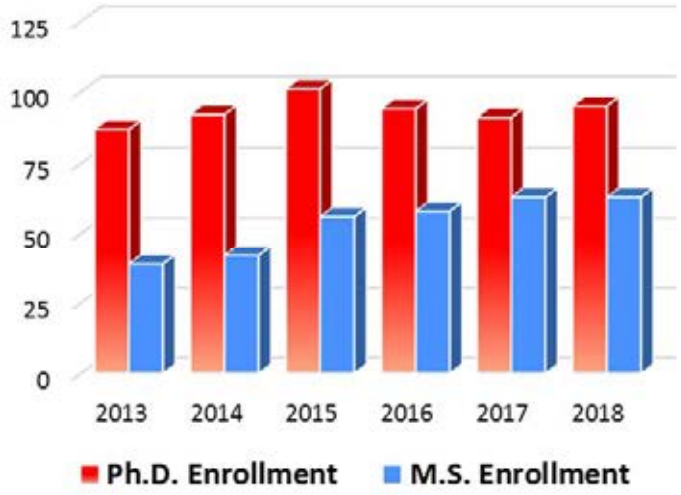
Programs

- ★CS and CSE undergraduate programs
- ★CompE joint with ECE Department
- ★Several minors, 8 concentrations and a graduate program with M.S. and Ph.D.
- ★Many non-major students



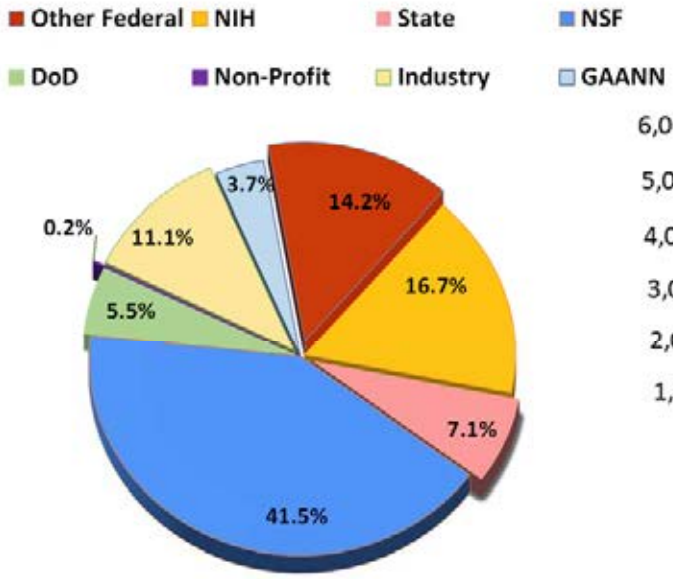
Current Enrollment - Fall 2018

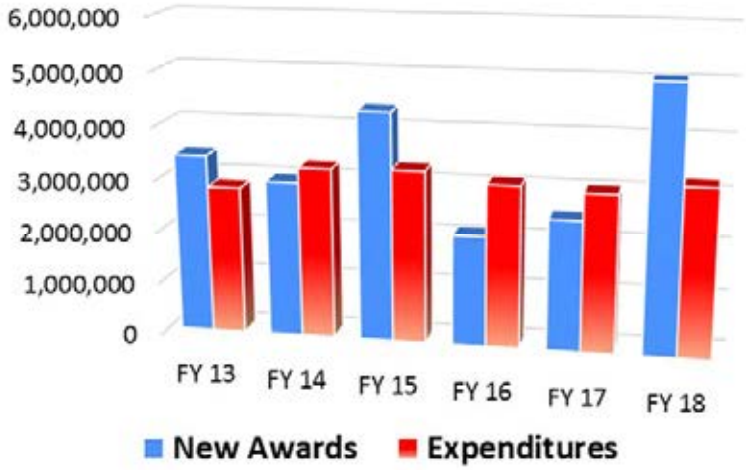
- ★763 undergraduate 63 M.S. 95 Ph.D. 193 Minors



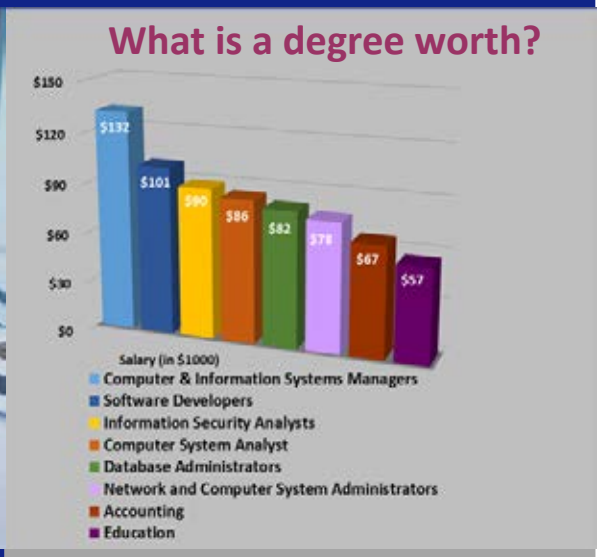
Research

- ★13 NSF Career Awardees to date
- ★26 journal articles
- ★118 conference papers
- ★$20,305,782 active research projects
- ★$3,213,297 in research expenditures
- ★$5,055,295 in new research awards





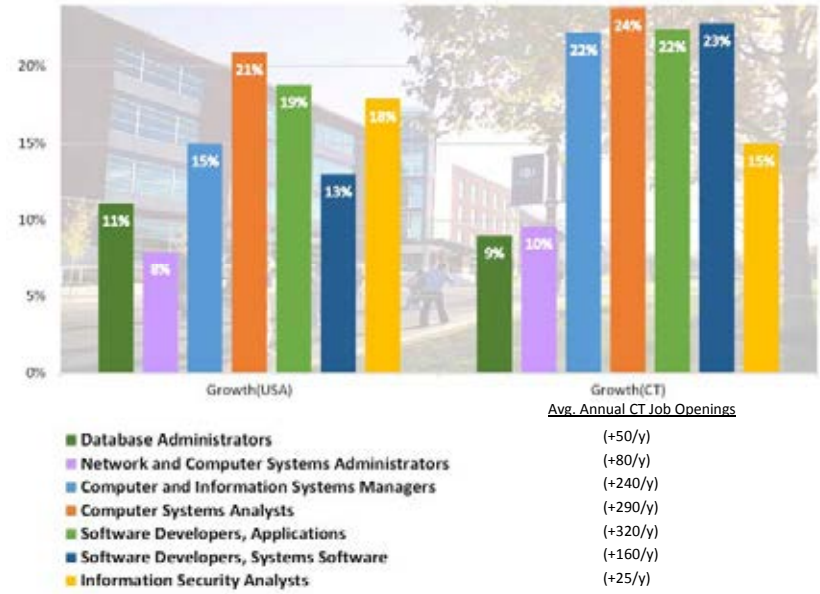
Computer Science & Engineering
University of Connecticut



The Faculty

Our faculty members graduated from top schools, are on the technological cutting edge and conduct externally-funded research (13 Faculty members are NSF CAREER-award recipients!) in exciting fields such as parallel and distributed computing, cryptography, cybersecurity, combinatorial optimization, networking, and bioinformatics.

Job Market 2014-2024



(Source: Bureau of Labor Statistics)

Modern Curriculum
State-of-the-art Facilities
World-Class Faculty
Endless Possibilities

A world of applications

- Bioinformatics
- Cryptography
- Cybersecurity
- High Performance Computing
- Networking and the Internet
- Optimization
- Parallel and Distributed Computing
- Voting Technology

Opportunities

- Three majors
- Several minors
- Eight concentrations
- Co-op/Internships
- Honors program and University Scholars
- Sponsored design projects
- Undergraduate research experience
- Graduate study

Visit us on the web at www.cse.uconn.edu

High School Students

Freshman Applicant Profile Sought by the School of Engineering

A freshman applicant to UConn must meet the following requirements:

- Be a graduate of an approved secondary school
- Have completed at least 16 units of work, of which 15 must be college preparatory in nature
- Be in the upper range of their high school class
- Have achieved an appropriate score on the SAT I or the ACT

Applications for freshman admission must include:

- Official high school transcript or official GED
- Official SAT or ACT scores
- Personal essay
- Application fee (non-refundable)

Minimum high school course requirements for the School of Engineering are as follows:

- 4 years of English
- 3 1/2 years of math (Algebra I, Algebra II, and Geometry; Pre-calculus preferred) **4 years is recommended**
- 2 1/2 years of social studies (including 1 year of U.S. History)
- 2 years of a **single** foreign language (3 years **strongly** recommended)
- 2 years of laboratory science
- 2 1/2 years of electives
- High School Chemistry
- High School Physics

Please refer to the current application for admission for more detailed information regarding requirements and application deadlines.

Freshman Applicant Profile Example – Computer Science & Engineering

Here is a typical profile of an incoming freshman:

- SAT math score of at least 600
- GPA of at least 3.0
- Average SAT score of 1300

For more specific information regarding admission, please direct your inquiries to:

The Office of Undergraduate Admissions
University of Connecticut, 2131 Hillside Road, Unit 3088, Storrs, CT 06269-3088
Phone: (860) 486-3137
Website: *admissions.uconn.edu*
E-mail: *beahusky@uconn.edu*

Bachelor Degree Programs

The Computer Science and Engineering Department offers two bachelor degree programs: a BSE in Computer Science and Engineering and a BS in Computer Science. In collaboration with the Electrical and Computer Engineering Department, we also offer a BSE in Computer Engineering. The first year of these programs is virtually identical, allowing students the opportunity to decide which program is right for them. The two BSE degrees continue this similarly throughout the sophomore year as well.

Which Degree to Choose?

The ***Computer Science*** program produces graduates with a broad understanding of both computing principles and computing practice. The program emphasizes the fundamental computing models through the design and analysis of algorithms and software. The structure of the program includes core courses in fundamental computing areas: functional and object-oriented programming, algorithms and data structures, computer architecture, and systems programming. In addition to taking the core courses, each student also completes a concentration in one of the following areas: theory and algorithms, systems and networks, cybersecurity, bioinformatics, software design and development, computational data analytics, unspecialized or individually designed. This degree program was first offered in the fall of 1999 and has received accreditation from CAC/ABET since 2000.

The ***Computer Science and Engineering*** program produces graduates with a broad perspective in both software and hardware topics pertinent to computing systems. The core of this program includes additional courses in analog and digital circuits and performance analysis, consistent with its increased emphasis on hardware systems. Computer Science and Engineering students also complete a concentration in the same areas as the Computer Science students. This degree program was first accredited by EAC/ABET in 1972. Since 1993, the program has earned accreditation from both the Engineering and Computing commissions of ABET.

The ***Computer Engineering*** program produces graduates with skills in designing computer hardware and peripherals, and emphasizes the electrical characteristics of the computer itself. It is focused on the design of computer hardware, associated core software structures and their interfaces. It is well suited to students interested in designing computers or computer interfaces, real time applications, or networking solutions. This degree program has received accreditation from EAC/ABET since 2006.

All three of these programs require students in their senior year to complete a two semester team-oriented capstone design and development project. Students work in teams of four to six and many projects are sponsored by industry. Students demonstrate projects at the School of Engineering Senior Design Day held each May.

Computer Science & Engineering
Bachelor of Science in Engineering Program
Catalog Year 2018-2019

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
CHEM 1127Q or 1147Q-Gen. Chem. I or Honors Chem I	4	PHYS 1501Q-Engineering Phys. I	4
MATH 1131Q- Calculus I	4	MATH 1132Q-Calculus II	4
ENGL 1010 or ENGL 1011-Acad. Writing	4	CSE 1729 - Intro to Principles of Programming	3
CSE 1010 - Intro Computing for Engineers	3	Area 2 (Social Science)	3
ENGR 1000-Orientation to Engineering	1	Area 1 (Arts and Humanities)	3
	16		17

SOPHOMORE YEAR

First Semester	Credits	Second Semester	Credits
PHYS 1502Q-Engineering Phys II	4	MATH 2410Q-Differential Equations	3
MATH 2110Q-Multivariable Calculus	4	CSE 2500 -Intro to Discrete Systems	3
CSE 2050 – Data Structures and Object-oriented Design	3	ECE 2001 – Electric Circuits	4
CSE 2300 – Digital Logic Design	4	PHIL 1104 (Area 1) - Phil. and Social Ethics	3
	15	Area 2 (Social Science)	3
			16

JUNIOR YEAR

First Semester	Credits	Second Semester	Credits
CSE 3100 - Systems Programming.	3	CSE xxxx - Concentration course 1	3
CSE 2304 or 3666 - Intro. to Comp. Arch.	3	CSE 3504- Prob. Perf. Analy. of Computer Sys.	3
CSE 3500- Algorithms and Complexity	3	CSE 3000-Contemporary Issues in CSE	1
Prob. and Stat.Course[1]	3	CSE Elective	3
Area 4 (Diversity and Multiculturalism)	3	Math 2210Q-Linear Algebra	3
	15	Elective	3
			16

SENIOR YEAR

First Semester	Credits	Second Semester	Credits
CSE 4939W-CS & E Design Project I	3	CSE 4940-CS & E Design Project II	3
CSE xxxx - Concentration course 2	3	CSE xxxx - Concentration course 4	3
CSE xxxx - Concentration course 3	3	CSE Elective[2]	3
Elective	3	Elective	4
Elective	3	Area 4 (Diversity and Multiculturalism	3
	15		16

Additionally the program must include one W course other than CSE 4939W, which may be used to satisfy other requirements or Free Electives.

1 This course must be chosen from the list of MATH 3160Q- Probability, STAT 3025Q Statistical Methods I, STAT 3345Q-Probability Models for Engineers or STAT 3375Q Introduction to Mathematical Statistics.

2 If needed to get 15 CSE credits in concentration and CSE electives. 126 total credits required, including 50 total CSE credits.

Revised 2/21/17

Computer Science & Engineering Concentration Requirements

Every CSE major must satisfy the requirements for a concentration. A concentration consists of four courses within a defined set of alternatives (one or more of the courses may be required for the concentration). A student must declare a single concentration to count toward graduation; that is the one that will be listed on his or her transcript. There are currently 8 concentrations available, these are listed below. For information about the concentration requirements, see the ***Guide to Course Selection,*** linked from the CSE department web page under Undergraduate Studies.

Concentration 1: Theory and Algorithms

Concentration 2: Systems and Networks

Concentration 3: Cybersecurity

Concentration 4: Bioinformatics

Concentration 5: Software Design and Development

Concentration 6: Computational Data Analytics

Concentration 7: Unspecialized
For the Unspecialized concentration, students must take required courses from 3 different concentrations, plus any other 2000+ level CSE course not used to fulfill another requirement.

Concentration 8: Individually Designed
Students may propose an individually-designed concentration to fit their academic or career interests. This will be a minimum of 12 credits at the 2000+ level, proposed by the student and approved by the student's advisor and the CSE Department Undergraduate Committee. The expectation is that such a concentration will have a strong unifying theme. This may include non-CSE courses, but the student will still be subject to the overall requirement of 50 CSE credits.

Computer Science Bachelor of Science Program
Catalog year 2018-2019

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
Lab Science[1]	4	Lab Science[1]	4
MATH 1131Q – Calculus I	4	Math 1132Q – Calculus II	4
CSE 1010 – Intro Computing for Engineers	3	CSE 1729 – Intro to Principles of Programming	3
ENGR 1000 – Orientation to Engineering	1	ENGL 1010 or 1011 – Seminar in Writing	4
Area 2 (Social Sciences)	3		
	15		15

SOPHOMORE YEAR

First Semester	Credits	Second Semester	Credits
Lab Science[1]	4	CSE 2304 or 3666 – Computer Architecture	3
CSE 2500 – Intro to Discrete Systems	3	CSE 3500 – Algorithms and Complexity	3
CSE 2050 – Data Structures & Object-Oriented Design	3	CSE 3100 – Systems Programming	3
MATH 2110Q – Multivariable Calculus or	4 or 3	Area 2 (Social Science)	3
MATH 2410Q – Elem. Differential Equations		PHIL 1104 (Area 1) – Phil. and Soc Ethics	3
Area 1 (Arts and Humanities)	3		
	17 or 16		15

JUNIOR YEAR

First Semester	Credits	Second Semester	Credits
CSE xxxx - Concentration course 1	3	CSE xxxx - Concentration course 2	3
CSE Elective	3	Area 4 Course (Diversity and Multiculturalism)	3
STAT 3025Q-Stat. Methods	3	CSE 3000 -Contemporary Issues in CSE	1
MATH 2210Q-Linear Algebra	3	CSE Elective[2]	3
Elective	3	Elective	3
	15	Elective	3
			16

SENIOR YEAR

First Semester	Credits	Second Semester	Credits
CSE 4939W – CSE Design Project I	3	CSE 4940 – CSE Design Project II	3
CSE xxxx - Concentration course 3	3	CSE xxxx - Concentration course 4	3
Area 4 (Diversity and Multiculturalism)	3	Elective	3
Elective	3	Elective[3]	3 to 4
Elective	3		
	15		12 to 13

Additionally the program must include one W course other than CSE 4939W, which may be used to satisfy other requirements or Free Electives.

---

[1] A two-course sequence must be selected from one of the following sequences. CHEM 1127Q, 1128Q; CHEM 1147Q,1148Q; CHEM 1137Q, 1138Q; PHYS 1401Q, 1402Q; PHYS 1601Q, 1602Q; PHYS 1501Q, 1502Q. An additional course must be selected from the department not selected for the sequence or from BIOL 1107, BIOL 1108, BIOL 1110, or GEOL 1050.

[2] If needed to get 15 CSE credits in concentration and CSE electives.

[3] Sufficient to make 120 credits, with at least 43 credits in CSE courses.

Computer Science Concentration Requirements

Every Computer Science major must satisfy the requirements for a concentration. A concentration consists of four courses within a defined set of alternatives (one or more of the courses may be required for the concentration). A student must declare a single concentration to count toward graduation; that is the one that will be listed on his or her transcript. There are currently 8 concentrations available, these are listed below. For information about the concentration requirements, see the ***Guide to Course Selection,*** linked from the CSE department web page under Undergraduate Studies.

Concentration 1: Theory and Algorithms

Concentration 2: Systems and Networks

Concentration 3: Cybersecurity

Concentration 4: Bioinformatics

Concentration 5: Software Design and Development

Concentration 6: Computational Data Analytics

Concentration 7: Unspecialized
For the Unspecialized concentration, students must take required courses from 3 different concentrations, plus any other 2000+ level CSE course not used to fulfill another requirement.

Concentration 8: Individually Designed
Students may propose an individually-designed concentration to fit their academic or career interests. This will be a minimum of 12 credits at the 2000+ level, proposed by the student and approved by the student's advisor and the CSE Department Undergraduate Committee. The expectation is that such a concentration will have a strong unifying theme. This may include non-CSE courses, but the student will still be subject to the overall requirement of 43 CSE credits.

COMPUTER ENGINEERING 2018-19

FRESHMAN YEAR

First Semester	Credits	Second Semester	Credits
MATH 1131Q – Calculus I	4	MATH 1132Q – Calculus II	4
CHEM 1127Q – Gen. Chem. I	4	PHYS 1501Q[1] – Engineering Physics I	4
CSE 1010 – Intro. to Computing for Engr.	3	CSE 1729 – Intro. Principles of Programming	3
ENGL 1010 or 1011 – Academic Writing	4	Arts and Humanities course[2]	3
ENGR 1000 – Orientation to Engineering	1	Social Sciences course[2]	3
	16		17

SOPHOMORE YEAR

First Semester	Credits	Second Semester	Credits
MATH 2110Q – Multivariable Calculus	4	MATH 2410Q – Differential Equations	3
PHYS 1502Q[1] – Engineering Physics II	4	ECE 2001 – Electric Circuits	4
CSE 2050 – Data Structures & OO Design	3	CSE 2500 – Intro to Discrete Systems	3
CSE 2300 – Logic Design	4	PHIL 1104 – Philosophy and Social Ethics	3
	15	Social Sciences course[2]	3
			16

JUNIOR YEAR

First Semester	Credits	Second Semester	Credits
ECE 3101 – Signals and Systems	3	ECE 3401 – Digital Systems Design	3
ECE 3201 – Electronic Circuit Design and Analysis	4	ECE 3411 – Microprocessor App. Lab or CSE 4903 – Microprocessor Lab	3
CSE 3100 – Systems Programming	3	CSE 4302 – Advanced Computer Architecture	3
CSE 3666 – Intro. to Computer Architecture	3	STAT 3345Q – Probability Models Engineers	3
MATH 2210Q – Linear Algebra	3	Diversity and Multiculturalism course[2]	3
	16		15

SENIOR YEAR

First Semester	Credits	Second Semester	Credits
ECE 4901 – E&CE Design I	2	ECE 4902 – E&CE Design II	3
ECE 4099W – Independent Study w/writing[5]	1	ECE 3421 – VLSI Design & Simulation	4
CSE 4300 – Operating Systems	3	Professional Requirement[3]	3
Professional Requirement[3]	3	Professional Requirement[3]	3
Design Laboratory[4]	3	Diversity and Multiculturalism course[2]	3
Elective	3		16
	15		

[1] Either the two-semester sequence of PHYS 1401Q-1402Q or the three-semester sequence of PHYS 1201Q-1202Q followed by PHYS 1230 or 1530 may be taken instead to satisfy this requirement. However, only eight credits of PHYS 1201-1202-1230/1530 can be used toward the required 126 credits for the Engineering degree.

[2] The courses from content areas one (Arts and Humanities) and two (Social Sciences) must be from four different departments. One course from either content area one (Arts and Humanities) or content area two (Social Sciences) may also be used to fulfill one of the requirements from content area four (Diversity and Multiculturalism). One course from content area four must be an international course.

[3] Choose three (3) from: ECE 3111, ECE 3431/CSE 3802, ECE 3221, ECE 4112, ECE 4121, ECE 4131, ECE4451, CSE 2102, CSE 3300, CSE 3500, CSE 3504, CSE4707, and CSE4709. At least one of the three must be ECE 4112 or CSE 3504.

[4] Choose one (1) from: CSE 3350/ECE 4401, CSE 4901/ECE 4402, ECE 4114, and ECE 4132

[5] One additional W course must be taken, typically as one of the content area courses.