DEPARTMENT OF COMPUTER AND DATA SCIENCES

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More Information: http://engineering.case.edu/cds/

While the BS degree in Computer Science at Case Western Reserve University was approved in 1987, the Department of Computer and Data Sciences (CDS) was recently established in 2019. Computer Science is the study of the theory, practice, and application of computer systems. Data Science is an interdisciplinary field that utilizes computer systems, computational algorithms, and statistical methods to manage, analyze, and visualize data from different domains in order to extract information and knowledge from data. Computer Science and Data Science are at the heart of modern technology with applications in many disciplines. They both have a profound impact on our society and drive job creation. Starting salaries in our fields are consistently ranked at the top of all college majors. Our graduates work in cutting-edge companies from giants to start-ups, in a variety of technology sectors, including computer and internet, business and finance, healthcare and medical devices, energy, and consulting.

CDS offers a BS degree in Computer Science, a Computer Science major toward the BA degree, a BS degree in Data Science & Analytics, a combined BS/MS program in Computer Science, and MS and PhD degrees in Computer Science. CDS also offers minors in Computer Science, Data Science, Computer Gaming, and Artificial Intelligence. The minor in Applied Data Science is administered by the Department of Materials Science and Engineering.

The department has access to high performance computing resources that include multiple computing clusters. Additionally, they recently installed an Artificial Intelligence SuperComputer (AISC) that was funded by an NSF Major Research Infrastructure (MRI) award. It is composed of advanced processors, memory, networking, and storage targeting AI applications.

Educational Philosophy

The CDS department is dedicated to developing high-quality graduates who will take positions of leadership as their careers advance. We recognize that the increasing role of technology in virtually every facet of our society, life, and culture makes it vital that our students have access to progressive and cutting-edge higher education programs. The program values for all of the degree programs in the department are:

- mastery of fundamentals
- creativity
- social awareness
- leadership skills
- professionalism

Stressing excellence in these core values helps to ensure that our graduates are valued and contributing members of our global society and that they will carry on the tradition of industrial and academic leadership established by our alumni.

Our goal is to graduate students who have fundamental technical knowledge of their profession and the requisite technical breadth and communications skills to become leaders in creating the new techniques and technologies which will advance their fields. To achieve this goal, the department offers a wide range of technical specialties consistent with the breadth of computer science and data science, including recent developments in the fields. Because of the rapid pace of advancement in these fields, our degree programs emphasize a broad and foundational science and technology background that equips students for future developments. Our programs include a wide range of electives and our students can also develop individualized programs that can combine computer and data sciences with other disciplines.

Research

At Case Western, we thrive to provide outstanding educational experiences for both our undergraduate and graduate students, while performing cutting edge research in:

a. Algorithms, Theory, and Quantum Computing
b. Artificial Intelligence and Machine Learning
c. Bioinformatics and Systems Biology
d. Data Science and Analytics
e. Databases & Data Mining
f. Computer Networks, Systems, and High Performance Computing
g. Security and Privacy
h. Software Engineering

Primary Faculty Appointments

Erman Ayday, PhD
(Georgia Institute of Technology)
Associate Professor
Cryptography, network security, trust and reputation management, big data analytics

Vipin Chaudhary, PhD
(The University of Texas at Austin)
Kevin J. Kranzusch Professor and Chair
High performance computing, machine learning, computational and data science, computer aided diagnosis and interventions, and quantum computing

Harold S. Connamacher, PhD
(University of Toronto)
Robert J. Herbold Associate Professor in Transformative Teaching
Constraint satisfaction problems, graph theory, random structures, and algorithms

Dianne Foreback, PhD
(Kent State University)
Assistant Professor
Secure and Dependable Distributed Systems, Networks and Algorithms

Mehmet Koyuturk, PhD
(Purdue University)
Andrew R. Jennings Professor of Computing Sciences
Bioinformatics and computational biology, computational modeling and algorithm development for systems biology, integration, mining and analysis of biological data, algorithms for distributed systems

Sanmukh Kuppannagari, PhD
(University of Southern California)
James C. Wyant Assistant Professor
Scaling Deep Reinforcement Learning and Privacy Preserving Deep
Learning on heterogeneous systems

Michael Lewicki, PhD
(California Institute of Technology)
Professor
Computational perception and scene analysis, visual representation and
processing, auditory representation and analysis

Jing Li, PhD
(University of California, Riverside)
Professor
Computational biology and bioinformatics, data mining and machine
learning, data science and analytics, algorithms

Vincenzo Liberatore, PhD
(Rutgers University)
Associate Professor
Distributed systems, Internet computing, randomized algorithms

Jing Ma, PhD
(University of Virginia)
Assistant Professor
Core expertise in AI/ML/Datamining with emphasis on causal inference
and graph mining.

Orhan Ozguner, PhD
(Case Western Reserve University)
Assistant Professor
Algorithms, data science, data structure, programming

H. Andy Podgurski, PhD
(University of Massachusetts, Amherst)
Professor
Software engineering methodology and tools, especially use of data
mining, machine learning, and program analysis techniques in software
testing, fault detection and localization, reliable engineering and software
security, electronic medical records, privacy

Soumya Ray, PhD
(University of Wisconsin, Madison)
Associate Professor
Artificial intelligence, machine learning, reinforcement learning,
automated planning, applications to interdisciplinary problems including
medicine and bioinformatics

An Wang, PhD
(George Mason University)
Assistant Professor
Systems and network security

Yinghui Wu, PhD
(University of Edinburgh (UK))
Theodore L. and Dana J. Schroeder Associate Professor
Data science

Kevin Xu, PhD
(University of Michigan, Ann Arbor)
Assistant Professor
ML, data analytics, human dynamics, network science and statistical
signal processing

Shuai Xu, PhD
(Florida International University)
Assistant Professor
Algorithms and theory

Yu Yin, PhD
(Northeastern University)
Assistant Professor
Core expertise in the broad area of computer vision that includes visual
synthesis and understanding, multi-modality fusion and transfer learning

Adjunct Faculty Appointments

Mark A. Allman, MSEE
Adjunct Instructor

Nicholas Barendt, MSEE, BSEE
Adjunct Sr. Instructor

Praphul Chandra, PhD
Adjunct Assistant Professor

Mahdi Cheraghchi Bashi Astaneh, PhD
Adjunct Associate Professor

Sanjaya Gajurel, PhD
Adjunct Assistant Professor

Ashwin Ganesan
Adjunct Instructor

Manish Gupta, PhD
Adjunct Assistant Professor

Dan Izad, BSME, MSME, and MCIS
Adjunct Instructor

Catherine Jaypandian
Adjunct Instructor

Luis Jimenez
Adjunct Instructor

Eamon Johnson, PhD
Adjunct Assistant Professor

Amey Joshi, PhD
Adjunct Assistant Professor

Suryaprakash Kompalli, PhD
Adjunct Assistant Professor

Ronald Loui, PhD
Adjunct Professor

Sreerama Murthy, PhD
Adjunct Associate Professor

Anand Narasimhamurthy, PhD
Adjunct Assistant Professor

Stanley Omeike
Adjunct Instructor

Gideon Samid, PhD
Adjunct Assistant Professor

Sadida Siddiqui
Adjunct Instructor

Sunil Kumar Vuppala, PhD
Adjunct Assistant Professor

Xusheng Xiao, PhD
(North Carolina State University)
Adjunct Assistant Professor
Software engineering, computer security

Miguel Zubizarreta-Ada, PhD
Adjunct Professor

Secondary Faculty Appointments

Gurkan Bebek, PhD
Assistant Professor
SOM-Center for Proteomics

M. Cenk Cavusoglu, PhD
(University of California, Berkeley)
Nord Professor of Engineering

Vira Chankong, PhD
Associate Professor
CSE-ECSE

Roger French, PhD
Professor
CSE-EMSE

Michael Fu, PhD
Timothy E. and Allison L. Schroeder Assistant Professor
CSE-ECSE

Mark Griswold, PhD
Professor
SOM-Radiology

Evren Gurkan-Cavusoglu, PhD
Associate Professor
CSE-ECSE

Fulai Jin, PhD
Assistant Professor
SOM-Genetics & Genome Sciences

Thomas LaFramboise, PhD
Associate Professor, Genetics
SOM-Genetics

Xiao Li, PhD
Assistant Professor
SOM-RNA Center

Christos Papachristou, PhD
Professor
CSE-ECSE

Satya Sahoo, PhD
Associate Professor
SOM-Dept. of Population & Quantitative Health Sciences

Peter Thomas, PhD
Professor
CAS-MATH

Xiong (Bill) Yu, PhD
Professor
CSE-ECIV

Emeritus Faculty

Gultekin Ozsoyoglu, PhD
(University of Alberta, Canada)
Emeritus Professor
Graph databases and data mining problems in metabolic networks, metabolomics, and systems biology, bioinformatics, web data mining

Z. Meral Ozsoyoglu, PhD
(University of Alberta, Canada)
Emeritus Professor
Database systems, database query languages and optimization, data models, index structures, bioinformatics, medical informatics

Michael Rabinovich, PhD
(University of Washington)
Emeritus Professor
Computer networks, distributed systems, Internet security and performance

Programs

- Artificial Intelligence, Minor
- Computer Science, BA
- Computer Science, BS
- Computer Science, Minor
- Computer Science, MS
- Computer Science, MS (Online)
- Computer Science, PhD
- Data Science and Analytics, BS
- Data Science, MS

Dual Degrees

- Programs Toward Graduate or Professional Degrees

Related Minors in Other Departments

- Applied Data Science, Minor (administered by the Department of Materials Science and Engineering)
- Computer Gaming, Minor (administered by the Department of Electrical, Computer, and Systems Engineering)

Facilities
Computer Facilities

The department computer facilities incorporate both Unix/Linux and Microsoft Windows-based operating systems on high-end computing workstations for education and research. A number of file, printing, database, and authentication servers support these workstations, as well as the administrative functions of the department. Labs are primarily located in the Olin and Glennan buildings, but include Nord Hall, and are networked via the Case network.

The Case network is a state-of-the-art, high-speed fiber optic campus-wide computer network that interconnects laboratories, faculty and student offices, classrooms, and student residence halls. It is one of the largest fiber-to-desktop networks anywhere in the world. Every desktop has a 1 Gbps (gigabit per second) connection to a fault-tolerant 10 Gbps backbone. To complement the wired network, over 1,200 wireless access points (WAPs) are also deployed allowing anyone with a laptop or wireless enabled PDA to access resources from practically anywhere on campus.

Off-campus users, through the use of virtual private network (VPN) servers, can use their broadband connections to access many on-campus resources, as well as software, as if they were physically connected to the Case network. The department and the university participate in the Internet2 and National Lambda Rail projects, which provides high-speed, inter-university network infrastructure allowing for enhanced collaboration between institutions. The Internet2 infrastructure allows students, faculty and staff alike the ability to enjoy extremely high-performance connections to other Internet2 member institutions.

Aside from services provided through a commodity Internet connection, Case network users can take advantage of numerous online databases such as EUCLIDplus, the University Libraries' circulation and public access catalog, as well as Lexus-Nexus™ and various CD-ROM based dictionaries, thesauri, encyclopedias, and research databases. Many regional and national institutional library catalogs are accessible over the network, as well.

Additional Department Facilities
Nord Computer Laboratory

This is a general-purpose computer facility that is open 24 hours a day, to all students. The lab contains 40 workstations that log into the MyApps virtual desk environment. Two workstations are equipped with scanners.

Virtual Worlds (Gaming and Simulation) Laboratory

The Virtual Worlds Gaming and Simulation Laboratory provides software and hardware to support education and research in computer gaming and simulation activities within the Computer and Data Sciences Department and the University at large. The lab has been leveraged to provide students with extensive gameplay opportunities and excellent, strongly experiential simulation and game development educational opportunities – primarily targeted to the CDS undergraduate population.

The lab also stimulates large amounts of cross-disciplinary collaboration in both education and research. Simulation and visualization techniques are of great value in all science and engineering fields, and the lab is capable of supporting advanced applications of these techniques in real-time applications. In addition, interactive technologies and video games require substantial artistic resources, which has resulted in excellent opportunities for educational and research collaboration with the Cleveland Institute of Art (CIA), the School of Nursing, the Medical School, and the Psychology Department. Of particular note has been the

Advanced Game Project course (CSDS 390) taught jointly by CWRU and CIA for juniors and seniors. This course has been very popular and has provided truly excellent student game design and production experiences while receiving industrial and popular recognition and acclaim. In addition, an entry-level computer game programming course (CSDS 290) is available for students who have taken both a Java-based programming course and a data structures course to provide an introduction to many of the technical aspects of computer game development. Many other courses in the department also use the lab as an important part of their curriculum including courses on computer graphics, artificial intelligence, simulation, digital signal processing, and control systems. The lab also supports research in the department requiring significant computational resources, e.g. GPU acceleration, VLSI simulation, etc.

A recent large donation for the lab has allowed for the update and renovation of the entire lab including the physical infrastructure (carpeting, furniture, etc.), the gaming PCs, and the gaming consoles. In addition, a new VR and AR room has been added to represent this new area connected strongly to computer gaming. The lab is now structured into a PC gaming area and an adjacent gaming console area, a VR/AR room, a portable gaming development room, and a team collaboration room.

The renovated lab includes the following primary equipment:

- 24 New Alienware PCs with Dell 27" 4K monitors
- 4 Sony Bravia Television monitors 75" 3DTV
- 2 Microsoft HoloLens AR Units
- 4 Oculus Rift VR units with Haptic Touch Input devices
- A 3D projector (and large wall screen) with 3D capability for common presentations
- 4 Xbox One Units with Xbox One controllers
- 4 PS4 Sony PlayStation units with controllers

Sally & Larry Sears Undergraduate Design Laboratory

This laboratory supports CDS/ECSE courses in circuits and includes a state-of-the-art lecture hall, a modernistic glass-walled lab, an electronics "store", and a student lounge and meeting area. Specialized lab space is available for senior projects and sponsored undergraduate programs. The lab is open to all undergraduates, and components are provided free of charge, so students can "play and tinker" with electronics and foster innovation and creativity. The laboratory provides access to PCs, oscilloscopes, signal generators, logic analyzers, and specialized equipment such as RF analyzers and generators. In addition, the lab includes full-time staff dedicated to the education, guidance and mentoring of undergraduates in the "art and practice" of hands-on engineering.

This is the central educational resource for students taking analog, digital, and mixed-signal courses in electronics, and has been supported by various corporations in addition to alumnus Larry Sears, a successful engineer and entrepreneur. Basic workstations consist of Windows-based computers equipped with LabView software, as well as Agilent 546xx oscilloscopes, 33120A Waveform Generators, 34401A Digital Multimeters, and E3631A power supplies. Advanced workstations are similarly configured, but with a wider variety of high-performance test equipment.