COMPUTER SCIENCE

OVERVIEW

The Department of Computer Science offers three graduate programs through the Graduate College: an Accelerated Master’s Program (AMP) that enables strong computer science undergraduate students to complete computer science Bachelor’s and Master’s degrees in 5 years; a Master’s Program (M.S.) in computer science with course work-only, project, and thesis options; and an interdisciplinary Ph.D. program that offers study in both traditional and cross-disciplinary areas of computing. The Department also contributes courses to and coordinates the Transdisciplinary Certificate of Graduate Study in Complex Systems.

DEGREES

- Computer Science AMP
- Computer Science M.S.
- Computer Science Ph.D.

FACULTY

Bongard, Joshua C.; Associate Professor, Department of Computer Science; PHD, University of Zurich
Chen, Elizabeth S.; Assistant Professor, Department of Medicine-General Internal Medicine; PHD, Columbia University
Dinitz, Jeffrey Howard; Professor, Department of Mathematics and Statistics; PHD, Ohio State University
Dunlop, Mary J.; Assistant Professor, School of Engineering; PHD, California Institute of Technology
Eppstein, Margaret Jean; Associate Professor, Department of Computer Science; PHD, University of Vermont
Hines, Paul D.; Assistant Professor, School of Engineering; PHD, Carnegie Mellon University
Lee, Byung S.; Professor, Department of Computer Science; PHD, Stanford University
Li, Dawei; Assistant Professor, Department of Microbiology and Molecular Genetics; PHD, Shanghai Jiao Tong University
Ling, Alan Chi; Associate Professor, Department of Computer Science; PHD, University of Waterloo
Mirchandani, Gagan S.; Professor, School of Engineering; PHD, Cornell University
Oughstun, Kurt Edmund; Professor, School of Engineering; PHD, University of Rochester
Pinder, George Francis; Professor, School of Engineering; PHD, University of Illinois Urbana-Champaign
Radermacher, Michael; Professor, Department of Molecular Physiology and Biophysics; PHD, University of Munich
Rizzo, Donna Marie; Professor, School of Engineering; PHD, University of Vermont
Sarkar, Indra N.; Assistant Professor, Department of Microbiology and Molecular Genetics; MLIS, Syracuse University
Skalka, Christian Edward; Associate Professor, Department of Computer Science; PHD, Johns Hopkins University
Snapp, Robert Raymond; Associate Professor, Department of Computer Science; PHD, University of Texas Austin
Wang, Xiaoyang; Adjunct Professor, Department of Computer Science; PHD, University of Southern California
Wu, Xindong; Professor, Department of Computer Science; PHD, Edinburgh University
Yu, Jun; Professor, Department of Mathematics and Statistics; PHD, University of Washington Seattle
Zia, Asim; Associate Professor, Department of Community Development and Applied Economics; PHD, Georgia Institute of Technology

Courses

CS 201. Operating Systems. 0 or 3 Credits. Supervisory and control software for multiprogrammed computer systems. Processes synchronization, interprocess communication, scheduling, memory management, resource allocation, performance evaluation, object-oriented systems, case studies. Prerequisites: CS 101 or CS 121; CS 104 or CS 124.

CS 204. Database Systems. 3 Credits. Techniques for processing very large collections of data. Secondary storage. Database design and management. Query languages and optimization. Database recovery. Prerequisite: CS 104 or CS 124.

CS 205. Software Engineering. 3 Credits. Treatment of software engineering problems and principles, including documentation, information hiding, and module interface specification syntax and semantics. Requires participation in a team project. Students who receive credit for CS 205 may not receive credit for CS 208 or CS 209. Prerequisite: CS 104 or CS 124. Cross-listed with: CSYS 205.

CS 206. Evolutionary Robotics. 3 Credits. Exploration of the automated design of autonomous machines using evolutionary algorithms. Coursework involves reading of research papers, programming assignments and a final project. Prerequisites: Junior standing and programming experience, or Instructor permission.

CS 222. Computer Architecture. 3 Credits. Architecture of computing systems. Control unit logic, input/output processors and devices, asynchronous processing, concurrency, parallelism, and memory hierarchies. Prerequisite: CS 101 or CS 121.

CS 224. Algorithm Design & Analysis. 3 Credits. Comprehensive study of algorithms including greedy algorithms, divide and conquer, dynamic programming, graph algorithms and network flow. Computational intractability. Approximation, local search and randomization. Prerequisite: CS 124. CS 125 and one course in probability (e.g. STAT 143, STAT 151 or CS 128) are recommended.

CS 228. Human-Computer Interaction. 3 Credits. The design, implementation and evaluation of user interfaces for computers and other complex, electronic equipment. Includes a significant project. Pre/co-requisites: Programming experience and Junior standing or Instructor permission.
CS 231. Programming for Bioinformatics. 3 Credits.
Introductory course on computing (including scripting, database, and statistical analysis) for developing bioinformatics applications. Particular emphasis is given to comparative genomics and systems biology scenarios. Prerequisites: STAT 151, STAT 153 or Instructor permission. Cross-listed with: MMG 231.

CS 232. Methods in Bioinformatics. 3 Credits.
This course provides a methodological survey of bioinformatics. Particular emphasis is given to algorithms associated with sequence analysis, comparative genomics, structural biology, and systems biology. Prerequisites: STAT 151, STAT 153, or Instructor permission. Cross-listed with: MMG 232.

CS 243. Theory of Computation. 3 Credits.
Reducibility and decidability, recursion theory, time and space complexity, P, NP, NP-completeness, PSPACE, PSPACE-completeness, L and NL, advanced topics in computability and complexity. Prerequisites: CS 124, CS 125.

CS 251. Artificial Intelligence. 3 Credits.
Introduction to methods for realizing intelligent behavior in computers. Knowledge representation, planning, and learning. Selected applications such as natural language understanding and vision. Prerequisites: CS 103 or CS 123; CS 104 or CS 124; STAT 153 or equivalent. Cross-listed with: CSYS 251.

CS 254. Machine Learning. 3 Credits.
Introduction to machine learning, including supervised and unsupervised learning algorithms, reinforcement learning, and computational learning theory. Prerequisites: CS 128, STAT 151 or STAT 153 or equivalent; Instructor permission. Cross-listed with: CSYS 254.

CS 256. Neural Computation. 3 Credits.
Introduction to artificial neural networks, their computational capabilities and limitations, and the algorithms used to train them. Statistical capacity, convergence theorems, backpropagation, reinforcement learning, generalization. Prerequisites: MATH 124 or MATH 271; STAT 153 or equivalent; computer programming. Cross-listed with: CSYS 256.

CS 260. Parallel Computing. 3 Credits.
Taxonomy of parallel computers, basic concepts for parallel computing, effectiveness and scalability, parallel algorithms for variety of problems, distributed memory and shared memory paradigms. Prerequisite: CS 104 or CS 124, or Instructor permission.

CS 265. Computer Networks. 3 Credits.
Introduction to the theoretical and pragmatic principles and practices of computer networking. Topics include: local area networks; the Internet; network and world-wide-web application programming. Prerequisites: CS 026 or CS 110, CS 101 or CS 121, and STAT 153 or equivalent.

CS 266. Network Security & Cryptography. 3 Credits.

CS 274. Computer Graphics. 3 Credits.
Graphical representation of two- and three-dimensional objects on color raster displays. Line generation, region filling, geometric transformations, hidden line and surface removal, rendering techniques. Prerequisite: CS 104 or CS 124, MATH 124 or MATH 271, recommended.

CS 275. Mobile Apps & Embedded Devices. 3 Credits.
A projects-based course focused on applications development on wireless and embedded platforms, including iOS, Arduino, and Linux-based devices. Emphasis on C programming and cyber-physical systems software. Prerequisite: CS 124. Pre/Co-requisites: CS 148 or CS 204 (recommended but not required).

CS 276. Integrative Computing. 3 Credits.
Integrative computing principles and practices: Abstraction via APIs, distributed systems orchestration, security, application design and implementation. Team projects for mobile and other networked, embedded devices. Prerequisites: Senior standing in Computer Science or Instructor permission.

CS 294. Independent Readings & Research. 1-6 Credits.
Independent readings and investigation under the direction of faculty member. Prerequisite: Department permission.

CS 295. Special Topic: Computer Science. 1-18 Credits.
See Schedule of Courses for specific titles. Subject will vary from year to year. May be repeated for credit.

CS 296. Special Topic: Computer Science. 1-12 Credits.
See Schedule of Courses for specific titles. Subject will vary from year to year. May be repeated for credit.

CS 302. Modeling Complex Systems. 3 Credits.

CS 303. Adv Top: Prog Environ & Language. 3 Credits.
Object-oriented, functional, or procedural programming languages, language design, parsing, translation, compilation, interpretation, programming and runtime environments. May be repeated for credit with Instructor permission.

CS 316. Adv Top: Computational Science. 3 Credits.
Topics chosen from engineering and scientific applications, visualization, large-scale data analysis. May be repeated for credit with instructor permission. Prerequisite: Varies by semester. Instructor permission required.

CS 321. Adv Top: Computer Architecture. 3 Credits.
Topics from computer architecture, network architecture, array and vector processors, memory hierarchies. May be repeated for credit with Instructor permission. Prerequisite: CS 222.
CS 331. Adv Tpcs Database & Knwldg Sys. 3 Credits.
Topics chosen from database design, knowledge based systems, object-oriented and relational systems, data models, knowledge representation. May be repeated for credit with Instructor permission. Prerequisite: CS 204, CS 224.

CS 332. Data Mining. 3 Credits.
Analytical and empirical techniques for analysis of large volumes of data. Topics include association analysis, classification, clustering, pattern discovery in sequential data, and Bayesian networks. Prerequisites: STAT 153 or equivalent; CS 251 recommended.

CS 346. Adv Top: Theory of Computation. 3 Credits.
Topics from complexity theory, analysis of algorithms, formal languages, combinatorial and geometric algorithms, and theory of databases, networks, distributed algorithms. May be repeated with Instructor permission. Prerequisite: CS 224, CS 243.

CS 351. Pattern Anyl & Artificial Intell. 3 Credits.
Topics chosen from pattern analysis, clustering, neural networks, planning, natural language understanding. May be repeated for credit with instructor permission. Prerequisites: CS 224, CS 351.

CS 352. Evolutionary Computation. 3 Credits.

CS 355. Statistical Pattern Recognit. 3 Credits.
Analysis of algorithms used for feature selection, density estimation, and pattern classification, including Bayes classifiers, maximum likelihood, nearest neighbors, kernels, discriminants, neural networks, and clustering. Prerequisite: STAT 241 or STAT 251 or Instructor permission. Cross-listed with: STAT 355, CSYS 355.

CS 361. Adv Topics: Systems Software. 3 Credits.
Topics chosen from operating systems, distributed or parallel software systems, real-time systems, experimental systems, software engineering. May be repeated for credit with Instructor permission. Prerequisite: CS 201, CS 222.

CS 363. Computer System Performance. 3 Credits.
Topics chosen from models of computer and operating system performance and queuing systems. May be repeated for credit with Instructor permission. Prerequisite: CS 201, STAT 151.

CS 365. Adv Top: Network Design & Analy. 3 Credits.
Topics chosen from network design, network protocols, network algorithms, and network performance. May be repeated for credit with Instructor permission. Prerequisite: CS 224, CS 265.

CS 374. Computer Graphic & Visualization. 3 Credits.
Topics chosen from computer graphics and visualization, such as rendering, hidden surface removal, animation, data visualization. May be repeated for credit with Instructor permission. Prerequisite: CS 224, CS 274.

CS 381. Seminar. 1 Credit.
Presentations by students, faculty, and guest speakers on advanced topics in Computer Science. May be repeated up to three times for credit.

CS 391. Master’s Thesis Research. 1-18 Credits.

CS 392. Master’s Project. 1-6 Credits.
Prerequisite: Department permission.

CS 394. Independent Study. 1-6 Credits.
Independent readings and investigation under the direction of a faculty member. Prerequisite: Instructor permission.

CS 395. Special Topics. 1-6 Credits.
Subject will vary from year to year. May be repeated for credit. Prerequisite: Instructor permission.

CS 491. Doctoral Dissertation Research. 1-18 Credits.
Credit as arranged.