## Computer Science

**CS 598  Special Topics**  credit: 2 TO 4 hours.

Subject offerings of new and developing areas of knowledge in computer science intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary.

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<th>CRN</th>
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<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>63912</td>
<td>Lecture-Discussion</td>
<td>AGP</td>
<td>09:00 AM - 10:15 AM</td>
<td>MW</td>
<td>1109 - Siebel Center for Comp Sci</td>
<td>Parameswaran, A</td>
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Credit Hours: 4 hours  
Human-in-the-loop Data Mgmt  
Restricted to Graduate - Urbana-Champaign.

The course explores two complementary roles for humans as applied to interactive data analytics: one, where humans are the analysts performing or supervising the analysis; here, the emphasis is on building usable tools for these analysts, and second, where humans are the crowdsourced workers assisting with the computation and analysis; here, the emphasis is on having humans process as little data as possible while gaining maximum benefit. Students will read a number of papers – both important landmark papers as well as cutting-edge papers, act as a discussant for a paper at least once, and complete a semester-long implementation project. Familiarity with basic databases, machine learning, and algorithms expected.

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<td>62086</td>
<td>Lecture-Discussion</td>
<td>AK</td>
<td>09:30 AM - 10:45 AM</td>
<td>WF</td>
<td>1103 - Siebel Center for Comp Sci</td>
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Credit Hours: 4 hours  
Cognitive Engineering  
Restricted to Graduate - Urbana-Champaign.

This course is oriented to engineering and computer science students who would like their research on interactive systems and technologies to be informed by relevant research in the social, behavioral and cognitive sciences, and to students in these sciences who would like their research to be relevant to technology or engineering design. The format will combine group projects and seminar discussions based on readings to be provided from the "Oxford Handbook of Cognitive Engineering" (J.D. Lee & A. Kirlik, 2013, NY: OUP), whose table of contents (list of topics to be covered) can be found on OUP and related websites. Open to graduate students and to senior undergraduates by permission of instructor.

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Credit Hours: 4 hours  
Fast Algorithms & Intrgl Equat  
Restricted to Graduate - Urbana-Champaign.


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<td>DAF</td>
<td>11:00 AM - 11:50 AM</td>
<td>MWF</td>
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<td>Forsyth, D</td>
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Credit Hours: 4 hours  
Geometry for AI Students  
Restricted to Graduate - Urbana-Champaign.
Topic: Computer vision methods for recognizing human activity. One of the great problems in computer vision is to say what people are doing from a picture or a video of them doing it. There are numerous applications, ranging from building models of how people behave to advance architectural design, to surveillance. This problem is very hard indeed, for several reasons. There is not a clean vocabulary for what people are doing, particularly for everyday activity. Often, the interesting stuff is very rare indeed, and people just walk. People can do a lot of different things. Finally, what they're doing looks different when seen from different angles. The course will involve a series of lectures, discussions and paper readings. Class meets in 3405 SC.

Credit Hours: 4 hours
Scripting Lang - Design Implem
Restricted to Graduate - Urbana-Champaign.
Prerequisites: Graduate standing
Scripting languages are widely used for all types of applications. They are the programming languages of the web and are also widely used for scientific computing and data analytics. This course will discuss the main characteristics of scripting languages, their capabilities for parallelism, their impact on productivity and performance, and interpreter and compiler techniques to implement them. Reading assignments will include research papers and class notes.

Credit Hours: 4 hours
Social & Information Networks
Restricted to Graduate - Urbana-Champaign.
Description: Networks are powerful frameworks to analyze large, complex data from vastly diverse sources?social networks such as Twitter, protein-protein interactions in biology, trade markets or information networks such as the World Wide Web. In this class, we shall study and critique recent work in key research areas in networks, including network formation, community discovery, web search, behavior diffusion, markets, epidemics and collective action. Students shall work together in teams to develop algorithms and to build systems to solve emerging research questions.

Credit Hours: 4 hours
Advanced Data Structures
Restricted to Graduate - Urbana-Champaign.
Topic: Advanced Data Structures
This course will survey important developments in data structures that have not (yet) worked their way into the standard computer science curriculum. The precise topics will depend on the interests and background of the course participants. Potential topics include include self-adjusting binary search trees; dynamic trees and graphs; geometric data structures; persistent data structures; kinetic data structures, I/O-efficient and cache-oblivious data structures; data structures for streaming, sketching, and filtering; data structures that beat information-theoretic lower bounds; and applications in computational geometry, optimization, networking, machine learning, databases, and other areas of computer science. Students in all areas of computer science and related disciplines are welcome, including algorithmically mature undergraduates. An undergraduate algorithms course at the level of CS 473 is a prerequisite; however, specific background material will be introduced as needed.

Credit Hours: 4 hours
Machine Learning Computation Bio
Restricted to Graduate - Urbana-Champaign.
This course focuses on modern machine learning techniques in computational biology, including probabilistic modeling, feature selection, graphical models, approximate inference and learning, Monte Carlo methods and neural networks. Students will learn the development of the theoretical concepts for these methods and the applications of these methods to a variety of problems in computational biology. This course is appropriate for graduate students in computer science, bioengineering, mathematics and statistics. Familiarity with basic statistics, probability and algorithms is expected.
### Social Spaces on the Internet

**Credit Hours:** 4 hours  
**Social Spaces on the Internet**  
**Restricted to Graduate - Urbana-Champaign.**  
**Topic:** Social Spaces on the Internet. The Internet is home to a panoply of varieties of human interaction. Social media, interactive games, telepresence, online environments, and simple text e-mails now mediate our normal experiences of education, medicine, politics, business, sociality, collective action, and more. As the Internet has become an infrastructure for social life and society itself, our ability to measure and represent that society is also transforming. In this cross-disciplinary university-wide seminar we will investigate the rise of "culture as data:" that is, the use of widespread networked computation to quantify, analyze, explain, and navigate our relationships to social institutions and each other. Students from all disciplines and colleges are welcome. There are no pre-requisites. This section meets with CAS 587, 30145.

### Software Verification

**Credit Hours:** 4 hours  
**Software Verification**  
**Restricted to Graduate - Urbana-Champaign.**  
**Topic:** Software Verification. Scientific methods for engineering reliable software is a grand challenge in computer science. This course is dedicated to studying state-of-the-art techniques for ensuring high reliability of software. We will study several techniques, ranging from testing, type-checking, static analysis, and formal verification, for ensuing correctness to ensure safety and security. The course will be driven by extensive student presentations of research papers and projects aimed to learn, explore, and perhaps even accomplish new research. The course will involve a project, aligned with the student's research area if possible. Graduate students already working on verification, security, or programming languages, with some basic knowledge of formal methods in verification, are encouraged to attend. The course will differ from CS476 as we will not be using rewriting techniques, and from CS477 as it will be more in-depth and research-oriented.

### Machine Learning for Signal Processing

**Credit Hours:** 4 hours  
**Mach Lrng for Signal Processng**  
**Restricted to Graduate - Urbana-Champaign.**  
**Topic:** Machine Learning for Signal Processing. Prerequisite: Linear algebra, Probability theory. Today we see an increasing need for machines that can understand complex real-world signals, such as speech, images, movies, music, biological and mechanical readings, etc. In this course we will cover the fundamentals of machine learning and signal processing as they pertain to this goal, as well as exciting recent developments. We will learn how to decompose, analyze, classify, detect and consolidate signals, and examine various commonplace operations such as finding faces from camera feeds, organizing personal music collections, designing speech dialog systems and understanding movie content. The course will consist of lectures and student projects and presentations. Students are expected to have a working knowledge of linear algebra, probability theory, and programming skills to carry an implementation of a final project (preferably in MATLAB, but all languages are welcome).
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<tr>
<td>63395</td>
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<td>Kumar, R</td>
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<td>46041</td>
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<td>09:30 AM - 10:45 AM</td>
<td>1109 - Siebel Center for Comp Sci</td>
<td>Abdelzaher, T</td>
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**Data-Driven Design**

Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

Explores the use of data-driven methods to support creative design processes by examining recent work in human-computer interaction, product design, cognitive science, machine learning, graphics, vision, and natural language processing. Students will read and discuss recent papers from these fields, and work in teams on a multi-week project to build data-driven tools to solve real-world design problems. Practical data mining and machine learning knowledge is emphasized: crowdsourcing and web scraping, model and feature selection, parameter tuning. The course has no formal prerequisites, but students should be algorithmically and programmatically mature.

**Sensing in Social Spaces**

Credit Hours: 4 hours
Restricted to Graduate - Urbana-Champaign.

Topic: Sensing in Social Spaces

According to the United Nations, presently 54% of the world population live in cities. This percentage will increase to 66% by 2050. Arguably, the most versatile “sensor” in urban areas is the human observer. Collectively, human observers post over 500 million tweets and over 70 million Instagram photos per day, making social media an interesting new “sensor network” for obtaining insights on a variety of events. This paper-reading course investigates unfolding research challenges and directions in distributed social sensing, overviews the broader landscape of its urban applications, including sustainability, green computing, IoT, and urban cyber-physical systems, discusses common misconceptions, presents the underlying theoretical foundations, and sheds light on related recent technologies and publications. The course includes an experimental project on a social sensing testbed.