- Syllabus

General Information

- **Course Description:**

  Both in our private and in our professional lives, we are inundated with knowledge and information stored and delivered on computer systems. This course will give an overview of the capabilities and limitations of computers to deal with knowledge. It will address the fundamentally different ways in which humans and computers deal with knowledge.The emphasis will be on methods and tools through which computers can support humans in their knowledge-intensive activities, rather than the knowledge processing activities embodied in conventional AI approaches like expert systems. Participants will explore this topic through in-class activities, and a combination of assignments, background research, and team projects.

  In the introductory part, we will examine the nature of knowledge, its role in human cultures, and cognitive aspects of dealing with knowledge. This will be followed by a discussion of knowledge organization schemes, both from a human-centered as well as from a computer-centered perspective.

  Another part will deal with the representation of knowledge in computers. One dilemma here is to bridge the gap between representation methods that are more suitable for computers, but difficult to use by humans, and vice versa. While not at the core of the course, knowledge processing in computers will be briefly addressed, in particular the critical distinction between the syntax-based symbol manipulation suitable for computes, and the way humans process knowledge by automatically interpreting knowledge, especially if it is represented via natural language.

  One of the core parts will be methods for searching and retrieving knowledge stored on computers. This will examine the basics of search technology as used by widely used search engines like Google, but also alternatives and extensions such as the use of meta-data for search and retrieval, and feature-based search (e.g. in images or non-textual documents).

  One critical aspect for usability of knowledge is its presentation to humans, most frequently in text-based form, or through visual means. We will examine visualization methods, alternatives to visualization, and cognitive methods (like the use of metaphors or analogies) to improve the presentation of knowledge to humans. Since knowledge often is considerably more useful when shared among groups, another part will deal with the sharing and exchange of knowledge, and how computers can support related activities.

  The final part will concentrate on the role of knowledge in societies, addressing issues like equal access to knowledge, or the use and abuse of potentially beneficial or dangerous knowledge. The purpose of this course is to examine the way computers can help humans deal with knowledge more effectively. It will explore various aspects of dealing with knowledge contained in computer-based repositories. Textbooks, for example, are traditional repositories of knowledge, relying on text, diagrams, and images as the most often used knowledge presentation techniques. Computers offer several additional venues to present knowledge, such as multimedia (e.g. videos), non-static diagrams and images, and interactive exercises and models. At the core of this course is the investigation of fundamental methods for dealing with knowledge through computers, and the analysis and evaluation of specific computer-based tools for the acquisition, organization, and presentation of knowledge. It consists of 3 lecture and 1 laboratory unit. CSC 481 (Knowledge-Based Systems) and graduate standing, or consent of the instructor.

- **Meeting Times and Places:**

  Monday evening; exact times and location to be determined

- **Instructor:**

Dr. Franz J. Kurfess
Office hours: TBD
Office: 14-218, Phone 756-7179, Email fkurfess@calpoly.edu

- **Goals and Objectives**

  The goal of the course is to understand important problems, challenges, concepts and techniques dealing with the organization and management of knowledge with the help of computers. Upon satisfactory completion of this course, participants are expected to:

  - Understand the fundamental concepts in the study of knowledge and its creation, acquisition, use and management.
  - Appreciate the role and use of knowledge for individuals, as well as organizations and institutions.
  - Be familiar with the basic concepts, methods, techniques, and tools for the support of knowledge-centric activities through computer-based systems.
  - Understand the basic components and functions of computer systems to support humans in dealing with knowledge.
  - Understand the principles of computer-based search and retrieval method for knowledge.
  - Be familiar with different ways of presenting knowledge to users via computers, with particular emphasis on text-oriented and visualization-based methods.
  - Be prepared for further study in the use of computers to support humans dealing with knowledge.
  - Critically evaluate current trends in the use of computers for knowledge-intensive activities, and their manifestations in business and industry.

  In order to achieve these goals, participants will learn how to identify knowledge essential for a domain and some important tasks in the domain. The will analyze different ways of using computers to capture, store, process, and present knowledge. Students will gain experience with computer programs systems of varying complexities that enable and support knowledge-intensive activities. The core aspect of these systems is to allow "knowledge workers" to deal with the ever-increasing amount of knowledge and information that becomes available and necessary for many tasks. This includes support for traditional tasks related to knowledge management, such as the grouping of related documents into categories or hierarchies, the generation of dictionaries and ontologies, or the construction of knowledge networks through references and citations.

  In addition, methods and techniques that rely heavily on features offered by computer-based systems can be used to augment the human-centered tasks. Examples for such approaches are collaborative filtering, automatic content- and usage-based categorization of documents, the categorization of non-textual information such as images, drawings or sound, or the extraction of relevant keywords from documents.

  In contrast to *knowledge-based systems*, where computers are actively involved in the manipulation and generation of knowledge, the goal here is to use computers as tools for activities mainly performed or directed by humans.

Textbooks and Course Material

To the best of my knowledge, there are no suitable textbooks available for such a course. Most of the books and articles on "knowledge management" are written with a business perspective, usually concentrating on the role of knowledge in corporations. Textbooks on "Knowledge-based Systems" and "Artificial Intelligence" mostly concentrate on the direct representation and manipulation of knowledge through computers, rather than on the support that computers can offer for human-centered knowledge management.

Further material will distributed in class, or made available through pointers to relevant Web pages. A collection of interesting items that I have encountered over the last few years is available as a Google notebook KM Nuggets. You may find additional material in the respective Google notebooks for the AI and HCI classes: AI Nuggets and HCI Nuggets.

Lecture Notes

The files with the PowerPoint slides will be made available via the course schedule.

Course Administration

Blackboard will be used for some administrative aspects of this class, such as distribution and submission of assignments, and for grading. We may also explore alternatives to Blackboard (such as wikis, Google Docs, or similar tools), in particular for the team projects and research papers.

Class Participation

This class will rely on interactive classroom activities, such as participation in group discussions, presentation of ideas and results (from related publication, class or assignments), leading discussions on selected readings, providing written summary materials (e.g. via Blackboard or other tools), etc. Success in this class depends on regular attendance, preparation of assigned readings and homework exercises, as well as a level of professionalism in the class presentations. Peer evaluations of papers and presentations may be included as part of the grade. We will establish more concrete evaluation criteria for participation in class.

Policy on Late Work and Extensions

My general policy for late submissions is a penalty of 10% per late business day. If there are situations where you have difficulties meeting a deadline, it is better to contact me in advance in order to discuss possible solutions.

Some of the graded work in this class depends strongly on presentations given by the participants. Once a team or individual has committed to a date for the presentation, extensions or changes in the dates may have to be restricted to documented medical or emergency reasons. With my approval, participants may swap presentations.

Grading Policy

" align="right">

Activity	Percentage
Assignments	30%
Research Presentation and Paper	30%
Team Project	30%
Class Participation	10%

This table gives an overview of the calculation of the grades. I reserve the right, however, to change the formula used. Please note that the project consists of several parts, which will be evaluated separately. With my approval, the topics for the assignments and the presentation/paper may be coordinated with your project topic. The project usually will be done in teams, and the performance of the team as a whole will be graded unless there is a clear disparity in the contributions of the individual team members. Should this be the case, I might ask for additional documentation like source code, work sheets, email messages, or draft copies of documentation to evaluate individual contributions.