

COURSE DESCRIPTION

Department and Course Number: C Sc 219

Course Coordinator: Meiliu Lu

Course Title: Machine Learning

Total Credits: 3

Current Catalog Description: Introduction to major paradigms and methods of machine learning. Inductive learning, explanation-based learning, classifier systems and genetic algorithms, analogical reasoning, case-based learning, connectionist learning, data driven approaches to empirical discovery, and basis of learning theory. Focus is on representative systems that have been built. Prerequisite: graduate standing.

Textbook: S. M. Weiss and C. A. Kulikowski, Computer Systems That Learn, Morgan Kaufmann, 1991

References: J. W. Shavlik and T. G. Dietterich, Readings in Machine Learning, Morgan Kaufmann, 1990;

J. R. Quinlan, C4.5: Programs for Machine Learning, Morgan Kaufmann, 1993

Course Goals:

1. To present an overview of machine learning.
2. To study how to estimate the performance of a learning system.
3. To introduce basic paradigms: rule induction, case-based reasoning, neural networks, genetic algorithms, and analytic learning methods.
4. To introduce applications of machine learning through case studies in domains such as knowledge discovery in database, diagnosis, process control, scheduling, classification, and prediction.

Prerequisites by Topic

1. A knowledge of some higher-level programming language.
2. Familiarity with the fundamental concepts of data structures and algorithms.
3. Understanding of basic discrete mathematics that includes set theory, functions, relations, and a course in statistics and probability.

Major Topics Covered in the Course

1. Machine learning and AI: the contributions of AI to learning techniques (3 hours)
2. Theoretical foundations for machine learning (6 hours)
3. Inductive paradigm: decision tree algorithms – ID3, C4.5 (9 hours)
4. Analytic paradigm: Explanation-Based Learning (3 hours)
5. Genetic paradigm: classifier systems, genetic algorithms, genetic programming (6 hours)
6. Connectionist paradigm: neural net models, perceptron, backpropagation (6 hours)
7. Case-Based Reasoning (3 hours)
8. Case Studies: PRODIGY system, SOAR system, and other existing system designs (4 hours)

9. Cross-paradigmatic observations: comparisons of learning methods, examples of hybrid system designs, future research directions (4 hours)
10. Tests (3 hours)

Laboratory Projects (specify number of weeks on each):

No significant component.

Estimate CSAB Category Content

	<u>CORE</u>	<u>ADVANCED</u>
Data Structures	_____	
Algorithms	_____	
Software Design	_____	
Computer Organization and Architecture	_____	
Concept of Programming Languages	_____	

Oral and Written Communication

Every student is required to make an oral presentation of typically 15 – 20 minutes duration, and to submit a written report of 5-10 pages on a selected topic.

Social and Ethical Issues

No significant component.

Theoretical Content

Approximately 50% of the lecture time is spent on theoretical topics.

Analysis and Design

Students learn the methods and algorithms primarily through problem-type illustrative examples that show the motivation behind the concepts, as well as their connection to the real world problems. Homework, presentation, and term project contribute to a major part of their learning to design process.