

Supervised Learning

Instructor: Prof. Jianlin Cheng

Department: Computer Science, University of Missouri, Columbia

Location: EBW 355; **Time:** TuTh 4:00 pm - 5:15 pm; **Office Hours:** TuTh 3:00 pm - 4:00 pm;

Semester: Fall 2011

Prerequisite: some machine learning or data mining background

Course web site: http://www.cs.missouri.edu/~chengji/supervised_learning/

Text Book: Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007.

Objectives:

This course covers the advanced supervised machine learning techniques used for classification and regression. The course intends to achieve two major goals. The first goal is to help students understand the theories of advanced machine learning methods. The second goal is to teach students how to apply these methods to solve a variety of real-world large-scale data analysis and pattern recognition problems such as text classification, image object recognition, and speech recognition.

Topics:

1. Introduction to machine learning and Bayes optimal learning rule
2. Learning parametric distributions (Maximum Likelihood Estimation (MLE) and Maximum a Posterior estimation (MAP))
3. MLE vs MAP, Bayes Optimal Classifier, Naïve Bayes Classifier
4. Generative vs. discriminative classifiers (logistic regression, linear regression, and polynomial regression)
5. Nonparametric methods (Kernel density estimation and kernel regression)
6. Model selection (overfitting, bias-variance tradeoff, cross validation, structural risk minimization, complexity regularization, information criteria)
7. Boosting and Bagging
8. Support vector machines (maximize margin, multi-class SVM, constrained optimization, Dual SVM, kernel trick)
9. Graphical models – Hidden Markov model
10. Graphical models – directed models, factorization, local Markov assumption, D-separation, representation theorem
11. Graphical models – undirected models, factorization, graph separation, variable elimination
12. Graphical models – learning CPTs, learning structure
13. Semi-supervised learning

Homework:

The course has several supervised machine learning assignments (either theoretical or practical) and a comprehensive project of applying supervised learning methods to a real-world problem. Students are encouraged to propose a group project to work on. Each group may have up to four students.

Grading:

Assignment (40%), project report (30%), project representation (30%)

A new grade scale for graduate courses (A+, A, A-, B+, B, B-, C+, C, C-, and F) is applied.

Intellectual Pluralism

The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Institute Director or Director of the Office of Students Rights and Responsibilities (<http://osrr.missouri.edu/>). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

Attendance Policy

Attendance is essential to understanding the course material and is required. As in the workplace, if you cannot attend a class session due to illness or emergency please call or e-mail before the class to inform the instructor of your absence.

Academic Dishonesty

Academic integrity is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.

ADA

If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office.

Office location: _____ Office hours: _____

To request academic accommodations (for example, a note taker), students must also register with the Office of Disability Services, (<http://disabilityservices.missouri.edu>), S5 Memorial Union, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage