Sample syllabus - students will receive the detailed syllabus at the beginning of the semester they are enrolled in the course.

CS 598 Practical Statistical Learning

Course Description

This course provides an introduction to modern techniques for statistical analysis of complex and massive data. Examples of these are model selection for regression/classification, nonparametric models including splines and kernel models, regularization, dimension reduction, and clustering analysis. Applications are discussed as well as computation and theoretical foundations.

Course Prerequisite

Knowledge of basic multivariate calculus, statistical inference, and linear algebra. You should be comfortable with the following concepts: probability distribution functions, expectations, conditional distributions, likelihood functions, random samples, estimators, and linear regression models.

Prior completion of one of the following is required before enrolled in this course:
CS 498 AML, CS 445 Computational Photography, CS 598 Deep Learning for Healtchare, CS 410, CS 412, or STAT 420

Course Goals

By the end of the course, you will be able to:

- Familiarize yourself with a broad range of approaches and techniques in machine learning.
- Have a deeper understanding of major algorithms and techniques in machine learning.
- Build analytics pipelines for regression problems.
- Build analytics pipelines for classification problems.
- Build analytics pipelines for recommendation problems.

Textbook

There is no required textbook for this course.

Regarding statistical approaches to machine learning, there are two popular textbooks suggested as a resource.

- An Introduction to Statistical Learning with Applications in R (basic)
- The Elements of Statistical Learning: Data Mining, Inference, and Prediction (more advanced)

You may also want to view the YouTube videos associated with the first book, as an additional resource.

Course Schedule

Week		Topic	Relevant Concepts and Techniques	Assignments
1		Introduction	Introduction to Statistical Learning, Variance and bias trade-off, Model evaluation.	Week 1 Quiz Coding 1 assigned
2		Linear Regression	Linear regression review, Model assessment, Some practical issues.	Week 2 Quiz Coding 1 due
3		Regularization	Subset selection, Ridge regression, Lasso, Principal components regression	Week 3 Quiz Coding 2 assigned
4		Tree Models	Regression tree, Pruning, Tree ensembles	Week 4 Quiz Project #1: Housing Data (start) Coding 2 Due
5		Nonlinear Regression	Polynomial regression, Splines, Local smoothers	Week 5 Quiz Project #2: Walmart stores (start)
6		Clustering I	Kmeans, Spectral clustering, Clustering evaluation	Week 6 Quiz Coding 3 assigned
7		Clustering II	Model-based clustering, EM algorithm, Latent Dirichlet Allocation model	Coding 3 Due
8		*Project Work Time*	---	Project #1: Housing Data (due)
9		Classification	Overview, Classification theory and evaluation, Naïve Bayes classifers	Week 9 Quiz
10		Linear Classifier	Logistic regression with regularization, Linear discriminant analysis	Week 10 Quiz
11		SVM	Support vector machines	Week 11 Quiz Project #3: Lending Club (start) Project #2: Walmart stores (due)
12		Classification Tree and Boosting		Week 12 Quiz Project #4 Sentiment analysis (start)

13		THANKSGIVING BREAK; NO CLASS	---	---
14		Recommendation	Recommender systems	Coding 4 assigned Project #3: Lending Club (due)
15		Large Scale Machine Learning	SGD with L1 penalty, Online algorithm, Deep learning	Coding 4 due
16		*Project Work Time*	---	Project #4 Sentiment analysis (due)

Elements of This Course

The course is comprised of the following elements:

- Video Lectures
- Graded Quizzes (10 total)
- Coding Assignments (TBD total)
- Mini-Projects (4 total)

Assignment Deadlines

For all assignment deadlines, please refer to the Course Deadlines, Late Policy, and Academic Calendar page.

Grading Distribution and Scale

Grading Distribution

Your final grade will be calculated based on the activities listed in the table below. Your official final course grade will be listed in Enterprise. The course grade you see displayed in Coursera may not match your official final course grade.

Assignment	Percentage
Graded Quizzes	40%
Coding Assignments	[[[TBD]]]
Mini-Projects	[[[60%]]]
Total	100%

Grading Scale

Total	Grade
90 - 100	A (A-, A, A+)

80 - 89	B (B-, B, B+)
70 - 79	C (C-, C, C+)
60 – 69	D (D-, D, D+)
Below 60	F

Student Code and Policies

A student at the University of Illinois at the Urbana-Champaign campus is a member of a University community of which all members have at least the rights and responsibilities common to all citizens, free from institutional censorship; affiliation with the University as a student does not diminish the rights or responsibilities held by a student or any other community member as a citizen of larger communities of the state, the nation, and the world. See the University of Illinois Student Code for more information.

Academic Integrity

All students are expected to abide by the campus regulations on academic integrity found in the Student Code of Conduct. These standards will be enforced and infractions of these rules will not be tolerated in this course. Sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. We will be actively looking for violations of this policy in homework and project submissions. Any violation will be punished as severely as possible with sanctions and penalties typically ranging from a failing grade on this assignment up to a failing grade in the course, including a letter of the offending infraction kept in the student's permanent university record.

Again, a good rule of thumb: *Keep every typed word and piece of code your own*. If you think you are operating in a gray area, you probably are. If you would like clarification on specifics, please contact the course staff.

Disability Accommodations

Students with learning, physical, or other disabilities requiring assistance should contact the instructor as soon as possible. If you're unsure if this applies to you or think it may, please contact the instructor and Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, via phone at (217) 333-1970, or via email at disability@illinois.edu.