Course Outline

STAT 841 / 441, CM 763 / 463
Statistical Learning-Classification
Fall 2010

Instructor:
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Lectures: (11:30-12:50TTh, MC 4063)

Prerequisites:
Grads: none for STATS/CS/ECE/SYDE grad students, instructor permission otherwise
Undergrads: STAT 231/241

Course Description: Classification, also known as pattern recognition is the problem of predicting a discrete random variable $Y$ from another random variable $X$. The random variable $X$ may take many different forms from Digital image libraries and text corpora to gene expression microarrays and financial time series.

This course provides a comprehensive introduction to the problem of classification and pattern recognition and reflects recent developments in the field.

Required Textbook: There is no required textbook for the class. Two recommended books that cover the similar material are:

- Hastie, Tibshirani, Friedman *Elements of Statistical Learning*
Additional references: For more on the theory, students may refer to:

- Devroye, Györfi, and Lugosi *A Probabilistic Theory of Pattern Recognition*
- Shawe-Taylor and Cristianini *Kernel Methods for Pattern Analysis.*

Tentative topics::

- Feature selection
- Feature extraction dimensionality reduction)
- Error rates and the Bayes classifier
- Gaussian and linear classifier
- Linear regression and logistic regression
- Neural networks
- Radial basis function networks
- Naive Bayes
- Trees
- Assessing error rates and model selection
- Support vector machines
- Kernel methods
- k-nearest neighbors
- Bagging
- Boosting
- Semi-supervised learning for classification
- Metric learning for classification
Evaluation: (tentative)

Assignments 40% (10% each)
Final project 40%
WikiCourseNote 20% (10% primary contribution)
(10% General contribution)

Details will be discussed in the first lecture

UW Academic Policies:

Although it’s unlikely to be of use in Stat 841/441, CM 763/463, the following are the University of Waterloo’s Academic Policies that all students and professors must go by.

Persons with Disabilities: The office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132 collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with OPD at the start of each academic term.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and grievances, Section 4.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offences and types of penalties, students should refer to: Policy 71 - Student Discipline.

Avoiding Academic Offences: Most students are unaware of the line between acceptable and unacceptable academic behaviour, especially when discussing assignments with classmates and using the work of other students. For information on commonly misunderstood academic offences and how to avoid them, students should refer to the Faculty of Mathematics Cheating and Student Academic Discipline Policy.

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals.