

MATH 783: TOPICS IN STATISTICS 2
STATISTICAL LEARNING AND DATA MINING:
MODERN MULTIVARIATE ANALYSIS

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Textbooks : *The Elements of Statistical Learning: Data Mining, Inference, and Prediction.*
Second Edition, 2009, Springer.
Hastie, Tibshirani, Friedman
www-stat.stanford.edu/~tibs/ElemStatLearn/
Modern Multivariate Statistical Techniques: Regression, Classification, and Manifold Learning
2008, Springer
Izenman
www.springer.com/statistics/statistical+theory+and+methods/book/978-0-387-78188-4

Evaluation : 3 Mini-projects (25 %)
Seminar presentation (15 %)
Final Project (60 %)

TARGET SYLLABUS

1. Principles of Statistical Learning
 - Loss Function and Optimization
 - Bias-variance trade-off, model selection criteria
2. Modern aspects of regression modelling
 - Ridge regression and Bayesian linear models
 - Lasso regression, LARS, Dantzig
 - Semi-parametric regression and functional data analysis
 - Nonparametric regression and smoothing
3. Supervised Learning and Discrimination
 - Discrimination techniques: Logistic regression, linear and quadratic discrimination
 - Nonparametric logistic regression
 - Separating hyperplanes and neural nets
 - Additive trees, MARS, and CART
4. Ensemble learning and other extensions
 - Bagging and boosting
 - EM algorithm and applications in semi-supervised learning
 - High-dimensional situations
5. Unsupervised Learning
 - Cluster analysis
 - Clustering with variable selection
 - Model-based clustering
 - Bayesian parametric clustering
 - Bayesian functional clustering
 - Bayesian nonparametric models and Dirichlet processes

EVALUATION: DETAILS

Please note that the method of evaluation for this class will be **on the following basis only**:

Three Mini Projects (25 % total, equally weighted)
Seminar presentation (15 %)
Final Project (60 %)

ACADEMIC INTEGRITY

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see

<http://www.mcgill.ca/integrity/>

for more information).

- In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.
- In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

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