# Statistical Learning
# Syllabus

Nick Beauchamp
NYU Department of Politics

Email: nick.beauchamp@nyu.edu
Office Hours: Monday, Wednesday, 2-4pm.

This is a class on statistical or machine learning. The primary texts will be Bishop's *Pattern Recognition and Machine Learning* and Hastie et. al.'s *The Elements of Statistical Learning.* There is considerable overlap in material between these two books, but I have found that two expositions can clarify ideas much better than one, especially given their varying examples and topics of focus. We will be approaching these topics, traditionally the domain of computer science, from the point of view of political science. Each week students will be expected to generate examples and project ideas that relate the material to problems and datasets specific to political science, and my own work on text analysis will provide a number of such examples throughout the course. In addition to weekly assignments, students will be expected to begin developing their projects from the start, and will be asked for frequent progress reports during the quarter. These methods provide a wealth of opportunities for innovative research in political science, particularly for anyone with large, complex data sets, dense time-series data, or a belief that their model may be highly nonlinear.

Reading List

C.M. Bishop. *Pattern Recognition and Machine Learning.* Springer New York, 2006

T. Hastie, R. Tibshirani, and J.H. Friedman. *The Elements of Statistical Learning.* Springer, 2009

Week 1: Introduction to Supervised Learning

Hastie, Ch. 2.

Week 2: Linear Methods: Shrinkage and LASSO

Hastie, Ch. 3

Week 3: Kernel Methods

Bishop, Ch. 6
Hastie, Ch. 6

Week 4: Neural Networks

Bishop, Ch. 5
Hastie, Ch. 11

Week 5: Support Vector Machines

Bishop, Ch. 7

Hastie, Ch. 12

Week 6: Unsupervised Learning: Clustering, Scaling, Principal Components

Hastie, Ch. 14

Week 7: Graphical Models

Bishop, Ch. 8, 13
Hastie, Ch. 17

Week 8: Combining Models 1: Model averaging, boosting

Hastie, Ch. 8-10
Bishop, Ch. 14

Week 9: Combining Models 2: Random Forests, Ensembles

Hastie, Ch. 15-16

Week 10: Student projects and wrap-up