SYST/OR 568 Applied Predictive Analytics

Fall 2017

George Mason University
Department of Systems Engineering and Operations Research

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Course Description: Introduces predictive analytics with applications in engineering, business, health care, marketing, and social economic areas. Topics include cross-sectional data processing, data visualization, correlation, linear and multiple regressions, classification and clustering, factor models, and predictive modeling performance analysis. Provides a foundation of basic theory and methodology with applied examples to analyze large engineering, social, and econometric data for predictive decision making. Hands-on experiments with *R* will be emphasized.

Prerequisites: Graduate standing (Undergraduate engineering math: Calculus, probability theory, statistics, and some basic computer programming skills.)

Textbooks:
Required:

Max Kuhn and Kjell Johnson, "*Applied Predictive Modeling*," Springer, 2013.

Recommended References:

1. W. N. Venables, D. M. Smith, and the R Core Team, "*An Introduction to R*," http://cran.r-project.org/doc/manuals/R-intro.pdf, CRAN, 2014.
1. Rob Hyndman and George Athanasopoulos, "*Forecasting: Principles and Practice*," OTexts, 2013.
2. Dean Abbott, "*Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst*," Wiley, 2014.
3. Thomas Miller, "*Modeling Techniques in Predictive Analytics: Business Problems and Solutions with R*," Pearson FT Press, 2013.
4. Chris Brooks, "*Introductory Econometrics for Finance*," 3rd edition, Cambridge, 2014.
5. Ruey Tsay, "*Introduction to Analysis of Financial Data with R*," Wiley, 2013.

6. Rene Carmona, "*Statistical Analysis of Financial Data in R*," Springler, 2014.
7. Jeffrey M. Wooldridge, "*Introductory Econometrics: A Modern Approach*," South-Western College Pub, 2012.

Optional Readings:

1. Foster Provost and Tom Fawcett, "Data Science for Business," O'Reilly, 2013.
2. Eric Siegel, "Predictive Analytics," Wiley, 2013.

Assignments and Exams:

There will be five hand-in assignments during the semester, a mini term project, as well as a mid-term exam and a final exam, both in-class. The exams will not be open book. However, you will be permitted a two-sided "cheat sheet" with notes and/or formulae.

Grading:

The assignments, mid-term exam, and term project constitute 30%, 30%, and 40% of the grades respectively.

Topics:

Unit #1:	Introduction; review of predictive modeling, inferential statistics, and *R* lab
Unit #2:	Predictive modeling and data pre-processing
Unit #3:	Exploratory data analysis; visualization, and kernel density
Unit #4:	Descriptive modeling: univariate and multivariate statistical models
Unit #5:	Regression models: linear prediction in business analytics and econometrics
Unit #6:	Nonlinear regression models and its applications in predictive analytics
Unit #7:	Linear classification models and discriminant analysis
Unit #8:	Nonlinear classification model, clustering, and classification tree
Unit #9:	Factor models and principal components