THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC

Department of Decision Sciences
DNSC 6314: Machine Learning I

Instructor: Patrick Hall, Visiting Faculty

Email: jphall@gwu.edu

Class Time & Location: **Virtual, Webex:** https://gwu.webex.com/meet/jphall
In-person: M, DUQUES 254, 4:30PM - 7:00PM (Section 10)
M, FNGR 210, 7:10PM - 9:40PM (Section 11)

Office Hours: T, Webex, 8:30 PM

Pre-requisite courses: Stochastics for Analytics I, Statistics for Analytics, or equivalent (JUD/DAD), MSBA Program Candidacy or instructor approval.

Class website: https://jphall663.github.io/GWU_ML/

Course Description
This course provides an introduction to machine learning (ML) and supervised learning. Techniques covered may include feature engineering, penalized regression, decision trees, neural networks and other common estimation techniques from the ML tradition. Class sessions include lectures and code examples. Assignments focus on theoretical basics, and practical foundations in an ongoing predictive modeling contest. After completing this course students will have a strong understanding of predictive modeling using ML, some understanding of the associated risks and pitfalls, and exposure to technologies like Python, git, GitHub, and Colab.

Recommended Texts
- *Elements of Statistical Learning*, by Trevor Hastie, Robert Tibshirani, and Jerome Friedman
- *Introduction to Data Mining* by Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, and Vipin Kumar
- *Pattern Recognition and Machine Learning*, by Christopher Bishop (Freely available PDF)
- *A Primer on Scientific Programming with Python*, by Hans Petter Langtangen
    - Related Free Materials
    - GWU Libraries EBook

Tentative Course Calendar

Class 1 (Virtual) 10 Jan 22	Preliminaries, Feature Engineering and Feature Selection
Class 2 24 Jan 22	Penalized Regression / Week 1 Assignment Due
Class 3 31 Jan 22	Model Assessment and Selection / Week 2 Assignment Due
Class 4 7 Feb 22	Decision Trees / Week 3 Assignment Due
Class 5 14 Feb 22	Artificial Neural Networks (ANN) / Week 4 Assignment Due
Class 6 28 Feb 22	Other Estimators: Support Vector Machines (SVM) and *k*-Nearest-Neighbors (kNN) / Week 5 Assignment Due
Class 7 7 Mar 22	Final Exam / Week 6 Assignment Due

Learning Outcomes
As a result of completing this course, students will:

- Gain knowledge of ML to include algorithmic foundations of penalized regression, decision trees, neural networks, and other supervised learning algorithms.
- Gain experience with real-world software packages like h2o and XGBoost.
- Familiarize themselves with important ML communities and technologies like Colab and GitHub.

Attendance and Participation
Students are expected to participate in group-based homework assignments, class lectures, and class coding demonstrations. Class participation will be measured by a combination of class attendance, office hour attendance, peer evaluations and communications with the instructor. Despite any difficulties inherent to remote instruction, students are expected to participate in class activities as much as possible.

Reading Assignments
Reading assignments will generally consist of sections from recommended texts, but may also include relevant scientific or popular media articles. Students are responsible for studying and understanding all assigned materials. If reading generates questions that are not discussed in class, the student has the responsibility of addressing the instructor or raising the issue in an appropriate digital medium. Any reading assignment is fair game for the final exam.

Additional Assignments

- **In class Participation:** As this will be a short, high-intensity 6 week course, student attendance and participation in class is expected and will contribute to final grades.
- **Weekly Homework Assignments:** Group homework assignments will address basic theoretical concepts and practical applications through an ongoing predictive modeling

project. Students are expected to write code and generate other artifacts (i.e. notebooks, visualizations, markdown) and to store them in a publicly accessible GitHub repository (or other public location, i.e. Kaggle kernel, personal website)

- **Final Exam:** A cumulative, written final exam will be held during the last class period. If COVID protocols prevent in-person gatherings at that time, the final exam will be replaced by a more in-depth group project.

Grading Contributions

In-class participation and/or peer evaluations	10%
Final exam	30%
Homework	60%

Numeric Grade Scale

≥ 94.00	A
90-93.99...	A-
87-89.99...	B+
84-86.99...	B
80-83.99...	B-
77-79.99...	C+
74-76.99...	C
70-73.99...	C-
≤ 69.99...	F

University Policy on Observance of Religious Holidays

In accordance with University policy, students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance. For details and policy, see: http://provost.gwu.edu/policies-procedures-and-guidelines.

Academic Integrity

Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For details and complete code, see: http://studentconduct.gwu.edu/code-academic-integrity. Violations of the academic integrity code can result in serious disciplinary action.

Contact Hours Statement
This 1.5-credit course includes 2.5 hours of direct instruction (class meetings) and a minimum of 5 hours of independent learning (outside of class), totaling a minimum of 7.5 hours per week, totaling approximately 52 hours for the 7-week term, including exams period.

Disability Support Services (DSS)
Any student who may need accommodation based on the potential impact of a disability should contact Disability Support Services in Rome Hall, 801 22nd Street, NW, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information see: http://disabilitysupport.gwu.edu. Phone: 202-994-8250.

Counseling and Psychological Services
GW's Student Health Center offers counseling and psychological services, supporting mental health and personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. For additional information see http://healthcenter.gwu.edu/counseling-and-psychological-services. Phone: 202-994-5300.

Safety and Security
In an emergency: call GWPD 202-994-6111 or 911. For situation-specific actions: review the Emergency Response Handbook: http://safety.gwu.edu/emergency-response-handbook. In an active violence situation: Get Out, Hide Out, or Take Out: http://go.gwu.edu/shooterprep. Stay informed: http://safety.gwu.edu/stay-informed.

Class Policy Changes
The instructor reserves the right to revise any items on this syllabus, including, but not limited to any class policy, course outline or schedule, grading policy, test date, etc. Note that the requirements for deliverables may be clarified and expanded in class, via email, or on Blackboard. Students are expected to complete the deliverables incorporating such additions.