NYU TANDON SCHOOL OF ENGINEERING
Finance & Risk Engineering

FRE-GY 7773
Machine Learning

Instructor Information

- Sebastien Donadio, Adjust Professor

Course Information

- FRE 9733
- Machine Learning
- This course covers the theory of Machine Learning and its fundamental applications in the field of Financial Engineering. Supervised, unsupervised, and reinforcement learning paradigms are discussed.
- This class will meet on Wednesday between 11a and 1:30p

Course Overview and Goals

This course is intended to teach basic machine learning concepts and techniques to students desiring to work in the financial sector. It is tailored for students without prior programming experience. At the end of this class, students will have the necessary programming and machine learning skills to be successful in their daily activities.

Upon completion of this course, students will be able to:

- Use machine learning in a context of algorithmic trading.

Class Project

You will receive the group composition for the class project at the beginning of the semester. It will constitute 35% of the course grade.

The class projects will be divided into 2 parts:

1- Theoretical part: gives 1 10-20 minute group presentation / week on the weekly topic.

Example: On Week2, we cover PCA. The assigned group will make a 15-20 minute presentation on the topic of PCA.

2- Practical part: you will create a trading strategy. You will study 6 different ML methods

Course Requirements

Class Participation

This course meets once a week for lectures and once a week for an optional TA session. Attendance in class is strongly encouraged. Most of the coursework revolves around 1 programming assignment, as the primary focus will be for students to code and learn machine learning.

Assignments

We will assign simple written problems at the end of each lecture that will be due the following week. The goal of these assignments is to make you understand the course better. Some content can be hard to appreciate in class, and we encourage you to work them at home the same day. They will constitute 25% of the course grade.

Suggested Readings

• Introduction to Machine Learning with Python: A Guide for Data Scientists
By Andreas C. Müller, Sarah Guido
• C. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag, 2006.
• I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, The MIT Press, 2016.
• A. Gé ron, Hands-On Machine Learning with Scikit-Learn and Tensorflow, O'Reilly Media, 2017.

Grading of Assignments

The grade for this course will be determined according to the following formula:

Assignments/Activities	% of Final Grade
Weekly Programming assignments	25%
Course Project:	35%

Mid-Term	15%
Final Exam	25%

Letter Grades

Letter grades for the entire course will be assigned as follows:

Letter Grade	Points	Percent
A	4.00	Example: 92.5% and higher
A-	3.67	Example: 90.0 – 92.49%
B+	3.33	Example: 87.5% - 89.99%
B	3.00	Example: 82.5% - 87.49%
B-	2.67	Example: 80% - 82.49%
C+	2.33	Example: 77.5% - 79.99%
C	2.00	Example: 70.0% - 77.49%
F	.00	Example: 69.99% and lower

Course Schedule

Topics and Assignments

Week/Date	Topic	Assignment Due
Week 1	General introduction of ML and algorithmic trading	Week2
Week2	LDA/PCA	Week3
Week3	Shrinkage / Regularization Lasso regression	Week4
Week4	Cross validation	Week5
Week5	Tree regression / Tree classification	Week6
Week6	Association rules	Week8
Week8	Bagging / Random Forest / Boosting	Week9
Week9	Cluster analysis	Week10
Week10	Support Vector Machine	Week11

Week11	Graphical Model	Week12
Week12	Neural network	Week13
Week13	Deep learning	Week14
Week14	Genetic algorithm	Week15

Exams

- Week 7: Midterm
- Week 15: Final Exam

Course Materials

Resources

- **Access your course materials**: NYU Classes (nyu.edu/its/classes)
- **Databases, journal articles, and more**: Bern Dibner Library (library.nyu.edu)
  NYU Virtual Business Library (guides.nyu.edu/vbl)
- **Obtain 24/7 technology assistance:** Tandon IT Help Desk (soehelpdesk@nyu.edu, 646.997.3123)
  NYU IT Service Desk (AskIT@nyu.edu, 212-998-3333)

Policies

Academic Misconduct

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School's rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School's Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:
    1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person's work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.
    2. Fabrication: including but not limited to, falsifying experimental data and/or citations.
    3. Plagiarism: Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.

4. Unauthorized collaboration: working together on work that was meant to be done individually.
5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission have been received from the course instructor(s) or research adviser involved.
6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.

Disability Disclosure Statement

Academic accommodations are available for students with disabilities. Please contact the **Moses Center for Students with Disabilities** (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

Inclusion Statement

The NYU Tandon School values an inclusive and equitable environment for all our students. I hope to foster a sense of community in this class and consider it a place where individuals of all backgrounds, beliefs, ethnicities, national origins, gender identities, sexual orientations, religious and political affiliations, and abilities will be treated with respect. It is my intent that all students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. If this standard is not being upheld, please feel free to speak with me.