NYU TANDON SCHOOL OF ENGINEERING

Finance & Risk Engineering

FRE 7773,
Machine Learning in Finance

Instructor Information

- Dr. Jacopo Tagliabue, Adjunct Faculty
- Dr. Ethan Rosenthal, Adjunct Faculty
- TA: Guojun Chen, gc2817@nyu.edu
- **Address**: NYU Tandon School of Engineering, One MetroTech Center, 19th floor, Brooklyn, NY 11201.
- **Phone**: 646 997 3623 (for Tandon School); contact via email please
- **Email:** jacopo.tagliabue@nyu.edu & epr8655@nyu.edu

Course Information

- **Course Number**: FRE 7773
- **Title**: Machine Learning in Finance
- **Description**: Overview of machine learning, with emphasis on practical industrial applications
- **Prerequisite**: Undergraduate level understanding of probability, linear algebra and familiarity with Python programming is expected
- **Class**: Friday 6-8:30 PM

Course Overview and Goals

This course is an introduction to Machine Learning concepts and Machine Learning Operations (MLOps) best practices, with applications to the financial industry. Leveraging the professors' collective experience in academia and industry, this course is designed to prepare students for data science situations they may encounter in their first few years at a financial institution, and give them hands-on exposure to real-world tools, including cloud computing and popular open source libraries.

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

- Train and test predictive models using Machine Learning in Python, and deploy them to power simple apps.

- Understand and appreciate the full lifecycle of Machine Learning models in industry, including software best practices, testing methodologies and basic deployment techniques.
- Have an understanding of the landscape Machine Learning and MLOps in order to further pursue individual topics of interest.

Course Requirements

Class Participation

Students are expected to attend all classes and participate in class discussions. Being a practical course, students are expected to have their laptop during class.

Assignments

6 HWs (70%). Generally Python /Jupyter based.

Tests & Quizzes

Final Project (30%) with presentation to class.

Assigned Readings

Each lecture will typically have specific readings (a paper, a blog post, open source code) assigned prior to class.

Grading of Assignments

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

Assignments/Activities	% of Final Grade
Assignment (6 Total)	70%
Final Project	30%

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

View Grades

Grades are available to students on NYU Classes.

Course Schedule

Topics and Assignments

Week/Date	Topic	Reading	Assignment Due

Week 1 9/2/2022	Course presentation; ML in Finance Use Cases; tools overview	TBD	None
Week 2 9/9/2022	Linear Models for Regression	TBD	None
Week 3 9/16/2022	Feature Engineering and Model Selection	TBD	HW1
Week 4 9/23/2022	Linear Models for Classification	TBD	None
Week 5 9/30/2022	Ensemble Models	TBD	HW2
Week 6 10/7/2022	A Case Study: Fraud Detection	TBD	None
Week 7 10/14/2022	Time Series Machine Learning; validation of students' projects themes.	Note: teams for the final project are finalized	HW3
Week 8 10/21/2022	Second half overview; MLOps and RecSys	TBD	None
Week 9 10/28/2022	From Theory to Practice: how to organize ML projects	TBD	HW4
Week 10 11/4/2022	Recommender Systems I	TBD	None
Week 11 11/11/2022	Student project update; Recommender Systems II	TBD	HW5
Week 12 11/18/2022	ML pipelines: the full lifecycle of ML models	TBD	None
Week 13 12/2/2022	Debugging and testing models	TBD	HW6

Week 14 12/9/20222	Project demo day	None	None

Tests and Quizzes

- The Final will be a project presentation based and due on the last day of class unless otherwise stated in class.

Course Materials

Required Textbooks & Materials

- None

Suggested Textbooks & Materials

- While the class will be based on original materials prepared by the professors and papers / articles from the field, students may benefit from reading ML and MLOps introductory books before / together with the class. We suggest in particular Deep Learning with Python, second edition (Chollet F.) for ML, and Designing Machine Learning Systems (Huyen C.) for MLOps.

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.