

Machine Learning for Finance

Instructor: Poojan Patel

Email: Poojan.patel001@umb.edu

Pre-requisites: No Prerequisites

Course Description:

Machine Learning for Finance introduces students to essential machine learning techniques within a financial context. The course covers key areas like data handling, supervised and unsupervised learning, and deep learning models, focusing on practical applications in finance. Students will gain a strong foundation in applying machine learning to financial data and market analysis.

Course Objective:

By the end of this course, students will be able to:

1. Understand the fundamentals of machine learning and its applications in finance.
2. Develop skills to acquire, preprocess, and analyze financial data.
3. Apply supervised and unsupervised learning techniques to identify patterns and insights in financial data.
4. Utilize deep learning models to tackle complex financial data challenges.
5. Interpret and implement alpha factors and basic portfolio theory within a machine learning framework.
6. Demonstrate practical knowledge through hands-on projects, focusing on real-world financial problems.

Grading:

In Class Quiz	20%
Midterm	30%
Final Project Report and Presentation	45%
Attendance	<u>5%</u>
	100%

In Class Quiz

Throughout the course, students will complete three in-class quizzes, each featuring ten multiple-choice questions. These quizzes are designed to reinforce key concepts and assess students' understanding in a quick, practical format. The best two scores from the three quizzes will be counted, allowing students the flexibility to perform their best while staying engaged with the material.

Midterm Exam

For the midterm, students will tackle a case study that applies machine learning concepts to a real-world financial problem. This assessment will include both data analysis and practical exercises, requiring students to work with provided datasets to derive insights directly in class. By engaging in this hands-on approach, students will demonstrate their understanding of key machine learning techniques and their application to finance. The midterm will serve as an opportunity to apply learned skills in a practical context, preparing them for the final project.

Final Project

For the final project, students will develop an in-depth analysis that showcases their ability to apply machine learning techniques in finance. The project should center on a significant financial topic, such as predicting market movements, analyzing asset performance, or uncovering insights from financial text data. Students will choose and preprocess data, implement machine learning models, and evaluate their results, demonstrating both technical and analytical skills. Project progress will be reviewed through a midterm update, and students will present their final findings and a comprehensive report at the end of the semester.

Guiding questions to support project development and presentation:

1. What financial question are you addressing?
Describe the focus of your project, whether it involves forecasting, risk assessment, or portfolio optimization. Explain why this question is relevant to finance.
2. How did you select and prepare your data?
Share the data sources you utilized, detailing any data cleaning, transformations, or feature engineering steps involved in preparing it for analysis.
3. What machine learning methods are you applying?
Outline the models and techniques you're using, such as supervised or unsupervised learning, deep learning, or NLP. Discuss why these methods are suited to your analysis.
4. What key insights or predictions did you uncover?
Summarize the main outcomes of your analysis, highlighting trends, patterns, or predictions. Explain how these insights contribute to a better understanding of the financial topic.
5. What challenges did you encounter?
Discuss any issues faced in model selection, data processing, or evaluation. Reflect on your problem-solving approach and any limitations in the analysis.
6. What are the real-world applications of your findings?
Reflect on how your results could be used in practical settings, such as enhancing trading strategies, identifying risks, or improving financial decision-making.

This project encourages students to apply machine learning in finance, combining data management, modeling, and interpretation skills to produce a meaningful analysis.

Presentation & Report Grading Rubrics

Depth of Research	20
Potential outlook	10
Applications	30
Insights	20
Presentation Skills & Formatting	10
Q&A	10
	100

Reference Books

1. Machine Learning for Algorithmic Trading: Predictive models to extract signals from market and alternative data for systematic trading strategies with Python 2nd ed. Edition
2. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville

Class Schedule

Week	MACHINE LEARNING FOR FINANCE	
1	Introduction to Machine Learning The Rise of ML in investment industry Setting up the environment	
2	Understanding the Market Getting acquainted to the data sources and Types - Capital Market Alternative Data Sources	
3	Introduction to Alpha Factors Introduction to Portfolio Theory Concepts	
4	SuperVised Machine Learning	In Class Quiz

5	Supervised Machine Learning	
6	Supervised Machine Learning	
7	Unsupervised Machine Learning	In Class Quiz
8	Midterm Exam	
9	Natural Language Processing	
10	Natural Language Processing	
11	Deep Learning	In Class Quiz
12	Convolution Neural Network	
13	Recurrent Neural Network	

14	Final Project Presentation	