Syllabus for IE471: AI for Finance

Instructors

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- TAs
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Objectives

The main objective of this course is to build up the basic knowledge on financial engineering theories including fixed-income securities, interest rate risks, modern portfolio theory, capital asset pricing model, and derivatives. In addition, hands-on experience for applications AI techniques such as dimension reduction, supervised/unsupervised learning, natural language processing, and reinforcement learning to finance will be provided with practice sessions.

Lectures

- Time: 1 to 2:15PM on Tue/Thu
- Location: E2 1501

References

- Class materials provided by instructors
- Investment Science 1st edition, Luenberger, Oxford University Press, 1998 (main textbook)
  - 2nd edition published in 2013 is also fine. Please note that the international version is available only for the 1st edition. I will cover the additional topics in the 2nd edition, so either version is fine.
- Options, Futures and Other Derivatives, 10th Edition, Hull, Prentice Hall, 2017
- Investments, 12th Edition, Bodie, Kane and Macus, McGraw-Hill/Irwin, 2021

Evaluation

- AI practice sessions: 30%
- Quizzes: 20%
- Term project: 15%
- Homework assignments: 25%
- Attendance: 10% (-3% for each absence after first 3 – can be negative)

Course Website

Course materials including lecture notes and homework assignments as well as course announcements will be posted on Slack workspace along with the KLMS website. Students are required to register to the site and strongly recommended to check the website periodically.

Course plan

This course consists of 4 modules + a term project.

Modules

- Each module includes ‘financial engineering theory sessions’ and ‘AI practice sessions’

- For each AI practice session, you should 1) watch a video clip that describes the project, 2) conduct various tests on the given hands-on AI exercise based on the provided codes and data set, and 3) write a report
- If you just follow the instructions, you can get full points. But if you can extend the skeleton code provided by the instructors, you can get extra points. Extension means: 1) using different data set other than ones provided by the instructors, 2) revising the codes significantly, 3) applying different AI algorithms, etc.
- Each module will be followed by a 30-min quiz
- Each module has one or two homework assignments

Term project

- Each team should choose their own topic that utilizes AI to solve problems in financial markets
- There will be Q & A sessions to guide your projects

Tentative Schedule

Module	Week	Content	Note
1	1	Course introduction	
		Basic theories of interest & bond basics	Assignment 1
	2	YTM, Duration, and Immunization	
		YTM, Duration, and Immunization	
	3	YTM, Duration, and Immunization	
		[AI Practice 1] Interest risk modeling via PCA	AI Practice 1
	4	Term structure of interest rates	Assignment 2
		Applied interest rate analysis	Assignment 3
	5	[AI Practice 2] Within stock classification via clustering	AI Practice 2 Quiz 1
2		Diversification, feasible set, efficient frontier	Assignment 4
	6	Markowitz model, two fund theorem, one fund theorem	
		Markowitz model, two fund theorem, one fund theorem	
	7	Markowitz model, two fund theorem, one fund theorem	
		[AI Practice 3] Stock return prediction via deep learning	AI Practice 3 Quiz 2
Midterm	8		
3	9	Capital asset pricing model	
		Capital asset pricing model	
	10	Factor models	
		Additional topics in portfolio theory	Assignment 5
	11	Additional topics in portfolio theory	
4		Forwards, futures, and swaps	Quiz 3
	12	Models of asset dynamics	Assignment 6
		Basic options theory	
	13	Basic options theory	
		[AI Practice 4] Hedging via deep reinforcement learning	AI Practice 4
	14	Additional option topics	
		Additional option topics	
	15	Additional option topics	
		Term project feedback session	Quiz 4
Final	16		