FIN 570
Machine Learning for Finance
2021-22 Module 1 (Fall 2021)

Course Information

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Teaching Assistant: TBA
Email:
Office Hour:

Classes:
Lectures: Monday & Thursday 1:30–3:20 PM
Venue: PHBS Building, Room XXX

Course Website:
https://github.com/PHBS/MLF

1. Course Description

1.1 Context

Course overview:

With the advent of computation power and big data, machine learning recently became one of the most spotlighted research field in industry and academia. This course provides a broad introduction to machine learning in theoretical and practical perspectives. Through this course, students will learn the intuition and implementation behind the popular machine learning methods and gain hands-on experience of using ML software packages such as *SK-learn* and *TensorFlow*. This course will also explore the possibility of applying ML to finance and business. Each student is required to complete a final course project.

Prerequisites: Undergraduate-level knowledge in probability/statistics and previous experience in programming language (python) is highly recommended.

1.2 Textbooks and Reading Materials

- *Python Machine Learning (3nd Ed)* by Sebastian Raschka (link): primary textbook (**PML**)
- *Machine Learning in Coursera* taught by Andrew Ng (link) (**CML**)
- *An Introduction to Statistical Learning (with Applications in R)* by James, Witten, Hastie and Tibshirani (link) (**ISLR**)
- *Deep Learning* by Goodfellow, Bengio and Aaron Courville (link) (**DL**)
- *Advances in Financial Machine Learning* by Marcos Lopez de Prado (**AFML**)

2. Learning Outcomes

2.1 Intended Learning Outcomes

Learning Goals	Objectives	Assessment (YES with details or NO)
1. Our graduates will be effective communicators.	1.1. Our students will produce quality business and research-oriented documents.	YES
	1.2. Students are able to professionally present their ideas and also logically explain and defend their argument.	YES
2. Our graduates will be skilled in team work and leadership.	2.1. Students will be able to lead and participate in group for projects, discussion, and presentation.	YES
	2.2. Students will be able to apply leadership theories and related skills.	
3. Our graduates will be trained in ethics.	3.1. In a case setting, students will use appropriate techniques to analyze business problems and identify the ethical aspects, provide a solution and defend it.	
	3.2. Our students will practice ethics in the duration of the program.	
4. Our graduates will have a global perspective.	4.1. Students will have an international exposure.	YES
5. Our graduates will be skilled in problem-solving and critical thinking.	5.1. Our students will have a good understanding of fundamental theories in their fields.	YES
	5.2. Our students will be prepared to face problems in various business settings and find solutions.	YES
	5.3. Our students will demonstrate competency in critical thinking.	YES

2.2 Course specific objectives

By the end of the course, students should be able to

- understand the goal and concepts of machine learning
- be familiar with various machine learning methods and understand the strength and weakness of them
- identify problems in finance and business which can be solved by machine learning
- use machine learning software such as *sk-learn* and *tenslorflow* to solve the problems

2.3 Assessment/Grading Details

The grading is composed of the following weights:
Attendance 20%, Mid-term exam 30%, Assignments 20%, Final Project 30%

- Mid-term exam will be taken on **Nov 1 in the 8th week.** There will be **no final exam**
- Attendance will be checked randomly. The score is calculated as 20 – 2x(#of absence)
- Leave request should be made 24 hours before except for emergency
- Job interview **cannot** be a valid reason for leave

2.4 Academic Honesty and Plagiarism

It is important for a student's effort and credit to be recognized through class assessment. Credits earned for a student work due to efforts done by others are clearly unfair. Deliberate dishonesty is considered academic misconducts, which include plagiarism; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis.

All assessments are subject to academic misconduct check. Misconduct check may include reproducing the assessment, providing a copy to another member of faculty, and/or communicate a copy of this assignment to the PHBS Discipline Committee. A suspected plagiarized document/assignment submitted to a plagiarism checking service may be kept in its database for future reference purpose.

Where violation is suspected, penalties will be implemented. The penalties for academic misconduct may include: deduction of honour points, a mark of zero on the assessment, a fail grade for the whole course, and reference of the matter to the Peking University Registrar.

For more information of plagiarism, please refer to *PHBS Student Handbook*.

3. Topics, Teaching and Assessment Schedule (Tentative)

Week	Dates	Topics and the corresponding textbook chapters
1	Sep 6 & 9	Course overview, introduction to Python (crash course), Jupyter notebook, Github, Etc
2	Sep 13 & 16	Linear regression (**ISLR** Ch. 3, **PML** Ch. 10), vector/matrix notation. Challenges in applying machine learning to finance Python crash course (Numpy)
3	Sep 20 & 23	Perceptron, Adaline, gradient descent (**PML** Ch. 2) Logistic regression, regularization, SVM (**PML** Ch. 3)
4	Sep 27	Kernel SVM, KNN, decision tree (**PML** Ch. 3) Data pre-processing, feature selection (**PML** Ch. 4)
		No class due to National day break
5	Oct 11, 13 & 14	Feature extraction: PCA and LDA (**PML** Ch. 5) Bias-variance trade-off, cross-validation(**PML** Ch. 6)
6	Oct 18 & 21	Confusion matrix and various measures (**PML** Ch. 6) Bootstrapping: bagging, random forest, ada-boosting (**PML** Ch. 7)
7	Oct 25 & 28	Course project topic selection and proposal
8	**Nov 1** & 4	Mid-term exam Unsupervised learning (PML Ch. 11) Deep learning: back-propagation, tensorflow, keras (**PML** Ch. 12-14)
9	Nov 8 & 11	Convolutional Neural Network (**PML** Ch. 15) Final projects presentation

4. Miscellaneous

- The email (jaehyuk@phbs.pku.edu.cn) is the preferred method of communication.