Investment Management and Machine Learning

FIN 582

Fall 2022

Asynchronous Online Instruction

Instructor: Dr. Wei Jiao

Date: January 18, 2022 – May 2, 2022

Email: wei.jiao@rutgers.edu

Office Hour: Wednesday 5:00 pm- 6:00 pm or by appointment

Course Description

This course provides a practical introduction to the use of big data and machine learning algorithms to improve investment management decisions. We start with the introduction to Python and financial data. We then cover topics on portfolio construction, stock pricing, and robo-advisor. Finally, we build models for financial asset performance based on machine learning algorithms, such as lasso regression, elastic-net regression, random forests, gradient boosting, and neural network.

Learning Goals and Objectives

The course has the following learning objectives:
1. Understanding the structures of financial data
2. Proficiency with using Python to process financial data and conduct statistical analysis
3. Proficiency with linear and non-linear machine learning models
4. Proficiency with model improvement and interpretation

Course Materials
1. Slides, video lectures, python code, and datasets will be posted on Canvas each week. (Please do not put any of our course materials online.)

2. How to use Python
(1) Download Python: https://www.anaconda.com/distribution/
(2) Spyder IDE (Integrated Development Environment): https://www.spyder-ide.org/
(3) GeeksforGeeks: https://www.geeksforgeeks.org/python-programming-language/?ref=shm

3. Machine learning models
(1) Scikit-learn: https://scikit-learn.org/stable/index.html
(2) Tensorflow: https://www.tensorflow.org/overview

4. Optional books
(These books are not required for our class)
(1) Python for Data Analysis, by Wes McKinney (published by O'Reilly Media)
(2) Advances in Financial Machine Learning, by Marcos López de Prado (published by John Wiley & Sons, Inc.)
(3) Deep Learning with Python by François Chollet (published by Manning Publications Co.)

5. Financial Data from S&P global Compustat database through Wharton research data services

Course Schedule

Week	Topics
01/18-01/23	Introduction to Investment Management, Python, and Machine Learning
01/24-01/30	Python Library: NumPy, Pandas, Matplotlib
01/31-02/06	Introduction to Financial Data
02/07-02/13	Constructing Portfolios
02/14-02/20	Stock Pricing
02/21-02/27	Robo Advisor
02/28-03/06	Linear Machine Learning Models
03/07-03/13	Non-Linear Machine Learning Models
03/14-03/20	Spring Break, No Class
03/21-03/27	Model Improvement and Intepretation
03/28-04/03	Neural Network I
04/04-04/10	Neural Network II

04/11-04/17	Neural Network III
04/18-04/24	Neural Network IV
04/25-05/01	Model Ensemble

Homework and Grade

<1> Homework projects will be assigned each week and will be due by midnight of next Sunday. Submissions should be made through Canvas-Assignments. Late submissions are not accepted.

<2> The overall grade in this course will be determined based on the homework project grades. We have 14 weekly projects in this class. At the end of our semester, the one of your homework projects with the worse grade will be dropped. Each homework project is worth 8 points. Thus, the maximum possible points are 104 points.

Grade Distribution

Your final grade will be determined using the following scale. **No exceptions will be made.**

Grade	Points
A	90.0 and above
B+	85.0 – 89.9
B	80.0 – 84.9
C+	75.0 – 79.9
C	70.0 – 74.9
D	60.0 – 69.9
F	Below 60.0

If your overall grade is below 60.0, you will receive an F (Failure without credit) in this class.

Keep in Touch

Since this is an online class, a viable and reliable form of communication is vitally important. Note that all class communication will be through your Rutgers email and Canvas. You are expected to check your Rutgers email at least two or three (equally spaced) times every week. All class announcements can also be accessed using the "Announcements" page in Canvas.

Academic Integrity

The Academic Integrity policy can be found at http://studentconduct.rutgers.edu/student-conduct-processes/academic-integrity/

Students are responsible for understanding the principles of academic integrity and abiding by them in all aspects of their work at the University. Students are also encouraged to help educate fellow students about academic integrity and to bring all alleged violations of academic integrity they encounter to the attention of the appropriate authorities.

Academic Integrity means that you (the student) must:
- •properly acknowledge and cite all use of the ideas, results, or words of others,
- •properly acknowledge all contributors to a given piece of work,
- •make sure that all work submitted as your own in a course activity is your own and not from someone else
- •obtain all data or results by ethical means and report them accurately
- • treat all other students fairly with no encouragement of academic dishonesty

Adherence to these principles is necessary in order to ensure that:
- •everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments
- •all student work is fairly evaluated and no student has an inappropriate advantage over others
- •the academic and ethical development of all students is fostered
- •the reputation of the University for integrity is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld. Violations are taken seriously and will be handled according to University policy.

Student Code of Conduct
The University's Student Code of Conduct can be found at http://studentconduct.rutgers.edu/university-code-of-student-conduct

Violations of the Student Code of Conduct are considered serious infractions of student behavior and students who violate the code are subject to penalties relative to the level of the matter. In general, students may not disturb normal classroom procedures by distracting or disruptive behavior, this includes online as well as in-person.

The Code of Student Conduct is more than a collection of University regulations to be abided by – it seeks to promote the University's values and educate. The Code of Student Conduct encourages students to be their authentic selves as they find their place on campus, while also encouraging students to embrace inclusion through discovery, dialogue, and development as they celebrate diverse backgrounds.

The spirit of the Code of Student Conduct promotes student engagement both on and off campus, global citizenship, and leadership. It encourages students to uphold the highest tenets of trust, honesty, and integrity, understanding at all times that our actions significantly impact our personal journeys, our communities, and our larger society.

Rutgers–Camden, Rutgers–Newark, and Rutgers–New Brunswick students originate from all corners of the world and travel between many campuses and cities. As our students strive to achieve their goals, they are expected to conduct themselves in accordance with University policies and procedures, but more importantly, the values and spirit that these policies and procedures are founded upon.

Violations of the Student Code of Conduct should be reported to the Dean of Students office deanofstudents@camden.rutgers.edu or 856-225-6050.

If the violation is immediate and a potential threat is a concern, call the Rutgers-Camden police at 856-225-6111

Disability Services/Accommodations

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: https://ods.rutgers.edu/students/documentation-guidelines.
If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form (https://webapps.rutgers.edu/student-ods/forms/registration).
Erin G. Leuthold, MS Ed
(856) 225-2717
Rutgers-Camden Disability Services:
311 North Fifth Street, Camden, NJ 08102-1405
Web page: https://ods.rutgers.edu/contact-ods/rutgers-university-camden
E-mail: disability-services@camen.rutgers.edu