MScFE 652 PORTFOLIO MANAGEMENT

Group Work Project # 3

See grading rubric here.

Scenario

Portfolio management is going through a renaissance. Why? Machine learning is changing the way people make decisions under uncertainty. Relying on time-tested, Nobel-Prize winning ideas sounds good, but in fact, these ideas may be outdated. Machine learning has already changed the way statistical analyses are done. When applied to the portfolio optimization process, that improvement could be enough to provide an advantage. Combined with leverage and other factors, these advantages could mean a substantial and significant outperformance over the competition.

Welcome to the 21st century of portfolio management! In this GWP, students will apply machine learning concepts of denoising, clustering, and backtesting to optimize a portfolio. Use the portfolios that were analyzed in the previous GWP.

Tasks

Step 1. Each student works on one of these topics independently by writing a 1–2 page report on the features and benefits of each of these topics.

- Improvements using denoising
- Improvements using clustering
- Improvements using backtesting

Step 2. Students work together to apply these to the group's portfolio from GWP2. Specifically, they will pick the best portfolio from GWP2. The 'best' portfolio will prove to have a superior risk reward relationship. They prepare a document explaining the merits of applying one, two, or all of these improvements to the current portfolio.

Step 3. Students show how multiple improvements potentially outperform single improvements. Students show which combination of multiple improvements (if any) outperforms single improvements, according to at least three metrics of the group's

choice. Examples of metrics include return, Sharpe ratio, expected shortfall, variance, maximum drawdown, Sortino ratio, etc.)

Step 4. Students will run these improvements by 'training' on the data up to the date of GWP2. Then students will 'test' the model on the 2 weeks of daily data between GWP2's date and the GWP3 date. They will show how well (or poorly) each of the improvements performed out-of-sample.

Step 5. Students answer the following:

1. What are the differences in performance according to these metrics for the different combination of improvements?
2. What reasons might explain these differences in performances (with specific reference to the financial products, the historical data, the math of the model dynamics, etc.),
3. In which cases, if any, does the incremental gain in performance according to the chosen metrics justify the additional complexity and effort of the improvements?

Submission requirements and format

One team member submits on behalf of the entire group the following:

1. The first page of the Report Template in PDF format completed with the required information
2. **1 zipped folder including:**
    a. One (1) 10–15 page Jupyter notebook that contains clear section headings:
        - Introduction (1 page)
        - 1–2 pages of each individual topic's features and benefits (3–6 pages)
        - Executable Code showing the implementation and results of each method (3–5 pages)
        - Interpretation that answers the 3 questions in step 4 (1–2 pages)
        - Conclusion (1 page)

** **Use Google Colab or GitHub to collaborate** in completing the executable Python program*

Rubric

Your instructor will evaluate your group submission for GPW1 using the following rubric:

Quantitative Analysis (open-ended questions) 40 Points	Technical and Non-technical Reports 30 Points	Writing and Formatting 20 Points
The group is able to apply results, formulas, and their knowledge of theory to real-life finance scenarios by doing the following: ● Providing all the necessary information to support their arguments. ● Presenting arguments that reflect group discussion and research. ● Using authoritative references to support a position and provide updated information. ● Concluding with practical takeaways for more insightful financial decision-making.	Technical Reports contain 3 parts: 1) summary of key results; 2) interpretation of results; and 3) the recommended course of action that can reasonably follow from those results and interpretations. **Note**: Technical reports will include the technicalities of models, such as names, methods of estimation, parameter values, etc. and exclude generalities about the work done. It should NOT include the names of Python code that was used.	A submission that looks professional should include: ● The axes, labels, and scales in graphs. ● No significant grammar errors or typos. ● Organized, clear structure, and easy to read document. ● Proper citations and bibliography using MLA format.
	Non-technical Reports contain 3 parts: 1) clear explanation of results; 2) the recommended course of action that follows; and 3) the identification of factors that impact each portfolio. **Note**: AVOID all references to model names, algorithms, unnecessary details, and focus on the investment decision.	