Enhancing Portfolio Optimization with Data Fusion and Machine Learning in Quantitative Finance

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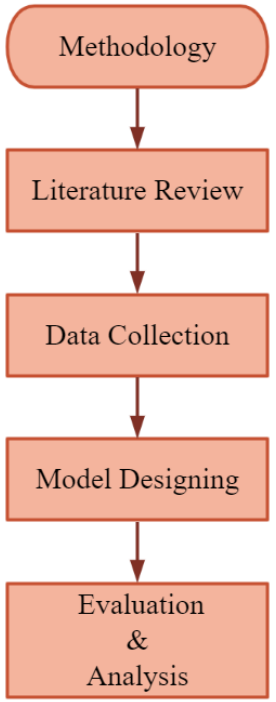
Introduction:

This project aims to revolutionize portfolio optimization in quantitative finance by integrating advanced machine learning techniques and data fusion methodologies. Our team strives to improve the problem that traditional methods will face: limitations in handling market complexities and integrating diverse data effectively.

Keywords:



Platforms:

CSMAR

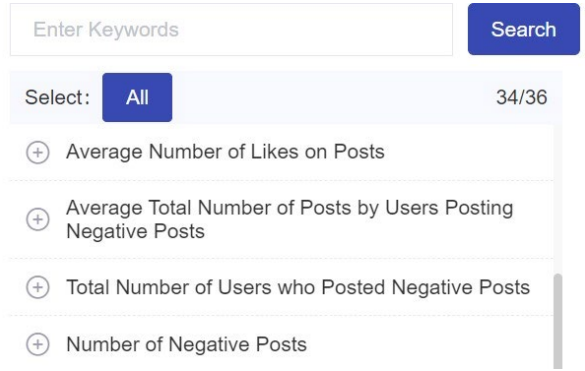
Qlib

SSH Connection

MobaXterm

Data Collection:

Based on the CSMAR platform, we use its downloadable CSV files to collect historical financial asset data and market sentiment data such as financial statements, investor sentiment indices, and sentiment consistency.



Model Reproducing:

Once we collected all the data, we used "Qlib" to choose the high-quality model (like LSTM) to fit our data; then, we used remote development (SSH connection) to reproduce and improve the model.

- Signal-based evaluation: IC, ICIR, Rank IC, Rank ICIR
  - $\text{corr}(\mathbf{x}, \mathbf{y}) = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}}$
  - $\text{IC}^{(t)} = \text{corr}(\hat{\mathbf{y}}^{(t)}, \mathbf{ret}^{(t)})$
  - $\text{ICIR} = \frac{\text{mean}(\mathbf{IC})}{\text{std}(\mathbf{IC})}$
  - $\text{Rank IC}^{(t)} = \text{corr}(\text{rank}(\hat{\mathbf{y}}^{(t)}), \text{rank}(\mathbf{ret}^{(t)}))$
  - $\text{Rank ICIR} = \frac{\text{mean}(\mathbf{Rank\ IC})}{\text{std}(\mathbf{RankIC})}$

Results and Conclusion:

Through trial and error, our team has reproduced three models, and we ran each model successfully 50 times. It fully proves that our plan is working, and this paves the way for further advancements in our field.

Model Name	Dataset	IC	ICIR	Rank IC	Rank ICIR
ADARNN	Alpha360	0.0468±0.01	0.3706±0.08	0.0544±0.01	0.4416±0.07
ADD	Alpha360	0.0419±0.00	0.3066±0.04	0.0550±0.00	0.4205±0.03
ALSTM	Alpha360	0.0478±0.01	0.3620±0.05	0.0585±0.00	0.4578±0.04

https://github.com/EthanYixuanMi/Machine-Learning-in-Quantitative-Finance