Memory Handling in Financial Time Series Modelling

How do Different Memory Mechanisms Affect a Model's Ability to Identify Mean-Reversion Signals?

Project Proposal for FYS5429, S26

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The overarching theme of the project is "different architecture's memory and dependency handling when modelling financial time series". We want to test autoregressive methods (AR[p]) with a relatively simple and short memory span of fixed lags compared to modern LSTM NNs with adaptive memory, and eventually also test the Transformer architecture with memory handled through an attention mechanism.

Our case and focus will be on a mean-reversion trading strategy, using data from cryptocurrency prices or the foreign-exchange market, possibly prices, spread or volatility. The mean-reversion premise assumes that, after a shock (e.g., a price spike/drop caused by an event), an asset's value tends to revert to its long-run mean. An ideal model will therefore detect the early signals of such reversal and forecast it.

We want to evaluate the effectiveness and performance of different models/architectures in identifying such relevant history. Then, we want to analyse how their distinct memory-handling mechanisms determine which part of the asset's history that are the most relevant. Finally, we will assess and conclude on whether the mechanisms are suitable for capturing such signals.

We are aware of different papers being both optimistic and pessimistic towards using DL architectures for (financial) time series forecasting, and we will use this literature as a starting point for our project:

- Are Transformers Effective for Time Series Forecasting? `https://ojs.aaai.org/index.php/AAAI/article/view/26317`
- iTransformer: Inverted Transformers Are Effective for Time Series Forecasting `https://iclr.cc/virtual/2024/poster/18933`
- Informer: Beyond Efficient Transformer for Long Sequence Time-Series Forecasting `https://ojs.aaai.org/index.php/AAAI/article/view/17325`

- Trading with the Momentum Transformer: An Intelligent and Interpretable Architecture https://arxiv.org/abs/2112.08534

Tentative timeline [1]

- **February**: Literature review, data inspection & filtering, and dataset pipeline.
- **March**: Baseline models and metrics pipeline.
- **April**: Training of models/architectures.
- **May**: Results and interpretation.
- **June**: Write-up and demos.

[1] Credits to Håkon Kornstad for the inspiration to draft a tentative timeline: https://github.com/CompPhysics/AdvancedMachineLearning/blob/main/doc/Projects/ProjectProposals/2026/Proposal_FYS5429_haakongk.pdf