NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Computer Science and Engineering
College of Engineering

Anticipative Portfolio Optimisation using an Interpretable Evolving Fuzzy Transformer Network

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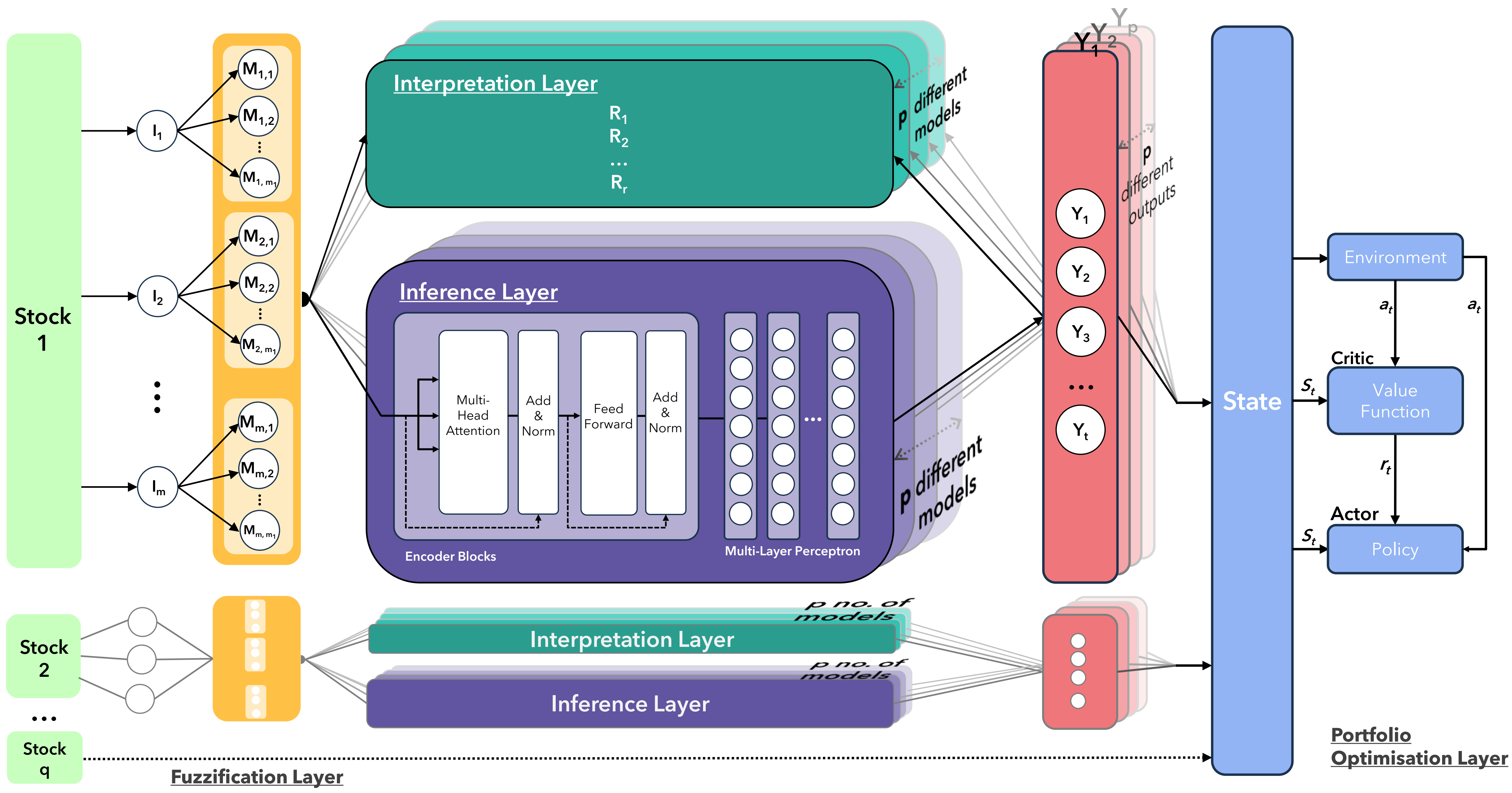


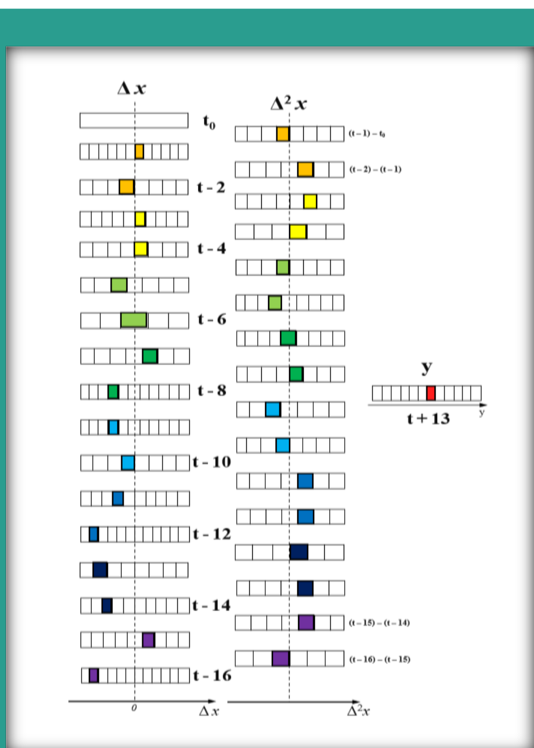
Objective: Create a pipeline for portfolio optimisation with a predictive model that is interpretable and accurate

Fuzzification Layer

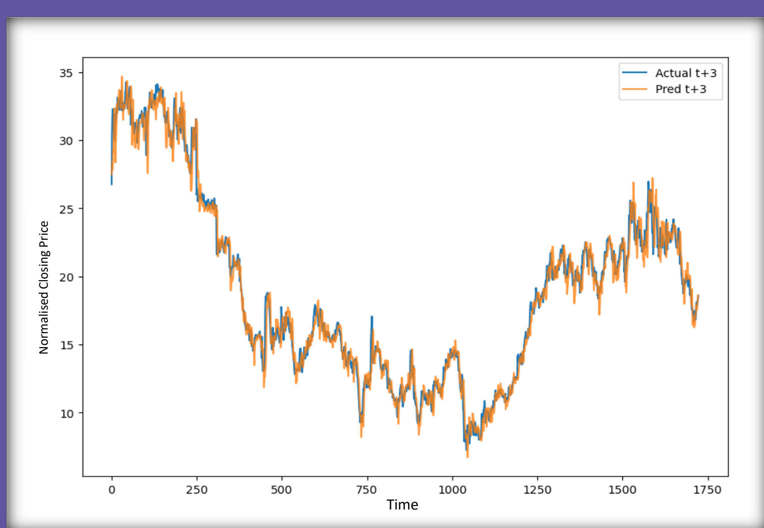
- Fuzzification done for interpretability and as a classification problem is easier than a regression problem
- Fuzzification through clustering was based on Kernel Density Estimation

Interpretation Layer

- Interpretation based off Hebbian theory, which explains synaptic plasticity of neurons.
- This is replicated by a layer mapping fuzzy inputs and outputs through a Mamdani Rule Base
- The strength of a neuron (rule) is based off how recently it was fired and the number of times it had been fired before



Inference Layer



- Transformer based model
- Hyperparameter tuning done with Genetic Algorithm, and MCES to reduce input dimension
- Maximum R^2: 99.7%
- Minimum R^2: 92.7%

Portfolio Optimisation Layer

- Use of predicted prices to generate idealised indicators for the stocks
- Perform portfolio optimization with deep reinforcement learning (A2C, PPO), with idealised indicators forming the state.
- A2C returned 124% over the test data, PPO returned 107%, versus the average portfolio of 104%.