

Sprint-3

Machine Learning and the Stock Market

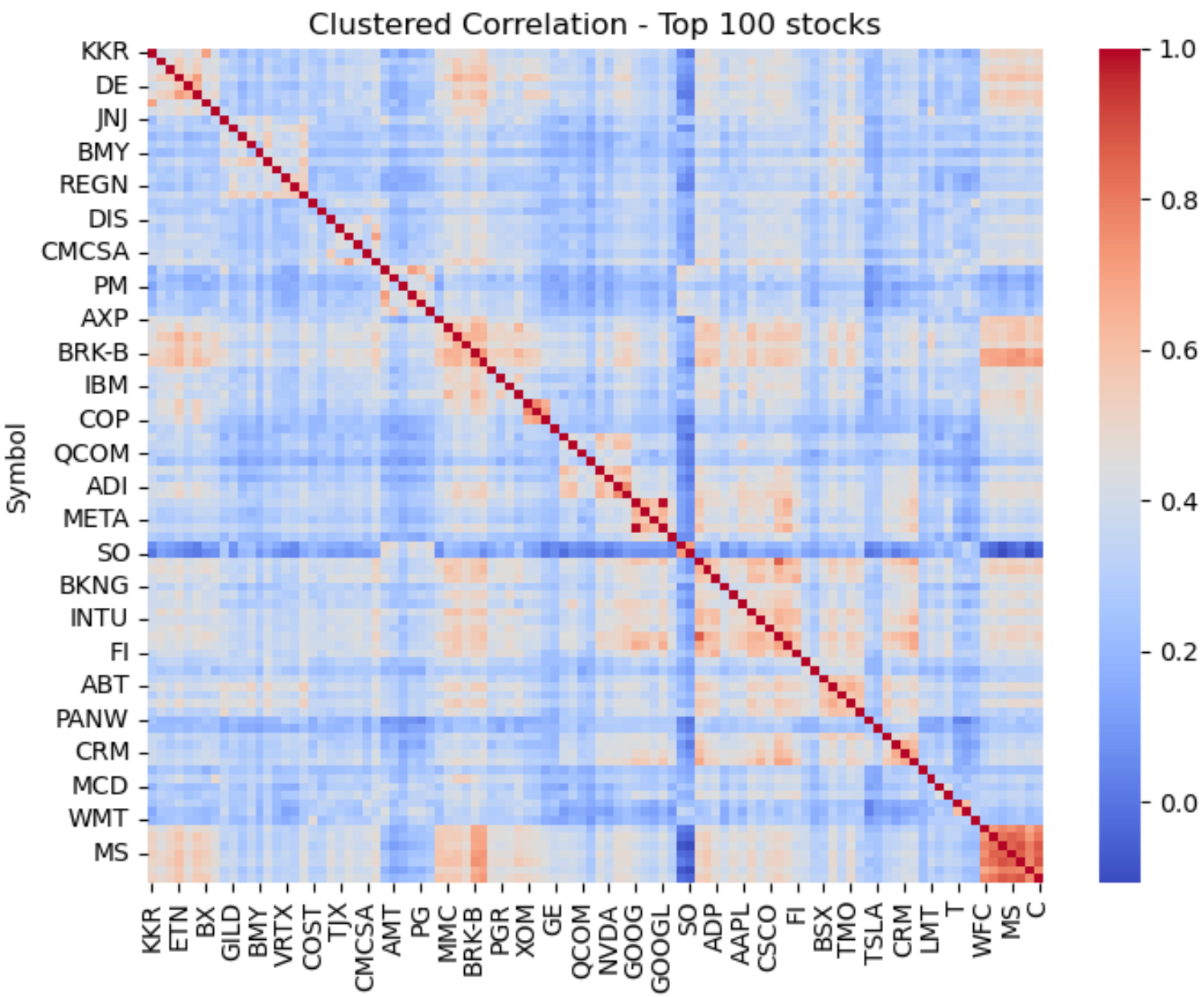
Hugo C Marrochio - Dec 6th 2024

Goals

Investigate possible avenues of ML techniques for stock trading, adapting techniques from Physics and Mathematics.

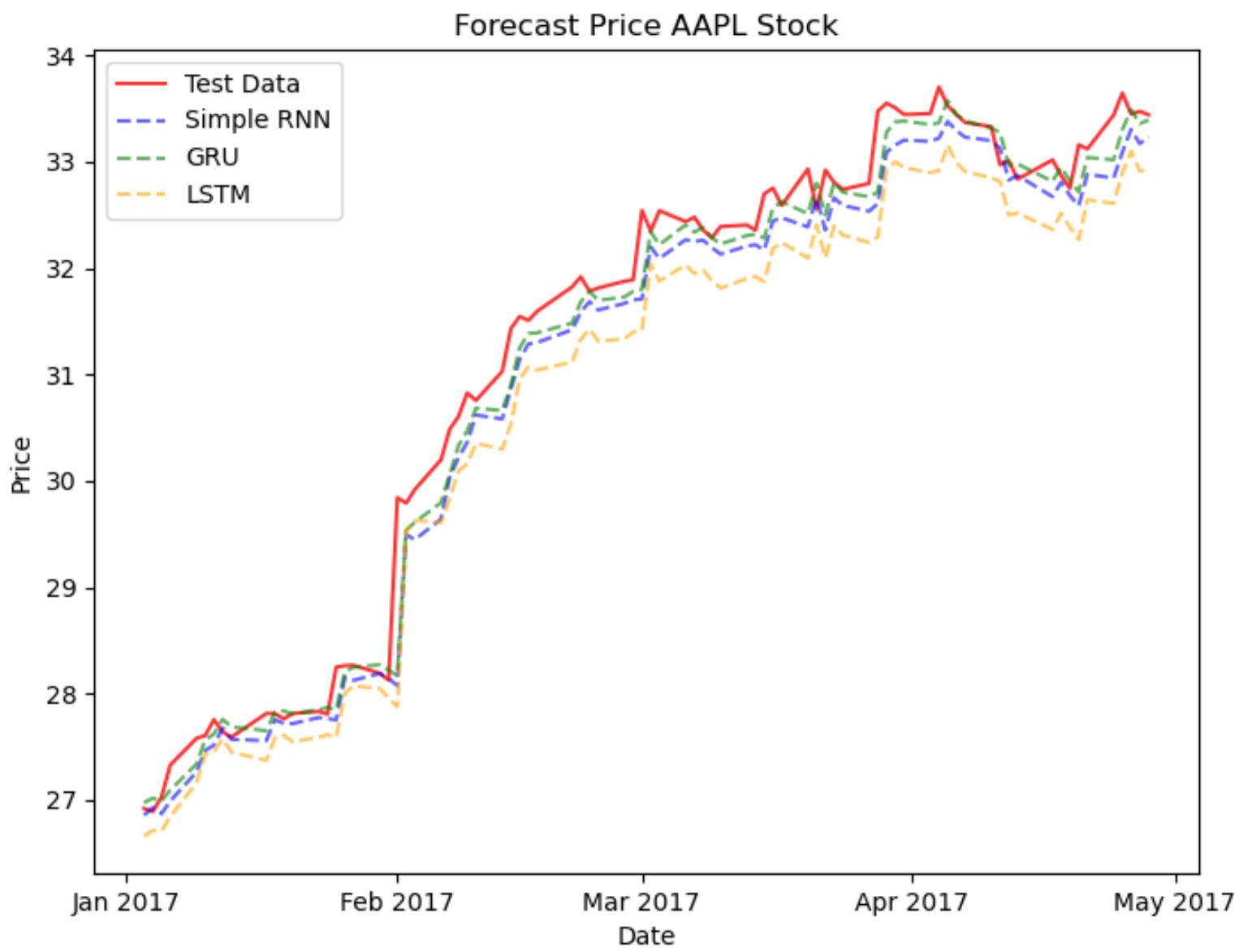
Unsupervised

Used techniques from randomness in order to denoise correlation and cluster similar stocks together



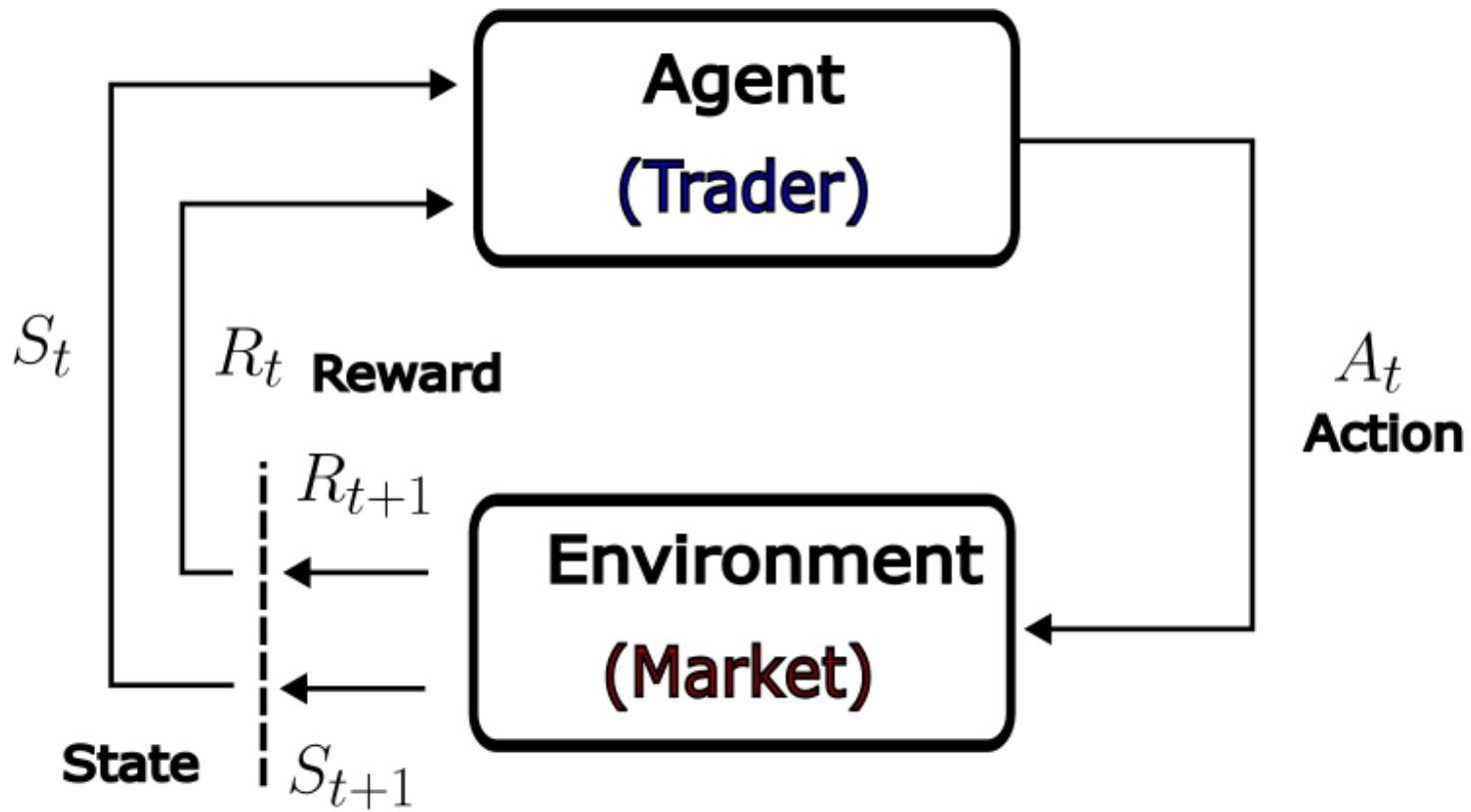
Supervised

Recurrent Neural Networks for price forecasting



Reinforcement Learning

Train an AI trader for automatically acting on stock market



Goals

Investigate possible avenues of ML techniques for stock trading, adapting techniques from Physics and Mathematics.

Unsupervised

Supervised

Reinforcement Learning

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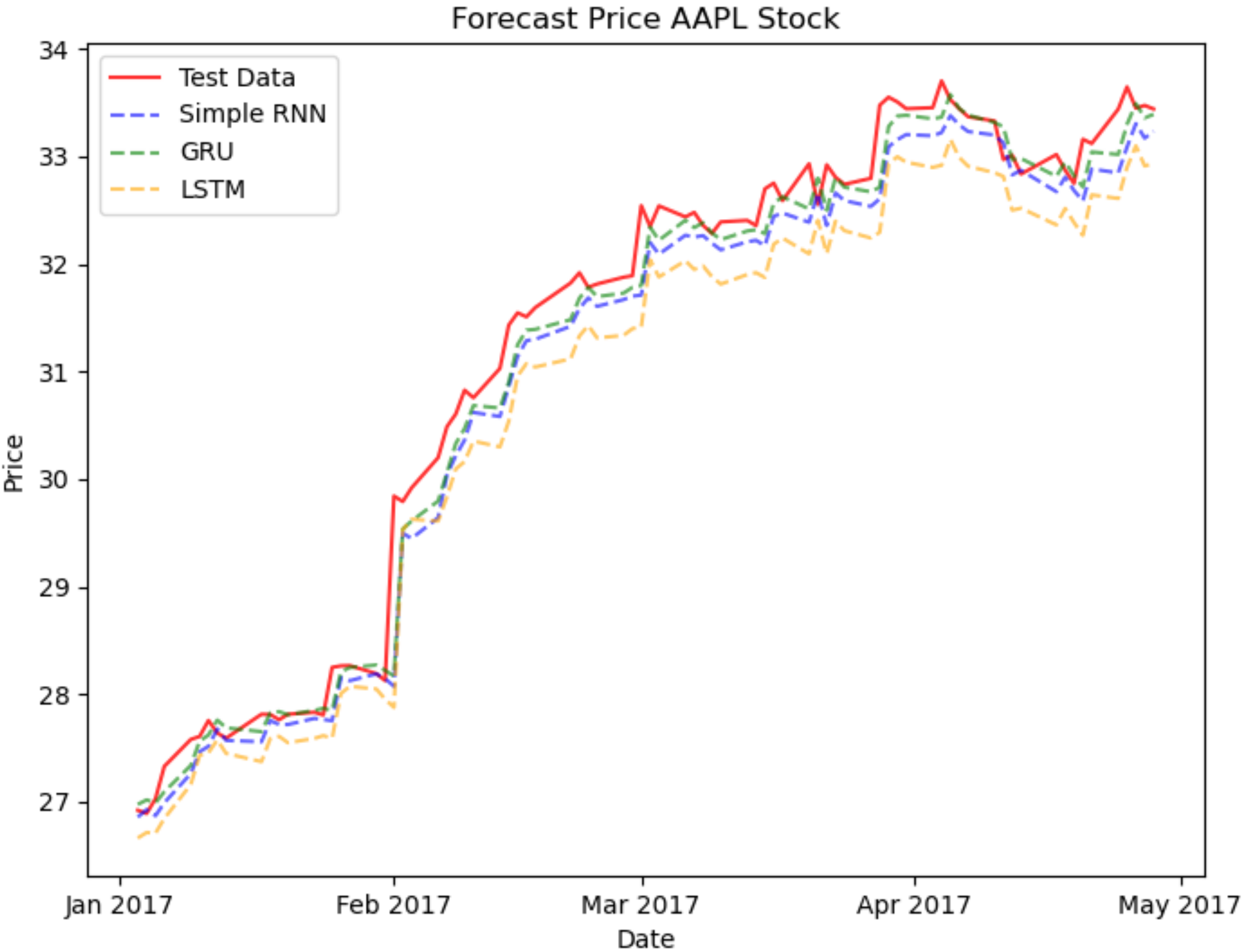
By *Asa Fitch* [Follow](#) and *Miriam Gottfried* [Follow](#)

May 21, 2024 12:50 pm ET

Neural Network Forecasting

The architectures tested were all mostly successful in forecasting in unseen data.

Caveat: Hyperparameter tuning can be time and resource consuming.

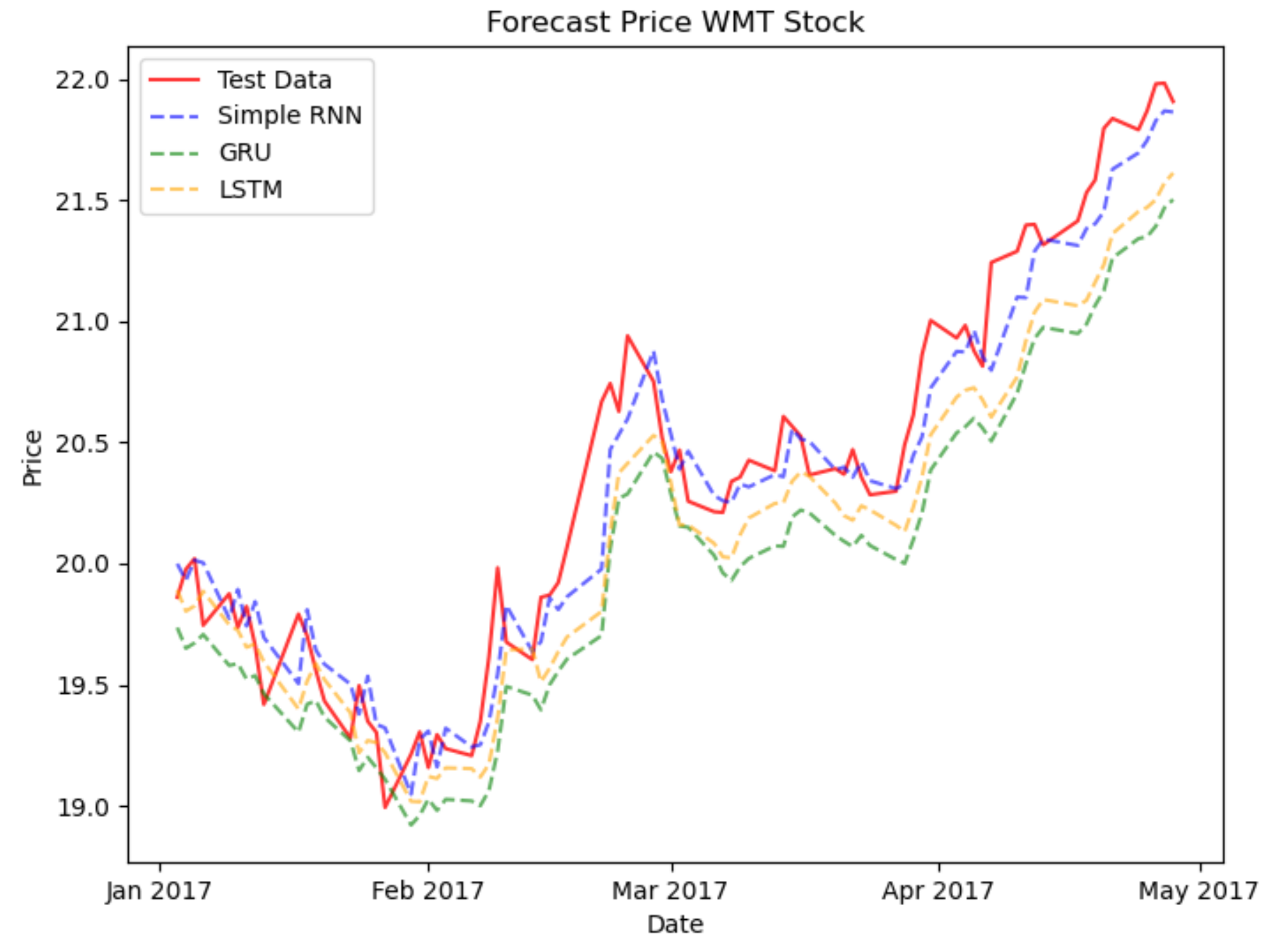
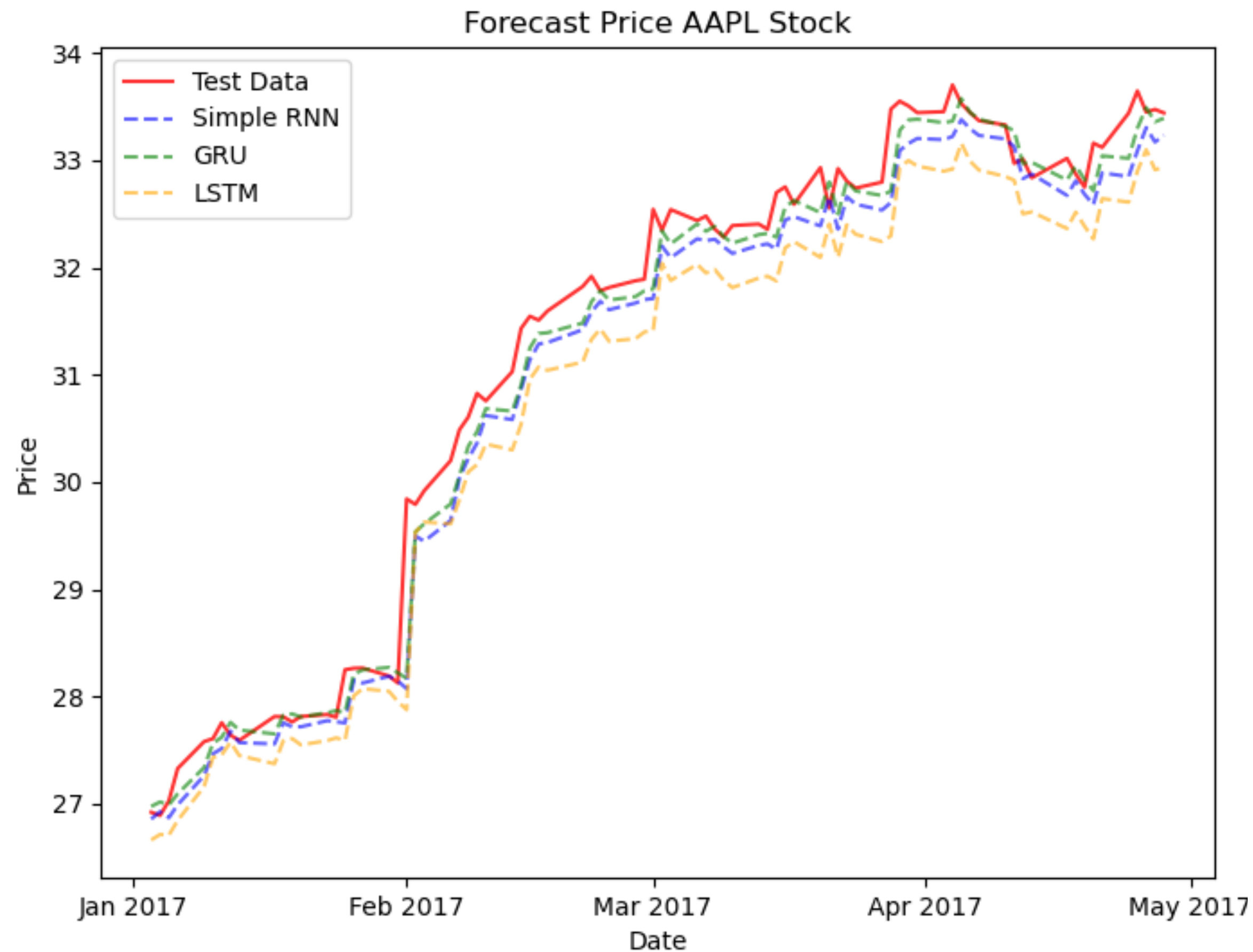


	Simple RNN	GRU	LSTM
A-Hidden States	40-80-40	40-80-40	40-80-40
B - Activation	Relu	Relu	Relu
C - Dropout	0.05	0.05	0.05
D - Batch	2	2	2
E - Learning Rate	0.001	0.001	0.001
F - Optimizer	Adam	Adam	RMSprop
MSE train	0.0029	0.0029	0.0035
MSE test	0.0017	0.0011	0.0039

Neural Network Forecasting

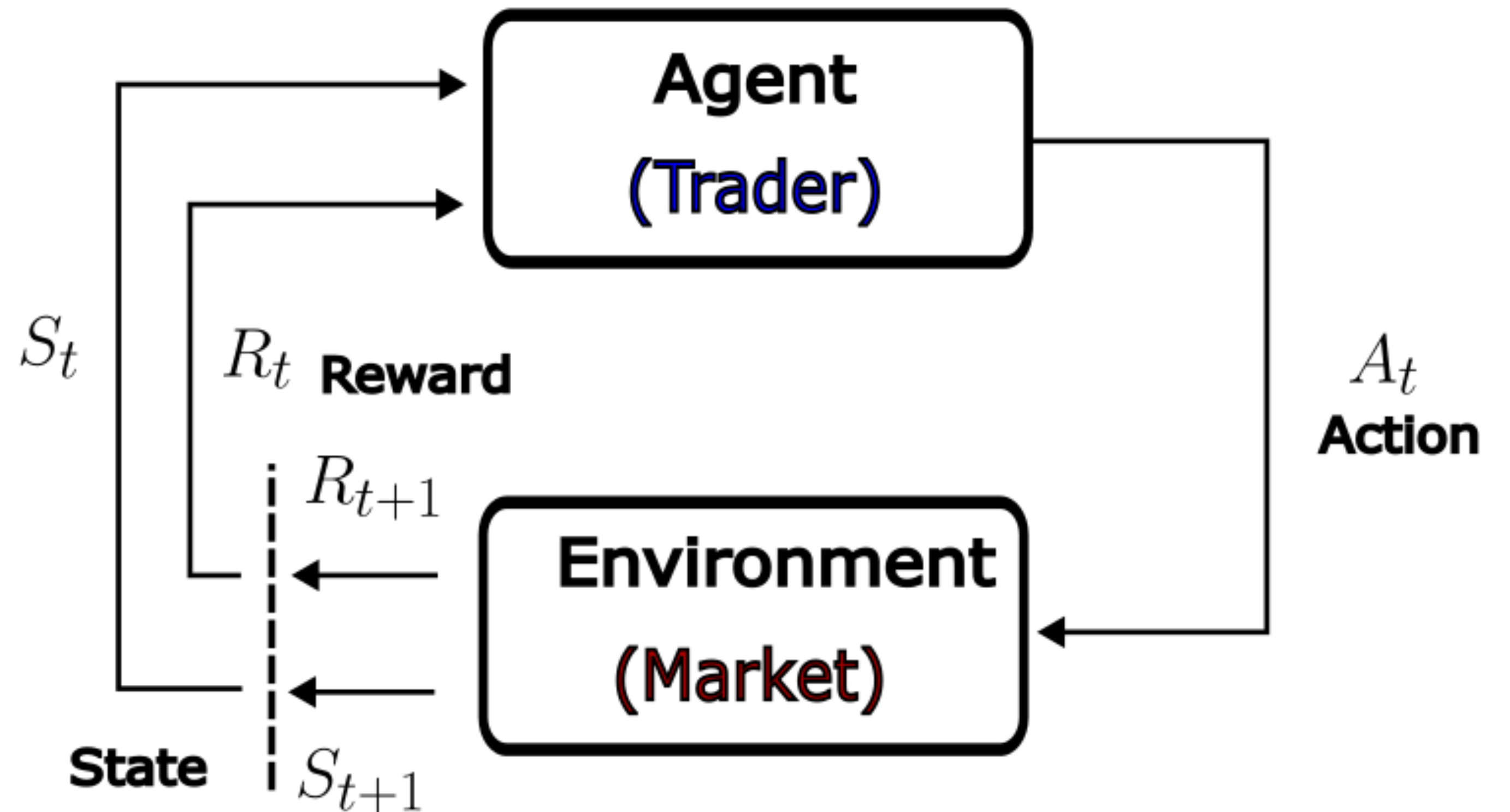
Simple test on same architecture on different stock:

Maybe not optimized but still promising forecast



Reinforcement Learning

- Basic Reinforcement Learning
- Action (Buy, Hold, Sell) 1 stock at a time.
- Simple model, mostly for proof of concept.
- Trade only **1 stock position** at a time, **trained** only on **2 months of data**



Reinforcement Learning

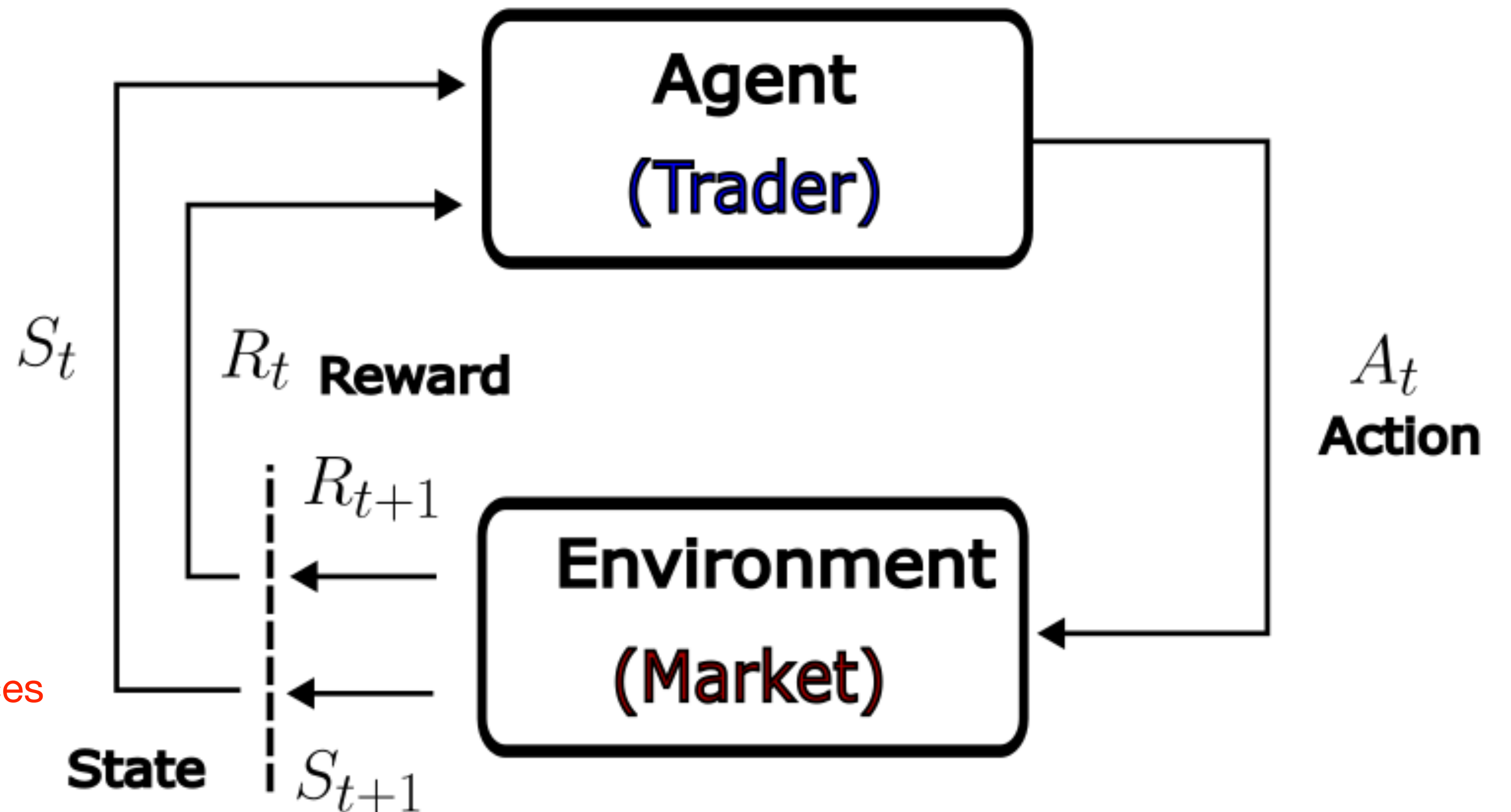
- Reward requires fine-tuning for trader to learn

$$\text{reward}_a = \frac{\text{portfolio}_{\text{new}} - \text{portfolio}_{\text{old}}}{\text{portfolio}_{\text{old}}}$$

Rewards instant profits

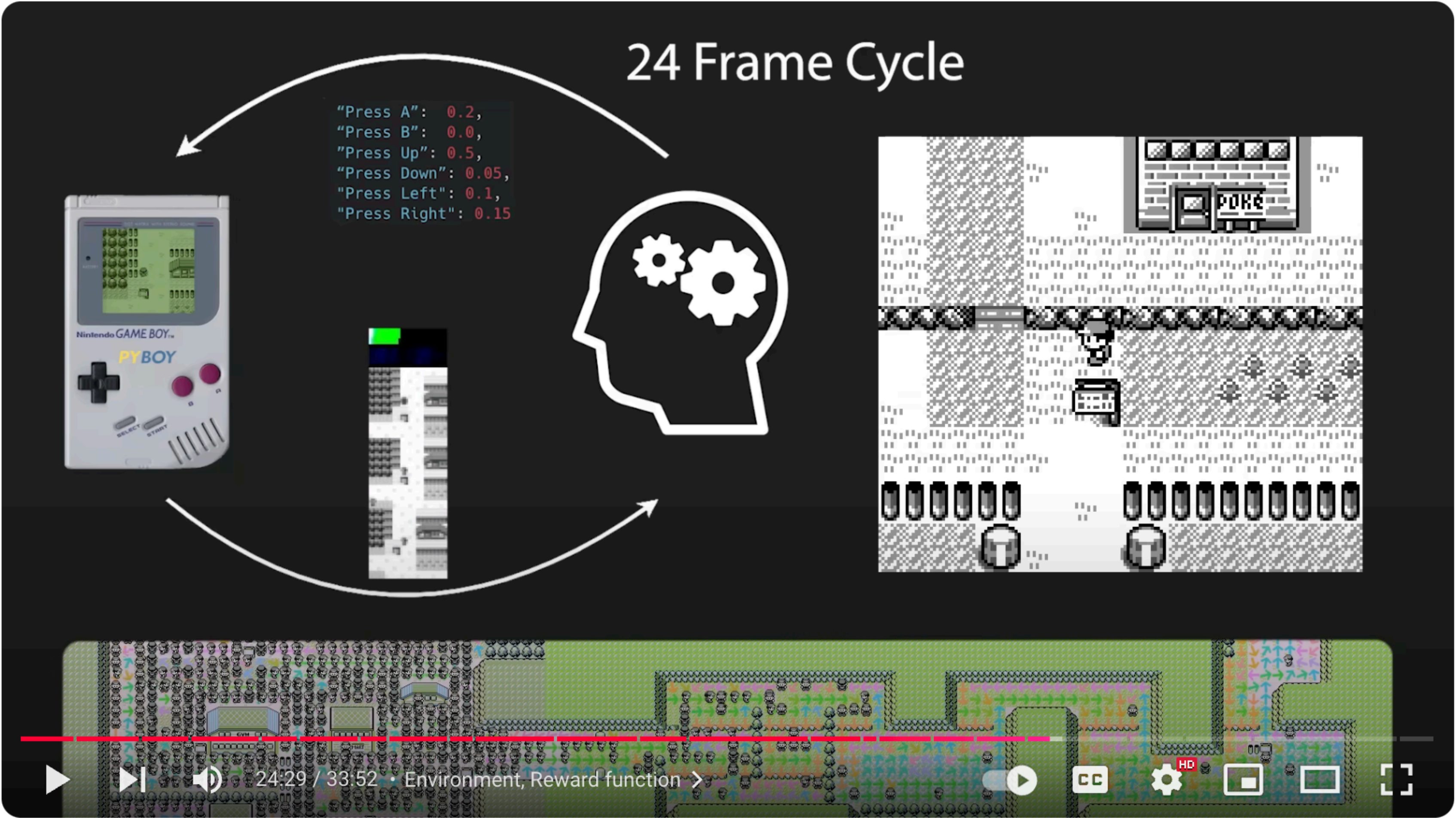
$$\text{reward}_b = \lambda \times \left(\frac{\mu - P_t}{\sigma} \right)$$

Compare price to past prices
average and std



- State: Includes a pre-trained NN price prediction, as well as past 3 prices

Reinforcement Learning



Training AI to Play Pokemon with Reinforcement Learning



Peter Whidden
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Reinforcement Learning

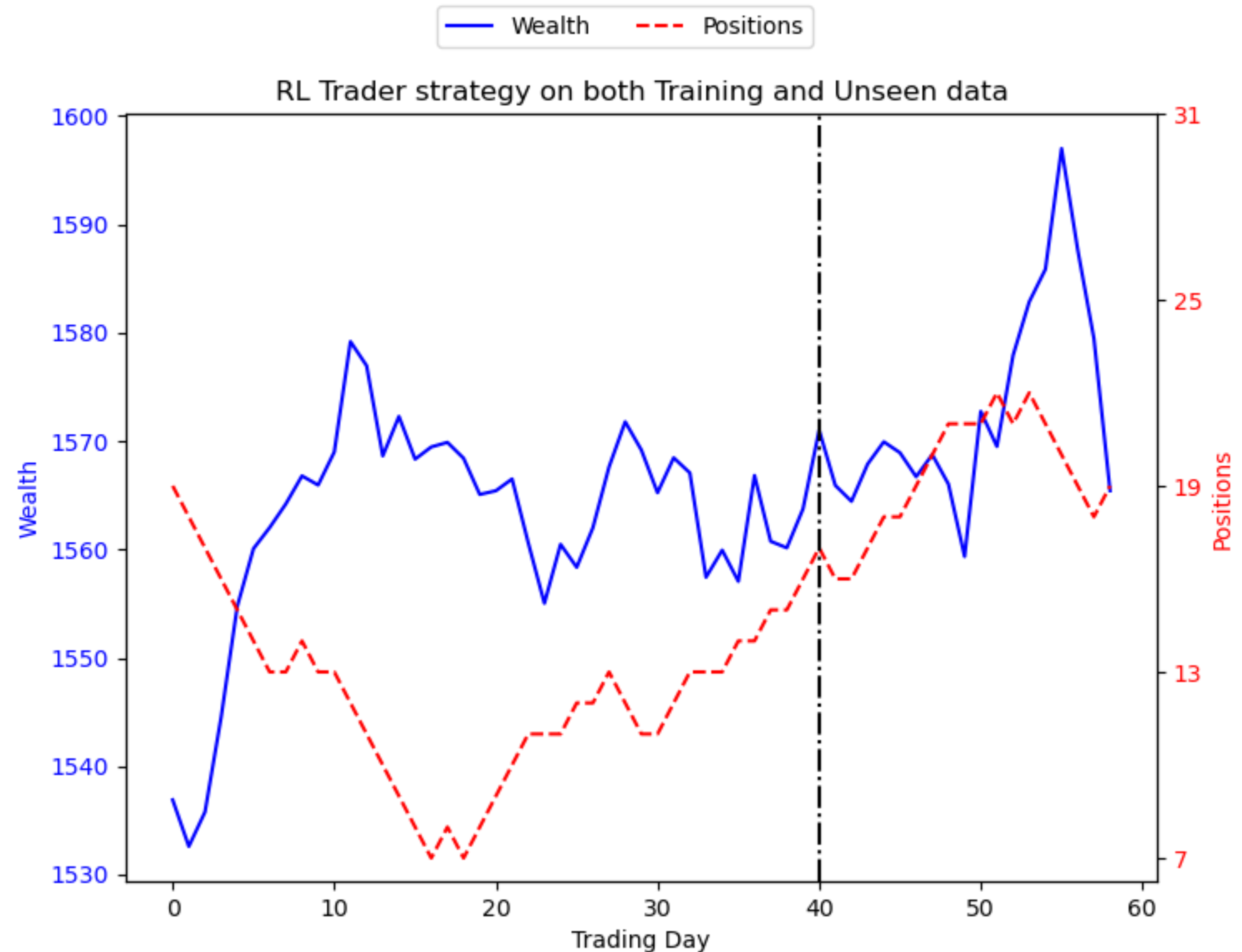
Prices with the actions at each day!

- Overall learned to sell as the market was rising!
- Example: Training 2 months of data, rolling window of size 3.



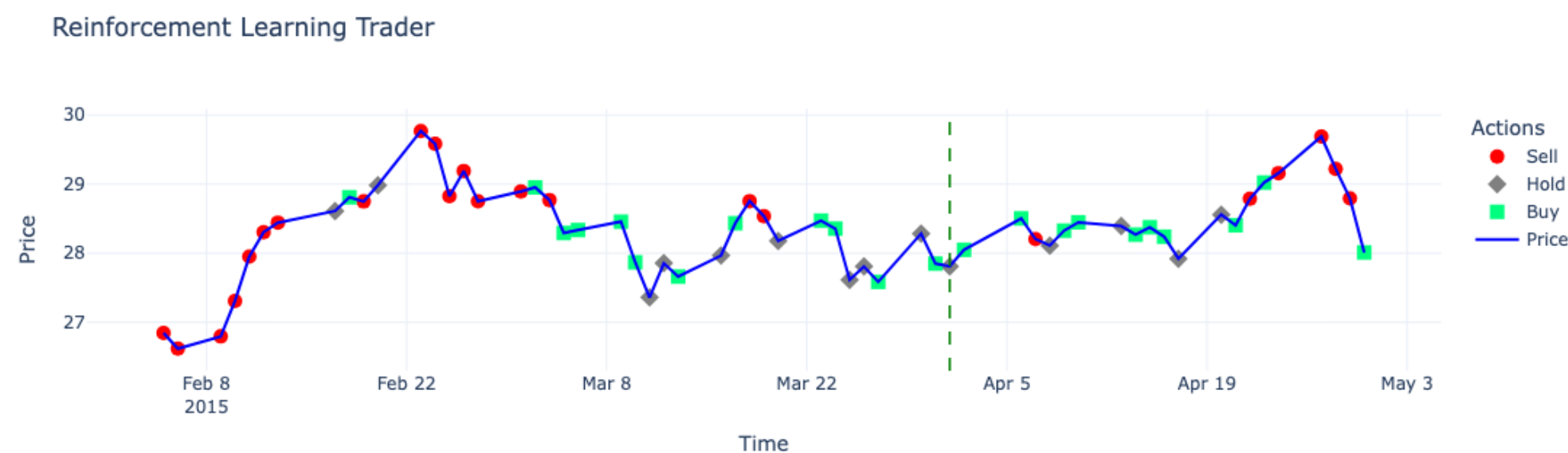
Reinforcement Learning

- Example of how resources evolved during said strategy
- Overall wealth increased!
- Even in this simple model, the AI trader learned strategies to buy, hold and sell
- As good as the training data (very limited window in my case)



Conclusion

- Explored promising possible avenues for different Machine Learning application for Stock Market analysis.
- Important to say we only looked at historical data and there would be MANY adjustments to do before trying to apply to real trading environment.
- Enough exciting progress for personal learning and base study for future analysis.
- Probably I will expand on my Reinforcement Learning model for Capstone 2!



Thank you BrainStation
instructors and friends!