

Fuzzy Adaptive Learning Control Network with Policy and Another Adaptive Resonance Theory (FALCON-PAART) Embedded Deep Structure

with applications in Stock Market Prediction and Analysis

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Motivation

To embed a deep learning model within the FALCON- PAART architecture to allow for data-driven fuzzy implication, to provide a close correspondence to real-world entailment of data, rendering the entire framework explainable for each individual prediction. It aims to combine the:

1. Interpretability of a fuzzy inference system
2. Accuracy of a deep learning model

To serve as an insightful model to make informed decision for Stock Trading.

Design & Implementation

FALCON-PAART Model

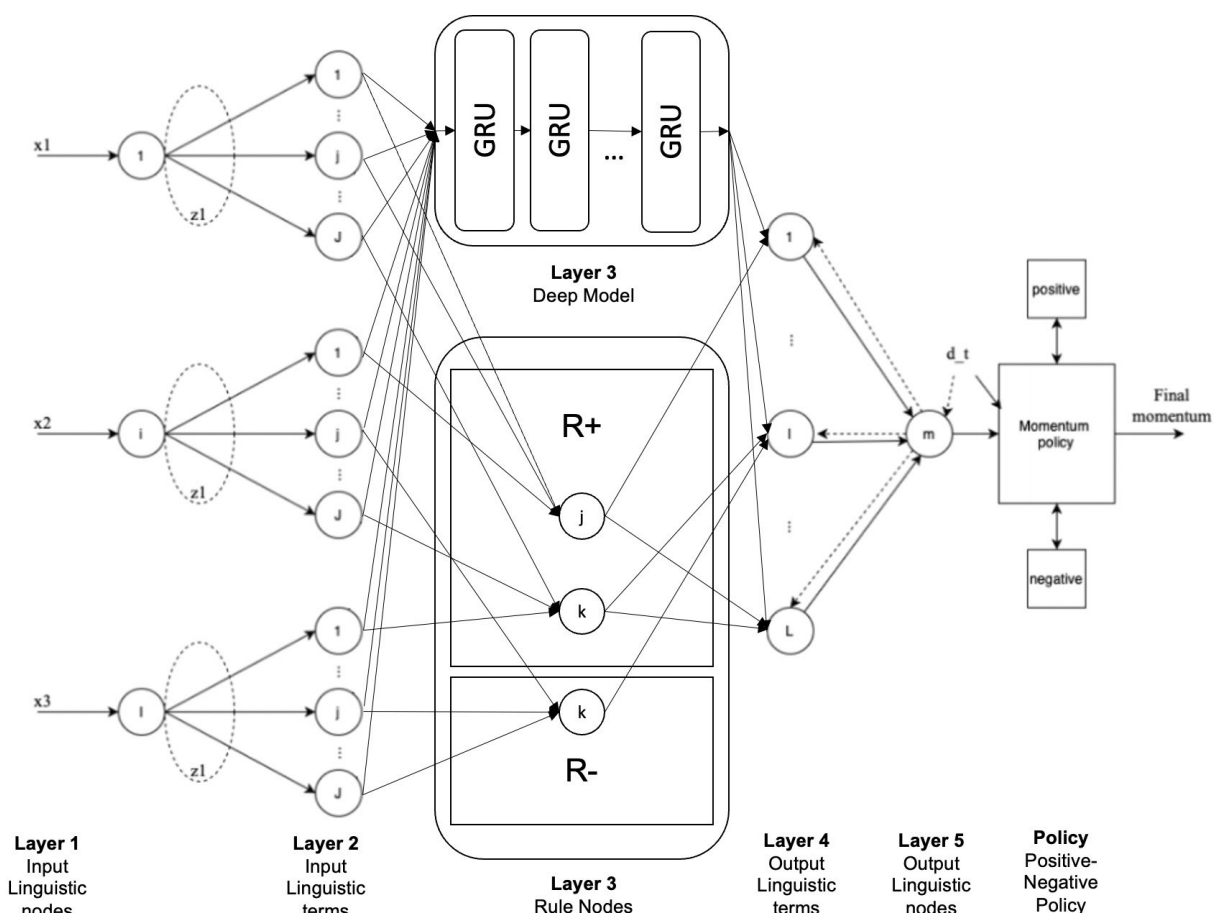
- Fuzzy ART: builds fuzzy clusters
- Momentum Policy: memory of previous states
- Positive/Negative Learning: governs different knowledge base

Deep Learning Model

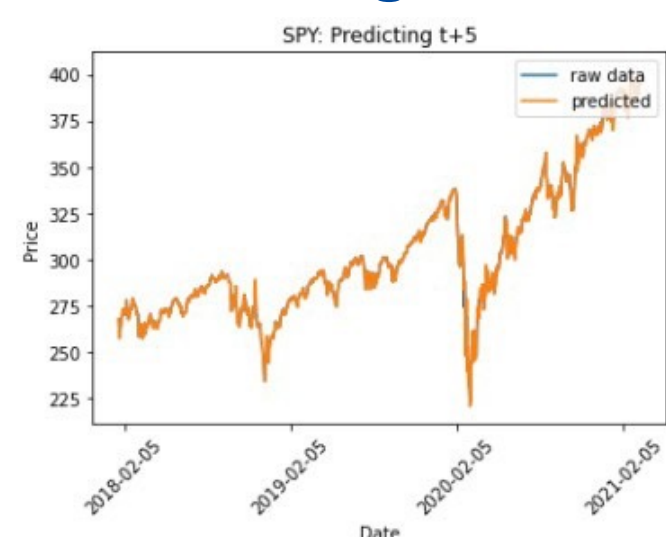
- RNN: ability to process memories of sequential data

Deep FALCON-PAART Model

- Parallel architecture
- Shared input/output linguistic for FALCON-PAART model and Deep learning model
- Fired fuzzy rules adds interpretability for RNN model.



Forecasting ETF Prices



- Forecasted up to t+13
- High correlation (R square > 0.99)
- Low RSME

Results: Stock ETF Trading

- **Modified MACD** uses forecasted price to **reduce time lag** in predicting the market
- **Genetic Algorithm** used to find **optimum buy and sell signal** to reduce commission fee on unnecessary trades
- **GA with Modified MACD** crossover strategy used
- **Consistently overperform** other techniques and strategies used, showing **promising results** across all 3 ETFs explored

	ETF-SPY		ETF-GLD		ETF-VWO	
	Returns	No. of Transactions	Returns	No. of Transactions	Returns	No. of Transactions
Buy & Hold	46.4%	1	28.8%	1	10.4%	1
Vanilla MACD	22.0%	71	-7.1%	68	2.1%	50
FALCON-PAART	36.7%	1	32.6%	6	14.1%	3
Modified-MACD	30.5%	89	37.6%	89	74.6%	85
GA- Modified MACD	60.5%	51	38.4%	85	78.5%	79