

Fuzzy-Embedded Gated Recurrent Unit (FE-GRU) System with Application in Stock Trading

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Goal of Project

Different investors have different risk appetite. Each of them view returns and losses differently and reacts differently. Hence, the project aims to propose a fuzzy-embedded neural network to predict stock market movement and eventually help to understand the decision-making process behind each prediction. The model proposed consists of a fuzzy system and an artificial neural network.

Motivation

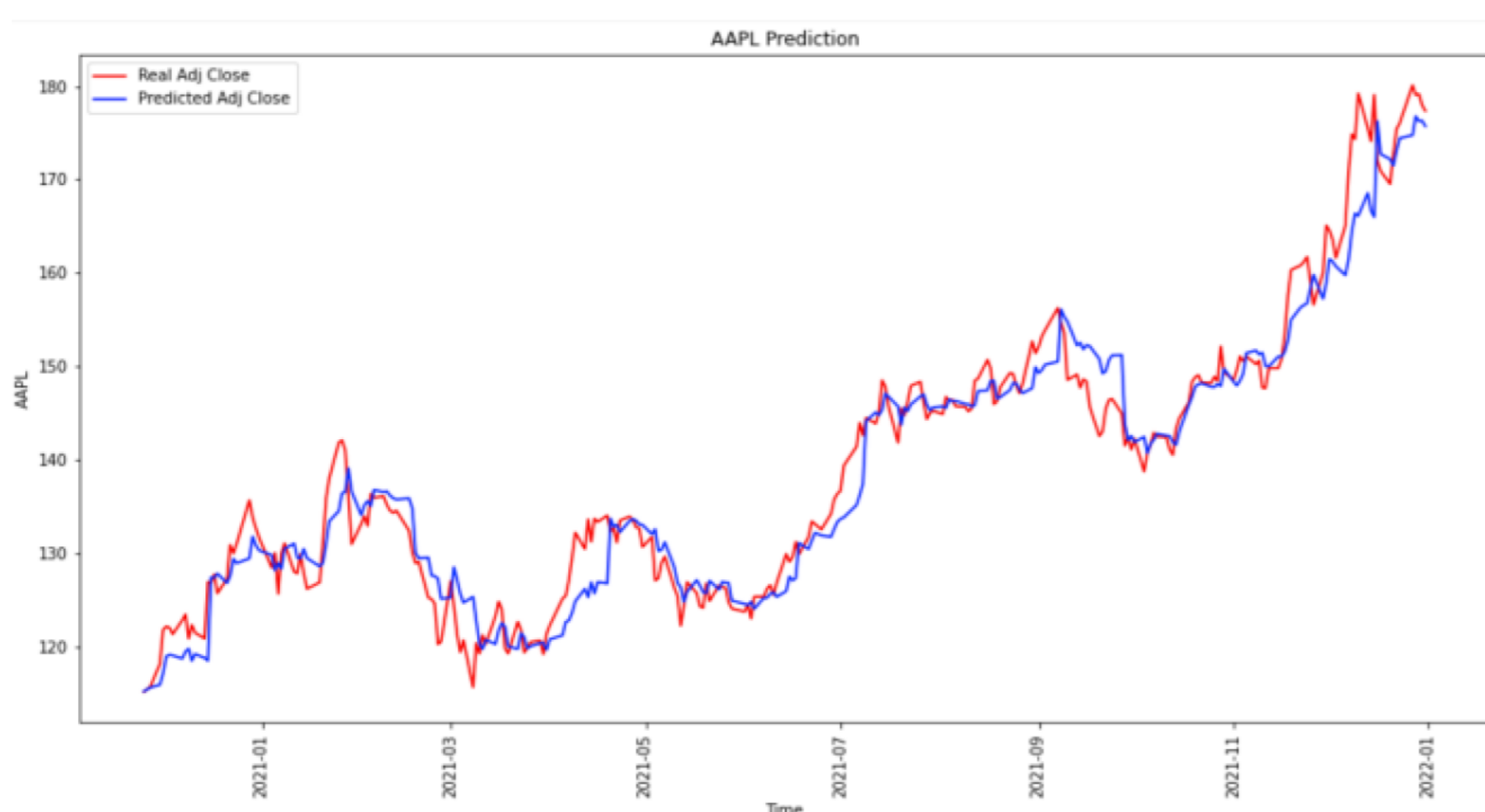
1. Huge area of interest in application of deep learning in finance
2. Portfolio managers' doubts when applying deep learning
3. Need for explanation behind result derived

Ticker Used

Apple Stock (^AAPL) 01/01/2011-01/01/2022

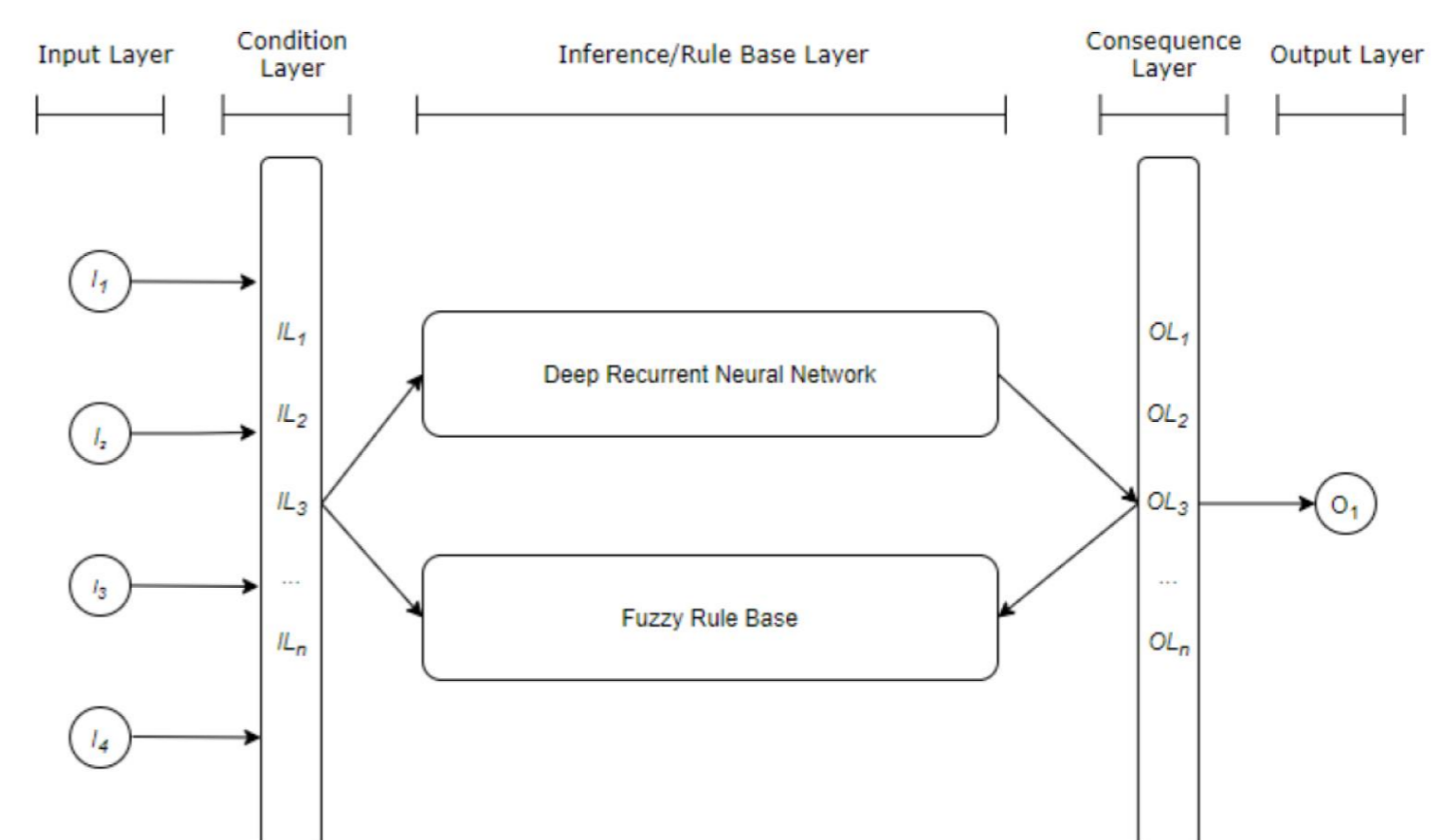
Performance/Accuracy

$R^2: 0.95$



FE-GRU Architecture

- Layer 1: Input Layer
- Layer 2: Condition Layer
- Layer 3: Inference Layer
- Layer 4: Consequence Layer
- Layer 5: Output layer



Benchmarking with ARIMA/Vanilla GRU

Metric	ARIMA	FE-GRU	Vanilla GRU
R^2	0.977	0.95	0.887
Advantage	One dimensional input	Well-rounded, interpretable	Well-rounded
Disadvantage	Computationally expensive, unstable in predicting trend reversals	Computationally expensive	Computationally expensive, hard to interpret results

RSI Trend Indicator Performance

Using Actual Close Price

RSI as a standalone indicator

- Base capital: \$100k
- Returns: \$8.9k
- Profit Percentage: 8.9%

RSI Indicator Ensemble (with BB and KC)

- Base capital: \$100k
- Returns: \$12.2
- Profit Percentage: 12.2%

Using Pred Close Price

RSI as a standalone indicator

- Base capital: \$100k
- Returns: \$19.05k
- Profit Percentage: 19.05%

RSI Indicator Ensemble (with BB and KC)

- Base capital: \$100k
- Returns: \$3.08k
- Profit Percentage: 3.08%

MACD Trend Indicator Performance

Using Actual Close Price

MACD as standalone indicator

- Base capital: \$100k
- Returns: \$49.9k
- Profit Percentage: 49.9%

MACD Indicator Ensemble (with WR)

- Base capital: \$100k
- Returns: \$16.7
- Profit Percentage: 16.7%

Using Pred Close Price

MACD as standalone indicator

- Base capital: \$100k
- Returns: \$64.3k
- Profit Percentage: 64.3%

MACD Indicator Ensemble (with WR)

- Base capital: \$100k
- Returns: \$39.1
- Profit Percentage: 39.1%