Stock Price Prediction Using RNNs

LSTM VS GRU + VOLUME + RELU | AAPL 2010–2023

Elizabeth Larez Diaz
CS 5393

Why Stock Price Prediction?

- Stock markets are sequential and nonlinear, making it perfect for RNNs
- Predicting future prices helps in algorithmic trading & investment
- We test deep learning models using 13 years of AAPL data
- Goal: compare model architectures, not build a trading strategy

Models Used

- LSTM
  - Long Short-Term Memory network
  - Strong baseline for time series
- GRU
  - Gated Recurrent Unit
  - Simpler structure, fewer parameters
- GRU + Volume + ReLU
  - Multi-feature input: Close & Volume
  - Uses ReLU for faster convergence

Dataset Overview

- Source: Yahoo Finance via yfinance API
- Stock: AAPL (Apple Inc.)
- Range: Jan 2010 – Nov 2023
- Daily closing prices, volume

- Used 60-day rolling windows to predict day 61

Training Pipeline

- All models trained on same pipeline:
  - Min-Max Normalization
  - Sequence creation (60 days)
  - 80% train / 20% test split
  - Adam Optimizer | MSE Loss | 100 Epochs
  - Validation split: 10% of training

Performance (RMSE)

- Root Mean Squared Error (Lower = Better):

- LSTM: ~3.62 USD
- GRU: ~2.82 USD
- GRU + Volume + ReLU: ~22.14 USD

Takeaway:

- Volume improves context
- ReLU can improve learning speed, however:
- Leaky ReLU?

Learnings

- GRU is simpler and slightly outperforms LSTM for this context
- Volume helps to capture market pressure/activity
- ReLU is viable in GRUs and speeds up convergence, but Leaky ReLU makes a big difference
- Model choice and feature engineering matter more than just depth

What I'd Try Next

- Use rolling windows for live prediction simulation
- Try on other stocks or build a multi-stock model
- Try LSTM with Volume
- Add scripts for graphs to be produced as the models are trained

Thank you!