Report on Data Science Project

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Novel Contributions

1 Dynamic Graph Construction

- Sliding Window Correlations: Updates graphs over time.

- Multi-Level Hierarchical Learning: Combines intra- and inter-sector dependencies.

2 Integration of LSTM with HGAT

- Replaces GRU with LSTM for better temporal modeling.

- Fuses multi-level embeddings: LSTM + HGAT + Dynamic Graph.

3 Reinforcement Learning for Trading Optimization

- PPO for trading actions.

- Continuous learning from market feedback.

Proposed Methodology

1 Data Collection and Preprocessing

- Weekly aggregation of NIFTY 500 and Yahoo Finance data.

- Cleaning, normalization, wavelet/Fourier transforms.

- Data augmentation: Gaussian noise, bootstrapping.

2 Time-Series Forecasting Using LSTM

- Predicts short and long-term stock trends.

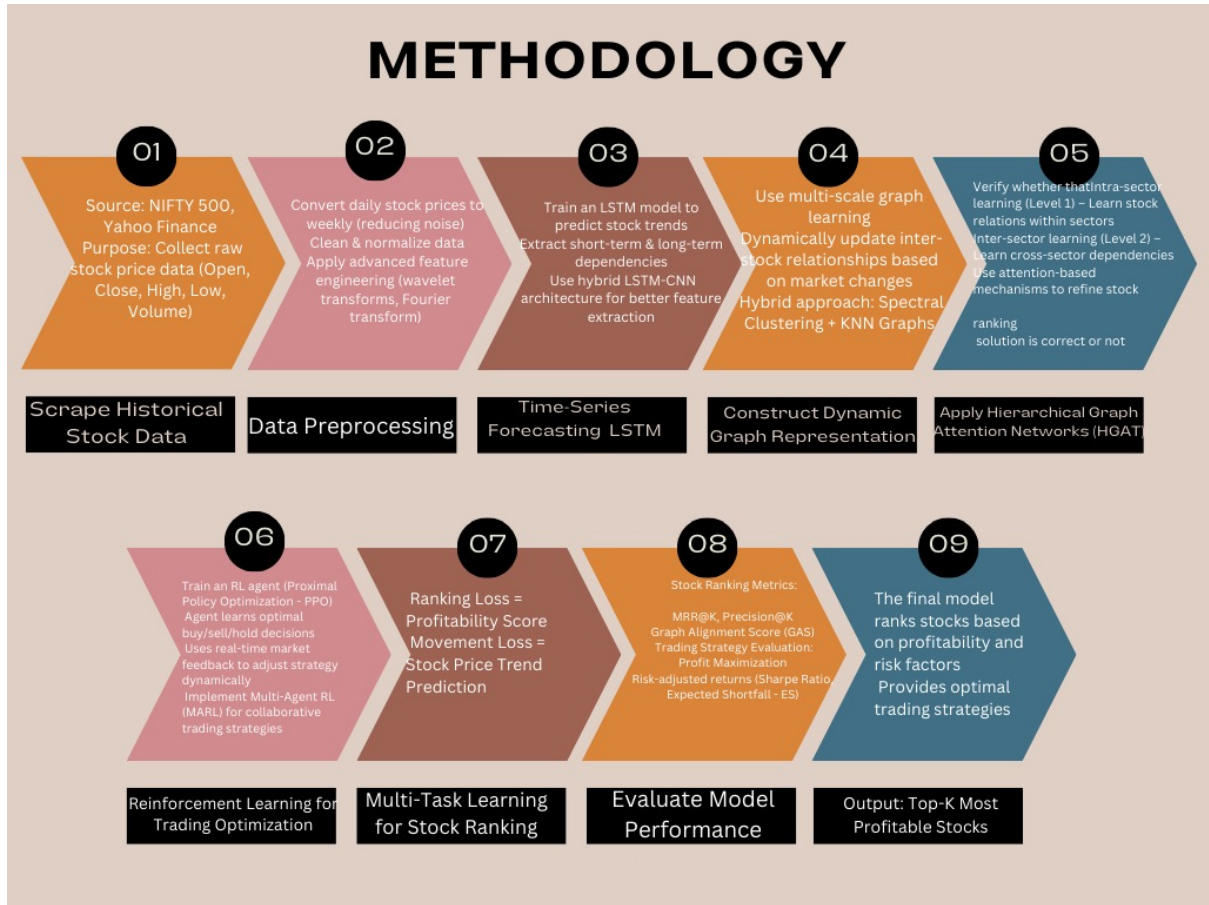- Hybrid LSTM-CNN and Transformer-LSTM for better features.

Figure 1: Methodology Diagram

3 Dynamic Graph Construction

- Multi-scale graph learning.

- Spectral clustering, KNN graphs.

- Dynamic edge weights and thresholds.

4 Hierarchical Graph Attention Network (HGAT)

- Learns intra- and inter-sector relationships.

- Self-supervised contrastive learning.

- Graph diffusion and BPR loss.

5 Reinforcement Learning for Trading

- PPO trains buy/hold/sell agents.
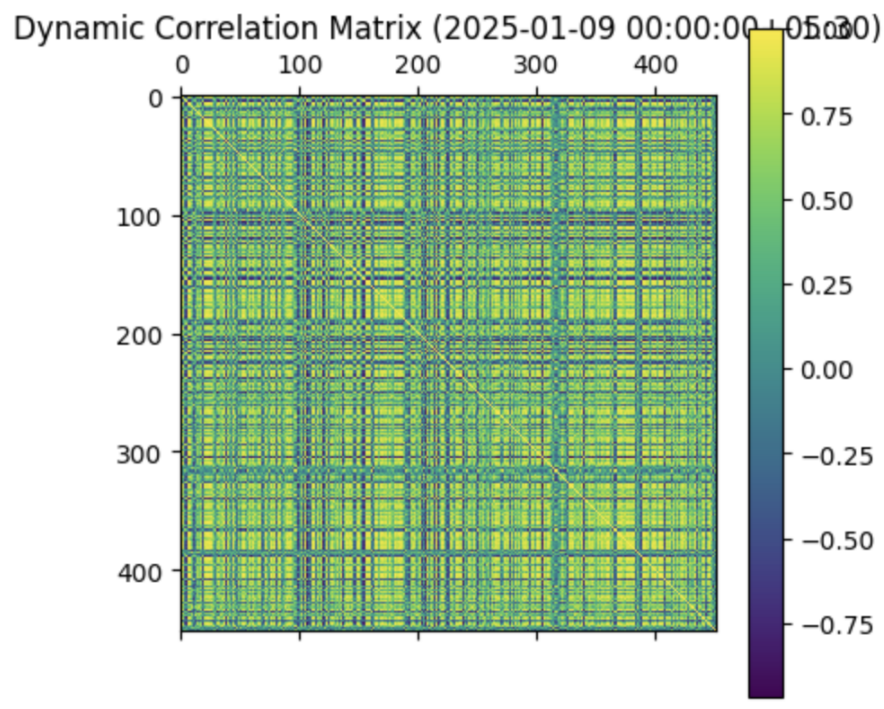
- Multi-agent RL adapts strategies.

Figure 2: DYNAMIC CORRELATION GRAPH

Figure 3: LSTM

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Episode 33/50 — Epsilon: 0.8518
Episode 34/50 — Epsilon: 0.8475
Episode 35/50 — Epsilon: 0.8433
Episode 36/50 — Epsilon: 0.8391
Episode 37/50 — Epsilon: 0.8349
Episode 38/50 — Epsilon: 0.8307
Episode 39/50 — Epsilon: 0.8266
Episode 40/50 — Epsilon: 0.8224
Episode 41/50 — Epsilon: 0.8183
Episode 42/50 — Epsilon: 0.8142
Episode 43/50 — Epsilon: 0.8102
Episode 44/50 — Epsilon: 0.8061
Episode 45/50 — Epsilon: 0.8021
Episode 46/50 — Epsilon: 0.7981
Episode 47/50 — Epsilon: 0.7941
Episode 48/50 — Epsilon: 0.7901
Episode 49/50 — Epsilon: 0.7862
Episode 50/50 — Epsilon: 0.7822
Top K Stocks to Buy:
              Stock  return_ratio  Action
107714    ADANIENT      0.200394       1
169902  EASEMYTRIP      0.200157       1
113783        MMTC      0.200000       1
47153   ADANIGREEN      0.200000       0
294440    APARINDS      0.199972       1
195171   KIRLOSENG      0.199969       1
272548        FACT      0.199967       1
88615          ITI      0.199823       1
29057         TTML      0.199668       1
146296        GSFC      0.199531       0
```

Figure 4: R-LEARNING RANKINGS

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Precision: 0.0222
Accuracy: 0.6053
Mean Reciprocal Rank (MRR): 0.2728
Mean Absolute Error (MAE): 0.0009
```

Figure 5: K=5

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Precision: 0.0222
Accuracy: 0.6080
Mean Reciprocal Rank (MRR): 0.2774
Mean Absolute Error (MAE): 0.0008
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Figure 6: K=10