

Hybrid AI Models for Intelligent Investment Advisory System in the Saudi Stock Market

AI901 Thesis Presentation

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1. Background, Problem, and Motivation

Why this topic matters

- Tadawul has grown in scale and importance, creating a need for better data-driven decision support.
- Stock prices are noisy, nonlinear, and sensitive to multiple internal and external factors.

Main problem

- Traditional models are often too limited to capture complex price dynamics in real market conditions.
- Many existing tools focus on prediction alone and do not support practical investment decisions.

Project direction

- The project develops a human-centered advisory framework for the Saudi market.
- The goal is to combine forecasting, stock relationships, and trading logic into one coherent system.

2. Research Gap, Aim, and Questions

Research gap

- Prior studies often target global markets, focus on a single model family, or emphasize full automation rather than investor-facing advisory output.

Research aim

- To design and evaluate a hybrid AI advisory framework for Tadawul that remains close to the first-term proposal while improving justification and structure.

RQ1

- Can hybrid forecasting models improve predictive quality over simpler baselines?

RQ2

- Can graph-based modeling capture useful relationships among stocks?

RQ3

- Can a reinforcement learning agent improve buy, sell, and hold decisions?

RQ4

- How can these outputs be presented as practical investor guidance?

3. Proposed Hybrid Framework



4. Data Collection and Preprocessing

Planned data inputs

- Historical daily OHLCV data for selected Saudi stocks and indices.
- Sector information and market-derived features.
- Technical indicators such as RSI, MACD, moving averages, and volatility measures.

Preprocessing pipeline

- Clean and align time series data.
- Handle missing values and outliers.
- Normalize features and create train, validation, and test splits.

Why this matters

- Reliable preprocessing improves model stability and fairness in evaluation.
- It also helps reduce noise before forecasting and trading components are trained.

5. Model Components and Decision Logic

Forecasting module

- Sequence models estimate short-term price direction or trend probability.
- This layer provides predictive signals rather than final decisions on its own.

Graph component

- A stock graph captures sector and inter-stock relationships.
- This allows the model to use information beyond a single isolated time series.

RL agent

- The trading agent receives market features and model signals as part of its state.
- Its action space is limited to buy, sell, and hold.

Decision layer

- Outputs are translated into practical investor guidance with confidence and simple risk cues.

6. Experimental Design and Evaluation

Evaluation setup

- Use out-of-sample backtesting on Saudi market data.
- Compare the hybrid system with simpler baseline models.
- Check robustness under different market regimes when possible.

Prediction metrics

- Accuracy, F1 score, RMSE, and related forecast-quality metrics.
- These reflect whether the forecasting layer produces useful signals.

Trading metrics

- Cumulative return, Sharpe ratio, win rate, and maximum drawdown.
- These assess whether the advisory and RL layers support realistic decisions.

7. Expected Contributions, Limits, and Next Step

Expected contribution

- A Saudi-market-oriented hybrid AI framework that combines forecasting, relational modeling, and reinforcement learning.
- A practical advisory output instead of a purely numerical forecast.

Study limits

- Results depend on historical data quality and may not fully generalize to unusual market events.
- The current scope is decision support, not a guaranteed profit system.

Immediate next step

- Complete the final formatting details, update student information, and prepare for oral discussion using this simplified slide flow.

Conclusion

This thesis presents a practical hybrid AI framework for the Saudi stock market. It stays aligned with the first-term proposal while refining the structure, justification, and presentation for final submission.

Thank you

Questions?