

An Integrated Technical and Fundamental Stock Analysis Model for the Saudi Stock Market (Tadawul)

Master of Science in Artificial Intelligence Thesis Defense

A hybrid AI framework combining technical and fundamental analysis to generate short-term trading signals compliant with CMA regulations.



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Research Problem & Objectives

The Research Gap

- Fragmentation between Technical Analysis (short-term) and Fundamental Analysis (intrinsic value) impacts trading decisions.
- Most AI studies focus on statistical price prediction accuracy rather than actual economic performance and profitability.



Technical Only

Misses company value



Fundamental Only

Misses timing signals

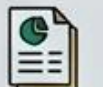
Main Objectives

- ✓ Integrate technical and fundamental indicators into a single hybrid AI model to improve decision accuracy.
- ✓ Define a practical economic target: achieve +5% profit before reaching -2% loss within a 5-10 day trading horizon.
- ✓ Evaluate model performance using real financial metrics: Sharpe ratio, Maximum Drawdown, and Win rate.
- ✓ Ensure full compliance with Capital Market Authority (CMA) regulations by relying solely on public data.
- ✓ Build a reproducible framework applicable to other financial markets or companies in the future.

AN INTEGRATED TECHNICAL AND FUNDAMENTAL STOCK ANALYSIS MODEL FOR THE SAUDI STOCK MARKET (TADAWUL)

Data Collection

 Historical Prices

 Financial Statements

 Company Fundamentals

Data Preprocessing

 Data Cleaning

 Feature Scaling

 Missing Values Handling

Feature Engineering

Technical Indicators	Fundamental Ratios
 RSI graph	 P/E ratio calc
 MACD chart	 ROE scale
 Moving Averages	 Debt-to-Equity balance
 Volatility symbol	 Profitability metric

Label Generation



Take Profit = +5% 

Stop Loss = -2% 

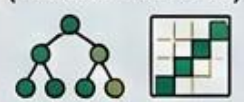
Binary Target (1/0)

Result, explain to rarity binary target (1/0)

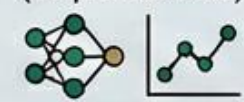
Enacting Data Gas Data

Train/Test Split

XGBoost
(Tabular Features)



BiLSTM
(Sequential Data)



Hybrid Ensemble

XGBoost

BiLSTM



Hybrid Ensemble





Weighing

Predictive Evaluation

 B1, R4, B2, R3, R2

 Accuracy

 Precision

 ROC-AUC

Trading Backtesting



Trade

Threshold Testing: 0.50 -> 0.75

Financial Evaluation

 Total Return

 Sharpe Risk vs. Return

 Maximum Drawdown

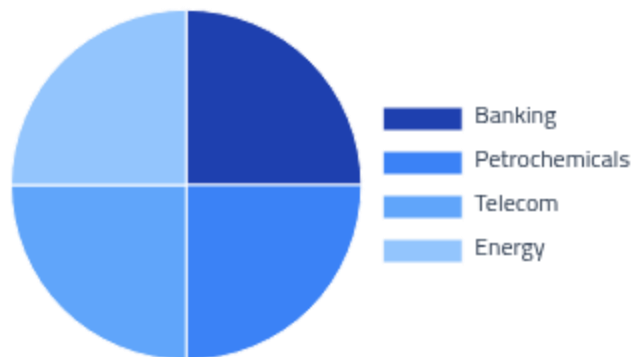
 Win Rate

Best Model Selection

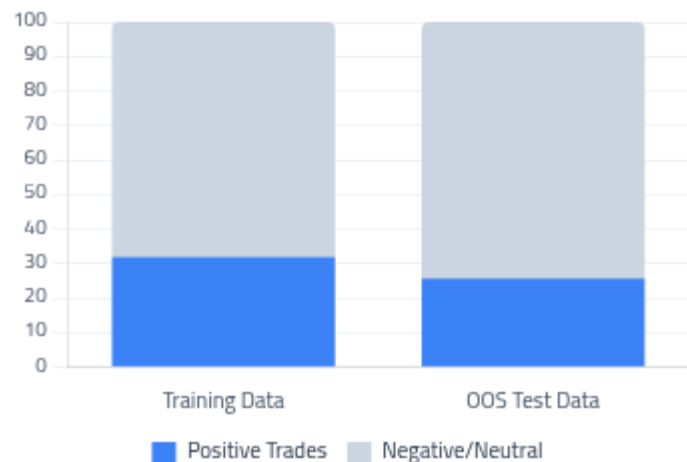
Selected Best Model Parameters

Dataset Overview & Statistics

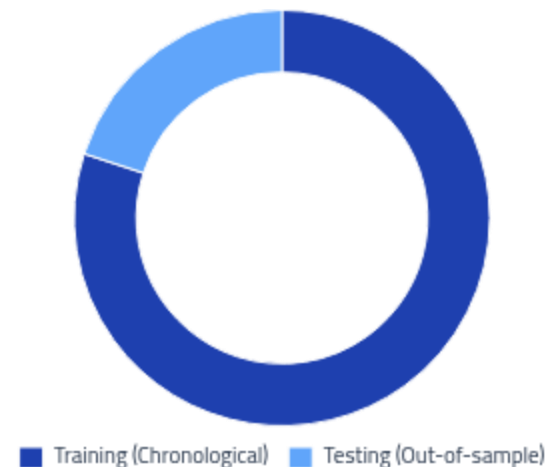
 Sector Distribution (20)



 Class Balance (Positive Trades)



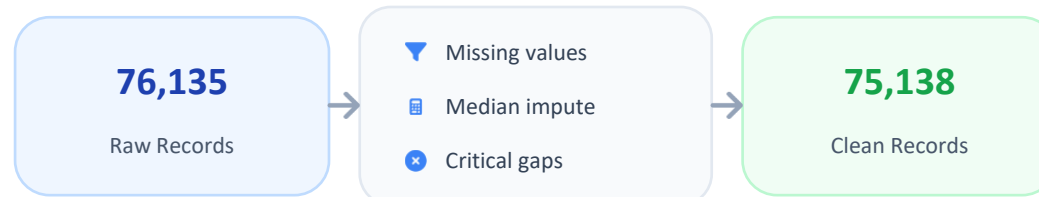
 Chronological Split



 Data Period (2021 - 2025)



 Data Cleaning Pipeline



Methodology & Hybrid Model Architecture



Data Preparation & Trading Rules

- 20 TASI Companies (2021–2025); 19,742 trading records.
- Target: +5% (Take-Profit), -2% (Stop-Loss), 5-10 day horizon.
- Strict chronological split with 0.30% transaction cost.



Technical Model: BiLSTM

- Time-series analysis using rolling windows (60 days).
- Architecture: 2 Bidirectional layers with Dropout (0.5).
- Activation: Sigmoid function with Early Stopping.



Feature Engineering

- Technical: Returns, MAs (SMA/EMA), RSI, MACD.
- Fundamental: Return on Equity (ROE), Debt-to-Equity (D/E).
- Additional: Profit Margin, Earnings Per Share (EPS).



Fundamental & Technical: XGBoost

- Deep integration of financial fundamentals with technicals.
- Class imbalance handling using scale_pos_weight.
- Parameters: max_depth=6, n_estimators=400, lr=0.05.



Hybrid Integration Framework

- 🔗 **Fixed Weight Distribution:** Relies 60% on XGBoost signals (Fundamental + Technical) and 40% on BiLSTM signals (Temporal + Technical).
- ⚡ **Threshold Selectivity:** A threshold of 0.75 was identified as the optimal decision point to ensure high-quality signals and reduce losing trades.
- 🛡️ **Financial Impact:** Requiring model agreement filters out false signals, increasing trading accuracy and significantly reducing Max Drawdown.

Conclusion & Recommendations

★ Key Conclusions

- The integration of technical and fundamental analysis within a hybrid AI framework generates superior short-term trading signals in the Saudi Stock Market.
- The true value of the model derives from improving entry/exit decisions and trade selectivity, rather than merely predicting price direction accurately.

🚀 Research Contributions

- Developed an interpretable hybrid model compliant with CMA regulations.
- Created a generalizable framework relying exclusively on public, structured data without utilizing unstructured rumors.
- Shifted the prediction problem from basic price trend classification to achieving specific, predefined economic objectives.

💡 Practical Implications

- Focus on risk-adjusted metrics (Sharpe Ratio, Max Drawdown) as primary evaluation criteria for automated trading models.
- Utilize higher decision thresholds to increase trade selectivity and minimize low-probability entries.
- Strictly enforce out-of-sample temporal testing and explicitly account for transaction and execution costs.

📌 Limitations & Future Work

Limitations: Scope restricted to 20 companies over 5 years. Does not fully incorporate liquidity constraints or price slippage for all scenarios.

Expansion: Apply the model to alternative financial markets and integrate broader macroeconomic indicators.

Technical Dev: Explore Reinforcement Learning (RL), implement dynamic thresholds, and build continuous retraining mechanisms to adapt to shifting market conditions.