



AI-Driven Stock Market Forecasting Using Financial Statement Analysis

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Introduction

In selecting the fiscal year-end for analysis, this study aligns itself with the Saudi stock market's (TASI) fiscal cycle to ensure uniformity in evaluating mid- to long-term directions of stocks. The TASI was chosen because Saudi-listed companies tend to synchronize annual reporting periods, and it facilitates cross-firm comparison and increases the reliability of time-series analysis. Alternatively, different fiscal year-ends for different companies might cause reporting lapses that would hinder accurate measurement of performance.

This research employs three primary stock analysis techniques:

Technical Analysis: Examines historical stock prices and trading volumes to identify patterns and forecast direction.

Fundamental Analysis: Evaluates a company's underlying value based on financial statements, profitability, management efficiency, and products.

Sentiment Analysis: Studies investor sentiment by reading news media, social media, and other public materials. (it is recommended that sentiment data be integrated into the dataset in future extensions of this research.)



Objectives

Develop and evaluate machine learning models to forecast stock price movement in the Saudi stock exchange using financial statement information.

To apply and contrast different machine learning algorithms, the Random Forest (RF), Feedforward Neural Network (FNN), Gated Recurrent Unit (GRU), Graph Attention Network (GAT), and Financial Graph Attention Network (FinGAT), to predict stock price variations.

Demonstrate the potential of machine learning techniques to enhance mid- to long-term investment decision-making in terms of reducing prediction error and identifying high-performing stocks.



Methodology



Dataset



**Financial Ratios of 18 Ratios as
Attributes**



Moving Time Period



Evaluation Metrics

Data Description

Historical financial statement data and market prices were obtained for listed companies on the Tadawul Stock Exchange, the dataset includes data from 253 publicly traded companies across various sectors, including banking, energy, industrials, healthcare, and real estate.

Source: Tadawul and company reports, Yahoo Finance, SAMA and GASTAT

Financial Ratios of 18 Ratios as Attributes

There are 18 financial ratios as input for models

There are five main types of financial ratios:

- ☐ Liquidity ratios
- ☐ Leverage ratios
- ☐ Asset efficiency ratios
- ☐ Market value ratios
- ☐ Profitability ratios

Type	Ratio	Calculation
Liquidity Ratios	Current	$\frac{\text{Current assets}}{\text{Current liabilities}}$
Leverage Ratios	Debt to Equality	$\frac{\text{Long Term Debt}}{\text{Shareholders' Equality}}$
	Debt to Capital	$\frac{\text{Long Term Debt}}{\text{Shareholders' Equality} + \text{Long Term Debt}}$
Asset Efficiency Ratios	Asset Turnover	$\frac{\text{Sales}}{\text{Total Assets}}$
	Inventory Turnover	$\frac{\text{Sales}}{\text{Inventories}}$
	Receivable Turnover	$\frac{\text{Net Credit Sales}}{\text{Receivables}}$
	Days Sales in Receivable	$\frac{\text{Receivables}}{\text{Net Credit Sales}} \times 365$
Market Value Ratios	Book Value per Share	$\frac{\text{Shareholders' Equality}}{\text{Shares Outstanding}}$
Probability Ratios	Gross Margin	$\frac{\text{Sales} - \text{Cost of Goods Sold}}{\text{Investment Base}}$
	Operating Margin	$\frac{\text{Operating Income Before Interest and Taxes}}{\text{Revenue}}$
	Pre-tax profit margin	$\frac{\text{Sales} - \text{Cost of Goods Sold}}{\text{Investment Base}}$
	Net Profit Margin	$\frac{\text{Net Operating Income}}{\text{Revenue}}$
	Return on Equality	$\frac{\text{Net Operating Income}}{\text{Shareholder's Equality}}$
	Return on Tangible Equality	$\frac{\text{Net Operating Income}}{\text{Tangible Shareholder's Equality}}$
	Return on assets	$\frac{\text{Net Operating Income}}{\text{Total Assets}}$
	Return on investment	$\frac{\text{Investment Gain}}{\text{Investment Base}}$
	Operating Cash Flow Per Share	$\frac{\text{Operating Cash Flow}}{\text{Shares Outstanding}}$
	Free Cash Flow per Share	$\frac{\text{Operating Cash Flow} - \text{Capital Expenditures}}{\text{Shares Outstanding}}$



Time Period

Data covers the period from 2015 to 2023, using quarterly financial reports.





Evaluation Metrics



Mean Absolute Error (MAE)



Root Mean Squared Error (RMSE)



Time Period

Data covers the period from 2015 to 2023, using quarterly financial reports.





The proposed Deep Learning models



Random Forest (RF)



Feedforward Neural Network (FNN)



Gated Recurrent Unit (GRU)



Graph Attention Network (GAT)



**Financial Graph Attention Network
(FinGAT)**



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Thank You