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IDENTIFICATION OF MOST SIGNIFICANT FINANCIAL PARAMETERS FOR LONG TERM STOCK TREND PREDICTION USING MACHINE LEARNING

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ABSTRACT

The Indian stock market is an intriguing and difficult industry. Demand and supply considerations are the fundamental determinants of equity share price. Prices rise when the majority of individuals begin to purchase, and they decrease when the opposite occurs. This research aims to identify the most crucial criteria for forecasting long term stock trend. We are making unique stock price predictions for eight distinct firms across several industries. We utilize twelve financial parameters for each organization to aid in assessing whether prices are likely to increase or decrease.

Index Terms - SVM, Decision Tree, PE (Price to Earnings ratio), EPS (Earning Per Share), ROE (Return On Equity), OPM (Operating profit margin).

INTRODUCTION

One of the main investment methods is long-term investing. Yet, determining a company's fair value and evaluating shares for long-term investment can pose challenges, as analysts must take into account a diverse range of financial factors and conduct comprehensive analyses for each. Thus far, machines have not yielded much assistance in forecasting the trajectory of company value over an extended duration. In this work, we introduce a machine learning-assisted method for assessing the long-term trend of equity prices.

Each stock market encompasses a vast array of listed stocks. In India, the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) list close to 2000 and close to 5000 stocks, respectively. For the average investor, identifying a fundamentally sound stock proves challenging, given the need to review extensive financial information for each firm.

FUNDAMENTALS OF STOCK MARKET

DATASETS

Screener.in was utilized to acquire the dataset. We have chosen eight distinct equities from various industries. We derived the following financial metrics for every stock in our dataset for every company:

- **Price to Earnings P/E Ratio –** It measures company's current share price relative to its per share earnings.
- **Earnings Per Share -** The earnings per share represent a company's profit divided by the total number of issued shares.
- **Sales/Revenue -** Sales/Revenue is the total amount of money a business makes from its main activities before deducting any costs. Sales are the money that a business makes from its clients' purchases of products or services.
- **Profit -** The amount that remains for a business after expenses are covered is called profit.
- **Reserve -** A highly liquid asset, such as savings account, put aside by a person or organization to cover unforeseen expenses or other financial responsibilities.
- **Borrowing –** Dues on a company.

- **ROE (Return on Equity) -** A measure of financial performance calculated by dividing net income by shareholders' equity.
- **OPM (Operating Profit Margin) -** This measure indicates the amount of money a business generates on a sale once all variable expenses of production -like labor and raw materials-have been paid. It is used before interest or taxes are paid.
- **D/E Ratio -** This ratio is derived by dividing a company's total liabilities by its shareholder equity. This metric is employed to evaluate the financial leverage of a company.
- **Promoter Holding -** The proportion of a company's shares held by its promoters, or the people or organizations that started or are in charge of the business, is known as the promoter holding.
- **FII Holding -** Foreign institutional investors (FIIs), institutional investors from overseas, invest in assets located in countries other than their own, corresponding to the locations of their respective headquarters.
- **DII Holding -** Investors managing a nation's financial assets on behalf of entities such as mutual funds, banks, insurance companies, and other organizations are termed domestic institutional investors, abbreviated as DIIs.

WHAT EACH PARAMETER INDICATES? & THEIR THRESHOLD VALUES:

We can use each of the above-mentioned financial information to determine if the stock is undervalued or overvalued. Each financial parameter has a specific threshold value, and this value can represent a variety of information, including whether the stock is expensive or cheap, the company's performance (i.e., good, average, or bad), operating efficiency, financial leverage, profitability, and investor and owner trust in the business.

Table I: What Parameters Indicates? & Their Threshold Values

Financial Parameters	Indicates	Threshold Values
PE [2][5][10]	Stock is expensive or cheap	< 15 OR 20
EPS [1][3][12]	Performance of company	Increased 15 to 20%
Sales/Revenue [5]	Performance of company	Increased 15%
Profit [3][5]	Performance of company	Increased 15%
Reserve	Reserve cash	More than borrowing
Borrowing	Dues on company	Less than reserve
ROE [4][5][11][12]	Profitability of the company	> 15 %
OPM (%) [12]	Operating efficiency	> 10 %
D/E Ratio [5][12]	Financial leverage	< 1.5 OR 2
Promoter Holding [1]	Trust of owner on company	> 50%
FII Holding	Trust of investor on company	> 5%
DII Holding		

MACHINE LEARNING FOR FINANCIAL INSTRUMENTS

Over the past few years, machine learning (ML) has found applications in various study areas, most notably finance and economics. Various researchers have developed tools to analyze past financial data and other relevant information to aid in investing decision-making by using machine learning (ML) algorithms.

More crucially, to provide accurate findings using historical or time series financial data, careful selection of the right models, data, and characteristics is necessary. To obtain reliable findings, it is crucial to use appropriate algorithms, build an effective infrastructure, and gather relevant data. The ML result is more accurate the higher the quality of the data.

The tremendous advancements in (ML) machine learning in recent years have transformed the way investors use data and provided the best analytical possibilities for all kinds of investments. ML is hence a useful tool to support financial investing. The ML techniques utilized and applied to forecast asset returns or identify the pattern

or distribution of asset returns are summarized in Table 2 [11]. These methods include portfolio optimization, prediction, classification, and clustering, among others.

For classification and prediction, the majority of researchers have employed C4.5 decision trees, SVM, Random Tree, Random Forest, Logistic Regression, Naïve Bayes, Bayesian Networks, KNN, and ANNs.

- **Support Vector Machine:** In machine learning, (SVMs) support vector machines are a form of supervised learning algorithm that are used to handle regression and classification tasks. SVMs are especially effective at tackling binary classification problems, which call for splitting a data set's elements into two groups. The optimal line, or decision border, between different data points of several data classes is the target of a (SVM) support vector machine method. When referring to this boundary in high-dimensional feature spaces, it is known as a hyperplane. In order to make it simple to identify between different data classes, the objective is to maximize the margin, which is the distance between the hyperplane and the closest data points of each category.
- **Decision Tree:** Decision trees, a form of supervised learning, utilize a tree-based approach to predict the outcomes of a target variable. Supervised learning involves employing regression and classification algorithms on labelled data, where the output variables are known. Acting as a guide during model training with predefined output variables, supervised learning leverages various features in the data to learn fundamental decision principles. Python decision trees are frequently applied for probability calculations and can effectively address both regression and classification challenges.

Table II: Existing Algorithms and Methods Employed for Financial Instruments

Methods	Type of financial instrument		
	Stocks	Bonds	Derivatives
Clustering			
K-Means	√		
SOM	√		
Hierarchical	√		
Clustering	√		
Prediction			
RF	√	√	
SVM	√	√	
MLP	√		√
LSTM	√		
RNN	√	√	√
GAs	√		√
KNN	√	√	√
SVR	√	√	√
MCS	√	√	√
ANNs	√	√	√
CART	√	√	
GP	√		√
BSM	√		√
GRNN	√		
RBF			√
BPNN	√	√	√
LR	√		√
HMM	√	√	√

Classification			
SVM	√	√	
KNN	√	√	
LR		√	
ANNs		√	

METHODS

For eight different companies—Reliance, Asian Paints, Bajaj Finance, HUL, TCS, Titan, and Vodafone Idea—a sophisticated comprehension of financial statistics is provided by the application of stock classification through machine learning models such as Support Vector Machines (SVM) and Decision Trees. The success of each method is examined by carefully matching key basic metrics such as PE, EPS, Sales/Revenue, Profit, Reserve, Borrowing, ROE, OPM, D/E Ratio, Promoter Holding, FII Holding, and DII Holding.

Table III: Classification Using Svm and Decision Tree with Different Pair of Financial Parameters

Companies	Algorithms	Accuracy	Financial parameters
Reliance Asian_Paint Bajaj_Finance HUL TCS Titan Vodafone	Support Vector Machine	75%	PE, EPS, Sales/Revenue, Profit, Reserve, Borrowing, ROE, OPM(%), D/E, Ratio, Promoter, FII and DII Holding
		75%	EPS, Profit, Reserve, ROE
		75%	Reserve, ROE
		82%	Profit, ROE
		83%	Profit, Reserve, ROE
		92%	EPS, Profit, ROE
		92%	EPS, Reserve, ROE
	Decision Tree	58%	PE, EPS, Sales/Revenue, Profit, Reserve, Borrowing, ROE, OPM(%), D/E, Ratio, Promoter Holding, FII Holding, DII Holding
		90%	EPS, Profit, ROE

Upon pairing these diverse financial datasets, the SVM and Decision Tree models are trained to classify stocks based on the provided parameters. Remarkably, varying accuracies emerge for each model, reflecting the intricacies of their respective algorithms. Notably, across both SVM and Decision Trees, it is consistently revealed that EPS (Earnings Per Share), Profit, and ROE (Return on Equity) stand out as the most significant financial parameters influencing stock classifications.

Figure 1

IMPLEMENTATION OF CLASSIFICATION OF STOCK USING FINANCIAL DATASET USING DECISION TREE

Earnings Per Share (EPS) serves as a crucial indicator of a organization's profitability on a per-share basis, while Profit and ROE provide insights into overall financial health and efficiency. The models' recognition of these key metrics highlights their effectiveness in discerning patterns within complex financial datasets.

The nuanced accuracy variations between SVM and Decision Trees underline the importance of considering different machine learning approaches in stock analysis. Investors gain valuable insights into the strengths and limitations of each model, allowing for a more informed decision-making process. Ultimately, the identification of EPS, Profit, and ROE as consistently significant parameters reaffirms their critical role in assessing and predicting the performance of diverse stocks across varied industries.

CONCLUSION

In conclusion, the research demonstrates the efficacy of employing Support Vector Machines (SVM) and Decision Trees for stock classification based on diverse fundamental datasets across eight major companies. The nuanced pairing of financial metrics reveals varying accuracies, emphasizing the importance of algorithmic diversity. Notably, consistent findings underscore EPS, Profit, and ROE as pivotal parameters shaping stock classifications. This insight not only enhances the understanding of machine learning models' performance but also provides investors with key indicators for informed decision-making in the dynamic realm of stock markets, emphasizing the critical role of earnings, profitability, and return on equity in predicting and categorizing stock performance.

FUTURE WORK

Future work should explore the integration of advanced machine learning techniques and feature engineering to enhance stock classification accuracy. Additionally, a comparative analysis with other classification models could provide deeper insights. Fine-tuning the models for sector-specific nuances and incorporating real-time data could further refine predictions. Investigating the impact of external economic factors on stock classification may offer a broader perspective. Moreover, expanding the dataset to include more companies and global market dynamics would contribute to a comprehensive understanding. The research could also benefit from incorporating sentiment analysis from financial news and social media for a holistic assessment of market sentiment influencing stock performance.

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