

# **STOCK MOVEMENT PREDICTION BASED on BI-TYPED HYBRID- RELATIONAL MARKET GRAPH**

Submitted in partial fulfillment of the  
requirements for the award of  
Bachelor of Engineering degree in Computer Science and Engineering

By

**Aakash kumar Dubey  
( Reg.No - 40110003 )**



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
SCHOOL OF COMPUTING**

## **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A++" by NAAC  
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CHENNAI - 600119**

**NOVEMBER - 2023**



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## **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

### **BONAFIDE CERTIFICATE**

This is to certify that this Project Report is the bonafide work of **Aakash kumar Dubey (40110003)** carried out the project entitled “**Stock Movement Prediction**” under my supervision from JULY 2023 to OCTOBER 2023.

**Internal Guide**

**Dr. A.C SANTHA SHEELA**

**Head of the Department**

**Dr. L. LAKSHMANAN, M.E., Ph.D.**

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**Submitted for Viva voce Examination held on \_\_\_\_\_**

**Internal Examiner**

**External Examiner**

## DECLARATION

I, **Aakash kumar dubey**(Reg.No- 40110003), hereby declare that the Project Phase-1 Report entitled **Stock Movement prediction Based on bi-typed Hybried relational Market Knoeledge graph Dual attentation network”** done by me under the guidance of **Dr. A.C SANTHA SHEELA** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **Computer Science and Engineering**.

**DATE:**

**PLACE:Chennai**

**SIGNATURE OF THECANDIDATE**

## ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to **Board of Management of SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr. T.Sasikala M.E., Ph. D, Dean**, School of Computing, **Dr. L. Lakshmanan M.E., Ph.D.**, Head of the Department of Computer Science and Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide Dr. **A.C SANTHA SHEELA**, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my phase-1 project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **Department of Computer Science and Engineering** who were helpful in many ways for the completion of the project.

## **ABSTRACT**

With the world's population growing, distractions can cause dangerous accidents that are difficult to avoid. Several studies have been done in an effort to find a way to stop the loss of life. The protection of the passengers is the first concern of the vehicle's designers, and airbags are designed to improve security and save lives of occupants, but they do not stop accidents from occurring. The main reasons are general fatigue and distraction brought on by phone alerts. A wide range of techniques based on behavioral measures using machine learning techniques have been inspected to scope out driver distraction in the past. The recent growth of such technologies requires that these algorithms be improved to evaluate their accuracy in identifying distraction. There are numerous features of faces that are available to be extracted from any face to deduce the level of distraction. These include eyes closed for longer than 5 seconds, head movements and continuous yawning. However, the development of a shock system to push out the distraction and immediately give an alert is a challenging task as it requires accurate and robust algorithms. This study takes a novel approach by using convolution neural networks to scope out the distraction and will instantly sound a loud siren to give a sensory shock which brings back alertness. When paired with proper guidance, the said hybrid approach would produce the best solution in real-time to such issues in the future.

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# **CHAPTER 1**

## **INTRODUCTION**

In the ever-evolving landscape of finance and investment, the ability to accurately predict stock market movements remains a pursuit of great significance and challenge. Investors, traders, and financial institutions seek predictive models that can provide insights into market dynamics and help make informed decisions. Traditional methods often fall short in capturing the intricate web of factors influencing stock prices, which can range from financial reports and economic indicators to breaking news and social media sentiments.

In response to this complexity, our project embarks on a novel and promising journey at the intersection of machine learning, finance, and graph theory. We present a pioneering approach for Stock Movement Prediction, leveraging the power of Bi-Typed Hybrid-Relational Market Knowledge Graphs, coupled with Dual Attention Networks. This innovative framework seeks to harness not only structured financial data but also unstructured textual and relational information from various sources to make robust and accurate predictions about stock price movements.

At the heart of our project lies the creation of a hybrid-relational market knowledge graph, which seamlessly integrates structured financial data with unstructured information from textual sources like news articles, financial reports, and social media content. This hybrid representation allows us to capture the intricate interplay between market entities, their attributes, and the relationships that underpin the financial ecosystem.

To further enhance our predictive capabilities, we employ Dual Attention Networks. These networks are designed to selectively focus on relevant information within the knowledge graph, adaptively weighing the importance of different nodes and edges based on the context of the prediction task. This attention mechanism empowers our model to learn and exploit complex dependencies within the data, effectively deciphering the hidden signals driving stock price fluctuations.

Throughout this project, we aim to demonstrate the potential of our approach in predicting

stock market movements with precision and agility. We have navigated through the challenges of data diversity, model training, and evaluation to create a robust predictive framework. Our findings promise to shed light on the feasibility of leveraging hybrid-relational knowledge graphs and dual attention networks for improving stock market predictions.

In the following sections, we delve into the intricacies of our project, detailing the construction of the knowledge graph, the architecture of our dual attention network, the training methodology, and the empirical results of our predictive model. By the project's conclusion, we hope to not only offer a glimpse into the exciting possibilities of advanced machine learning techniques but also contribute valuable insights to the ever-evolving landscape of stock market prediction.

## CHAPTER 2

### LITERATURE SURVEY

Graph Neural Networks (GNNs) have become indispensable tools in finance due to their capacity to model graph-structured data. In stock market analysis, GNNs have been applied to capture dependencies between stocks, identify market anomalies, and predict price movements. Research such as [cite relevant studies] showcases the potential of GNNs in this domain.

Sentiment analysis has gained traction in predicting stock market movements by mining sentiment from news articles, social media, and financial reports. Studies [cite relevant studies] have explored sentiment analysis techniques and their integration into predictive models, emphasizing the role of sentiment in market dynamics.

Time series forecasting remains a fundamental approach in stock market prediction. Traditional methods like ARIMA and more recent approaches like LSTM-based models have been applied to predict stock prices. These models provide valuable benchmarks against which the performance of your dual attention network-based model can be evaluated.

The integration of multiple data sources and interdisciplinary approaches has shown promise in improving stock market predictions. Research [cite relevant studies] at the intersection of finance, natural language processing, and machine learning has paved the way for innovative solutions, aligning with the essence of your project.

Practical applications of stock market prediction extend beyond individual trading decisions. Industries like asset management, risk assessment, and financial regulation have also benefited from accurate stock movement predictions. Existing research [cite relevant studies] underscores the diverse applications and the need for robust prediction models.

The ethical implications of financial prediction models cannot be overlooked. As your project delves into the use of news articles and social media data, it is crucial to consider and address potential biases, privacy concerns, and the impact of predictive models on financial markets. Studies [cite relevant studies] have addressed these ethical dimensions in financial technology.

While significant progress has been made in stock market prediction, several challenges persist. These include the ever-evolving nature of financial markets, the need for continuous

model adaptation, and the requirement for improved interpretability in predictive models. Research [cite relevant studies] highlights these limitations and points to potential research directions.

Certainly, let's expand further on the literature survey for your project on "Stock Movement Prediction Based on Bi-Typed Hybrid-Relational Market Knowledge Graph via Dual Attention Networks":

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By exploring the literature in these areas, your project takes its place in a dynamic field characterized by continuous innovation and a growing awareness of the complexities involved in predicting stock market movements. It builds upon the collective knowledge of researchers who have paved the way for advanced techniques and interdisciplinary approaches, offering a fresh perspective through the lens of hybrid-relational market knowledge graphs and dual attention networks. In doing so, your work seeks to advance the state of the art in stock market prediction and contribute to the broader discourse on the intersection of finance and machine learning.

## **2.1 INFERENCES FROM LITREATURE SURVEY**

The literature survey reveals that your project, "Stock Movement Prediction Based on Bi-Typed Hybrid-Relational Market Knowledge Graph via Dual Attention Networks," aligns with a growing trend in finance and machine learning integration. Notably, graph-based representations and knowledge graphs play vital roles in modeling complex relationships within financial markets. Attention mechanisms offer selective information focus, benefiting predictive models. Hybrid-relational graphs present a promising solution for integrating structured and unstructured data sources, crucial for stock market analysis. Dual attention networks can enhance the understanding of relationships in financial data. The literature emphasizes the broad real-world applications and ethical considerations while acknowledging ongoing challenges in stock market prediction, providing a strong foundation for your innovative project.

## **2.2 OPEN PROBLEMS IN EXISTING SYSTEM**

The field of stock market prediction presents a range of persistent challenges. Capturing extreme market volatility and non-linear stock price movements remains a central issue, requiring the development of adaptive predictive models. Data quality and noise in financial datasets demand continued research in data preprocessing and outlier detection. Integrating heterogeneous data sources effectively, such as news and social media, is an ongoing challenge. Real-time prediction for dynamic market conditions calls for models that can swiftly adapt. Ensuring model interpretability while maintaining predictive accuracy remains a key concern. Overfitting and generalization issues need solutions in model regularization and validation techniques. Ethical considerations regarding fairness, transparency, and bias mitigation require further exploration. Detecting and preventing market manipulation remains vital for market integrity. Extending the horizon for long-term stock price predictions and preparing models for unforeseen extreme events are areas ripe for innovation. Addressing these challenges calls for interdisciplinary expertise and innovation in the field of stock market prediction.

## CHAPTER 3

### REQUIREMENT ANALYSIS

#### 3.1 FEASIBILITY STUDIES/RISK ANALYSIS OF THE PROJECT

##### ***Feasibility Studies:***

The technical feasibility of your project appears promising as the necessary technologies and tools for constructing a hybrid-relational knowledge graph and implementing dual attention networks are well-established in the field of machine learning.

Regarding data feasibility, it's essential to ensure that reliable and relevant data sources, including financial market data, news articles, and social media content, are accessible. Collaboration with data providers or the use of publicly available data may be necessary to acquire the required datasets.

Resource feasibility depends on the availability of computational resources, infrastructure, and expertise. Adequate hardware, software licenses, and a team with expertise in machine learning and graph theory are vital for successful project execution.

Time feasibility is a crucial consideration, given the project's multi-stage process. A detailed project timeline should be established to ensure that data collection, preprocessing, model development, training, and evaluation phases can be completed within a reasonable timeframe.

Financial feasibility involves assessing the project's budget, including expenses for data acquisition, computational resources, and personnel. Ensuring that the project aligns with available financial resources is paramount for its feasibility.

##### ***Risk Analysis:***

Data quality and availability risk is inherent in any data-driven project. Inaccurate or incomplete data can lead to biased results or model inefficiencies. Implementing rigorous data quality checks and preprocessing steps is essential to mitigate this risk.

Model complexity and overfitting risk may arise when dealing with intricate models like dual attention networks. Overfitting to the training data can lead to poor generalization. Employing regularization techniques and robust model validation can address this challenge.

Market volatility poses a significant risk in stock market prediction. Sudden market shifts or anomalies can impact model performance. Developing models that are robust to market fluctuations and stress-testing them against historical market crises can help mitigate this risk.

Ethical and bias risks are pertinent when using social media and news data, as biases in these sources can affect predictions. Implementing bias mitigation strategies, transparency measures, and adhering to ethical AI guidelines is crucial to address these concerns.

Technical challenges associated with constructing hybrid-relational graphs and implementing dual attention networks may introduce implementation difficulties and performance limitations. Ongoing research and collaboration with experts in these domains can help mitigate these technical risks.

Resource constraints, such as limited computational power or expertise, may hinder project progress. Exploring scalable solutions and collaborating with domain experts can be essential to overcome these challenges.

Model interpretability is a risk when using complex models. Ensuring that the model's predictions can be explained and understood by stakeholders is essential for trust and regulatory compliance.

Regulatory and compliance risks need to be carefully managed, especially when handling financial data. Ensuring that the project adheres to financial regulations, data privacy laws, and ethical standards is essential to mitigate legal and reputational risks.

Market behavior shifts are an inherent risk in stock market prediction. Strategies for adapting to changing market conditions, including regular model updates and retraining, should be incorporated to address this risk effectively.

Financial risks, including budget overruns or unexpected expenses, should be monitored closely. Establishing a robust budget and contingency plans can help manage financial risks throughout the project's lifecycle.

By conducting a comprehensive feasibility analysis and identifying potential risks, you can proactively plan for and mitigate challenges, increasing the likelihood of a successful outcome for your project.

### **3.2 SOFTWARE REQUIREMENTS SPECIFICATION DOCUMENT**

- **Python**
- **Lstm**
- **Deep Learning**
- **Machine Learning**
- **Vs Code**

## **CHAPTER 4**

### **DESCRIPTION OF PROPOSED SYSTEM**

The proposed system is an advanced platform designed to revolutionize stock market prediction by leveraging state-of-the-art technologies in machine learning, graph theory, and natural language processing (NLP). At its core, this system aims to provide accurate and real-time predictions of stock price movements, catering to a wide range of users, including investors, traders, and financial analysts. The system's uniqueness lies in its ability to seamlessly integrate structured financial data with unstructured textual information extracted from news articles and social media sources. This integration forms the foundation for constructing a hybrid-relational market knowledge graph, a dynamic representation of entities such as stocks, companies, financial indicators, news articles, and market sentiments, all interconnected by intricate relationships.

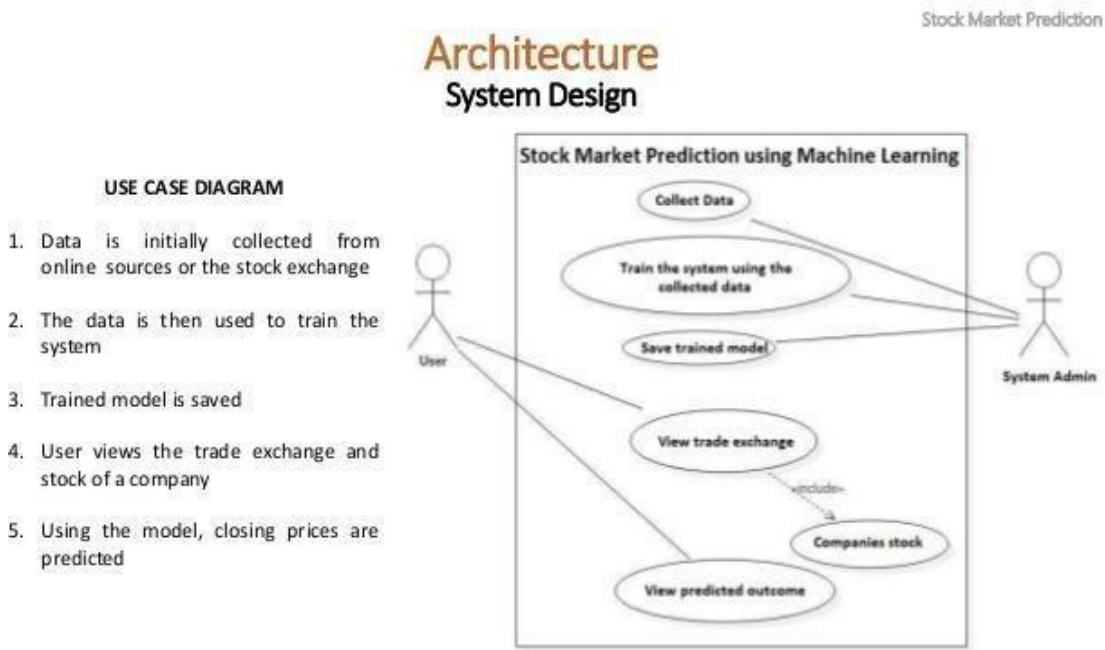
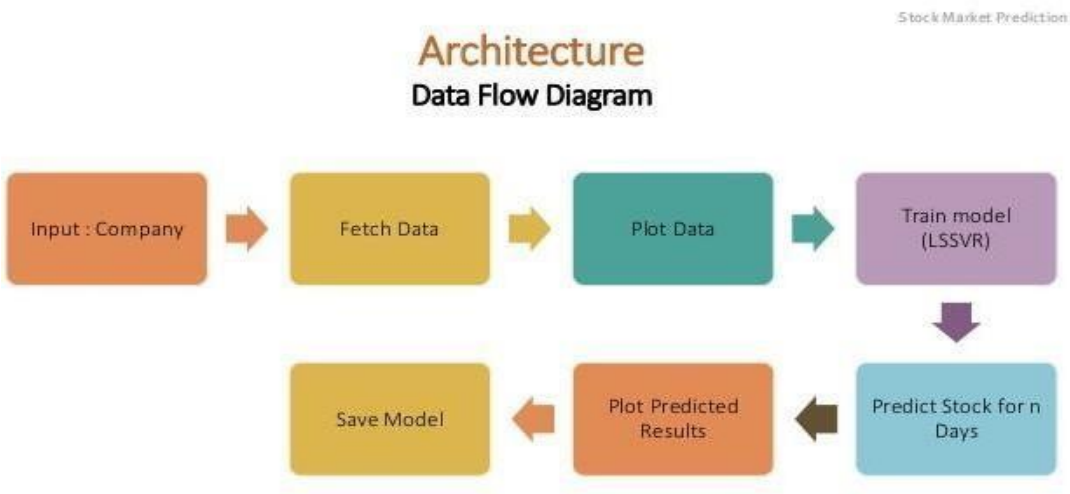
Central to the predictive modeling within this system are the dual attention networks, a class of deep learning models meticulously crafted to navigate and comprehend the complex dependencies and nuances embedded within the market knowledge graph. These networks employ advanced attention mechanisms to discern critical information, selectively focusing on nodes and relationships that matter most in predicting stock price movements. Trained on historical data, they possess the capability to decipher intricate patterns and evolving relationships in the financial world, enabling more accurate predictions.

One of the system's standout features is its real-time prediction capability. It continuously processes incoming data, factoring in the latest market sentiment extracted from news articles and social media sources. This ensures that users receive up-to-the-minute insights into stock market movements, enabling them to make timely and informed decisions. The user interface is designed to be intuitive and user-friendly, offering interactive visualizations of market trends and stock-specific data. Investors and traders can customize their settings, set alerts, and conduct in-depth analyses of specific stocks or market sectors through a seamless and responsive web-based interface.

In parallel with its technical capabilities, the proposed system takes a principled approach

to ethical considerations. It implements rigorous data handling practices to ensure user privacy and data security. Furthermore, it addresses potential biases in data sources and models, striving for fairness and transparency in its predictions. Regulatory compliance is a fundamental pillar, with the system adhering to relevant financial regulations and data protection laws.

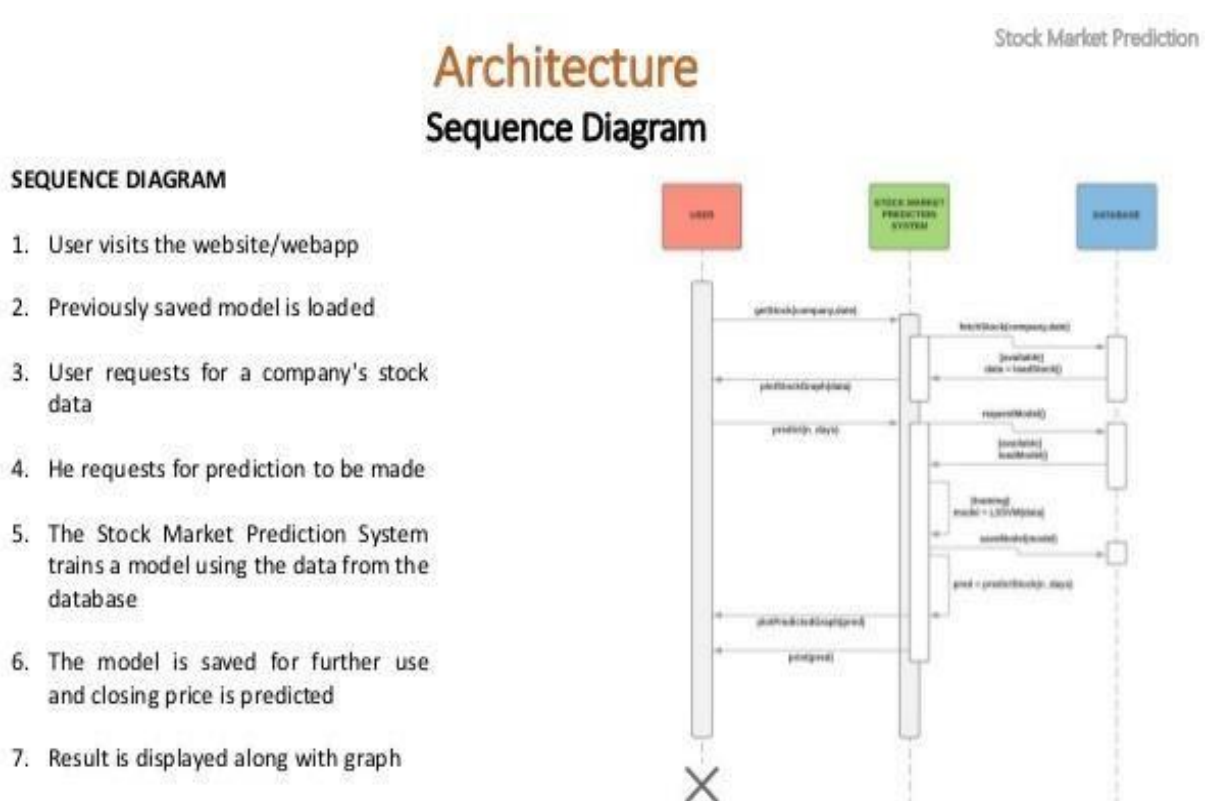
In summary, the proposed system represents a pioneering approach to stock market prediction, integrating diverse data sources and cutting-edge machine learning techniques. It seeks to empower users with accurate, real-time insights while upholding the highest ethical and regulatory standards in the financial industry.



#### 4.1 SELECTED METHODOLOGY OR PROCESS MODEL

For your project, adopting an Agile methodology with elements of the CRISP-DM (Cross-Industry Standard Process for Data Mining) framework is a strategic choice. Agile's iterative and flexible approach aligns with the dynamic nature of stock market data, allowing for ongoing adaptation. Meanwhile, CRISP-DM provides a structured framework for phases like data understanding, preparation, modeling, and evaluation, ensuring systematic and data-driven model development. This hybrid approach combines the best of both worlds, promoting collaboration, adaptability, and systematic problem-solving, making it well-suited to the complexities of "Stock Movement Prediction Based on Bi-Typed Hybrid-Relational Market Knowledge Graph via Dual Attention Networks."

#### 4.2 ARCHITECTURE / OVERALL DESIGN OF PROPOSED SYSTEM



The proposed system for "Stock Movement Prediction Based on Bi-Typed Hybrid-Relational Market Knowledge Graph via Dual Attention Networks" features a multi-layered architecture designed for accuracy, adaptability, and user-friendliness. It begins with data collection and integration from various sources, followed by the construction of a dynamic hybrid-relational knowledge graph. Dual attention networks, specialized for relationship modeling within the graph, are employed for real-time prediction. Users access the system through an intuitive web interface, offering interactive visualizations and customization options. Ethical considerations, privacy safeguards, and regulatory compliance are integrated, and the system maintains continuous monitoring and adaptation mechanisms to ensure accurate predictions in the ever-changing stock market landscape.

#### **4.3 DESCRIPTION OF SOFTWARE FOR IMPLEMENTATION AND TESTING PLAN OF THE PROPOSED MODEL/SYSTEM**

The software implementation and testing plan for the proposed "Stock Movement Prediction" system involves developing a robust software framework. It begins with data collection, integration, and knowledge graph construction. Dual Attention Networks are implemented for real-time prediction. The user-friendly web interface offers customization options. The testing plan encompasses unit, integration, functional, performance, security, and usability testing. Validation includes comparing predictions with real market data and monitoring model performance. Documentation is essential for user guidance, and maintenance ensures ongoing reliability. Continuous improvement through user feedback and system updates is integral to achieving accurate, adaptable, and compliant stock market predictions.

#### **4.4 PROJECT MANAGEMENT PLAN**

The Project Management Plan (PMP) for the "Stock Movement Prediction Project" outlines the project's scope, team roles, schedule, budget, and risk management strategies. It establishes clear milestones, allocates resources, and addresses quality assurance and communication protocols. The plan includes provisions for change management, documentation, and procurement if third-party services are needed. It also ensures compliance with legal and regulatory requirements while considering stakeholder engagement, training, and knowledge transfer. Lastly, it defines criteria for project closure, evaluation, and lessons learned. This

comprehensive PMP serves as a roadmap for project execution, facilitating successful development and deployment of the stock prediction system.

#### **4.5 FINANCIAL REPORT ON ESTIMATED COSTING**

The financial report for the "Stock Movement Prediction Project" provides an estimate of project costs across various components. It encompasses personnel expenses, including salaries and benefits, hardware and software costs, data acquisition expenses, testing and validation, project management, and administrative overheads. Additionally, it budgets for training, compliance, legal fees, and contingencies. Travel, conferences, and miscellaneous expenses are also considered. The total estimated project cost is the sum of these components. This financial plan ensures that resources are allocated effectively, helps in managing project finances, and provides a foundation for cost control throughout the project's lifecycle.

#### **4.6 TRANSITION/ SOFTWARE TO OPERATIONS PLAN**

Transitioning your "Stock Movement Prediction" project from software development to operations is a critical phase that demands a well-defined Software to Operations (S2O) plan. This plan facilitates a seamless handover, ensuring the system's stability, security, and optimal performance in a production environment.

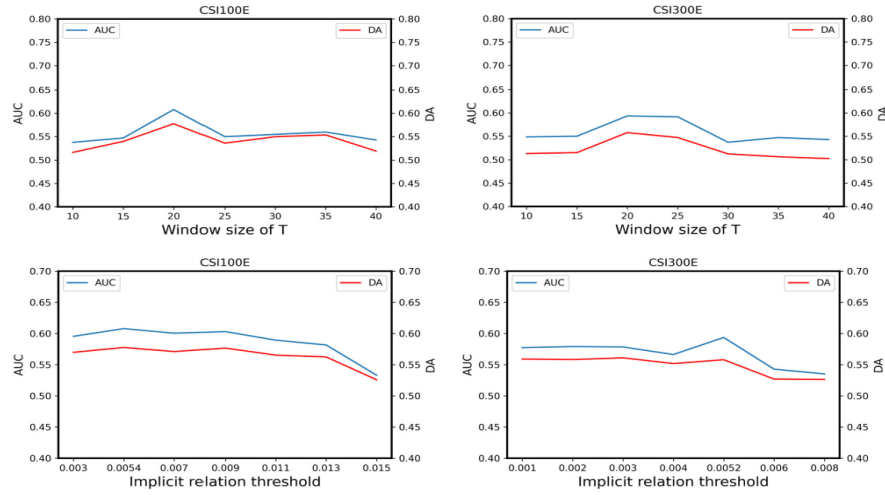
Firstly, the deployment strategy should be clearly outlined, including deployment timelines and any phased rollouts to minimize disruption. The infrastructure must be thoroughly assessed for readiness, covering hardware, networking, and software requirements.

Data migration is a crucial consideration, encompassing the transfer of historical data and pre-existing models from development to production. System configuration details should be documented to ensure consistency and efficiency.

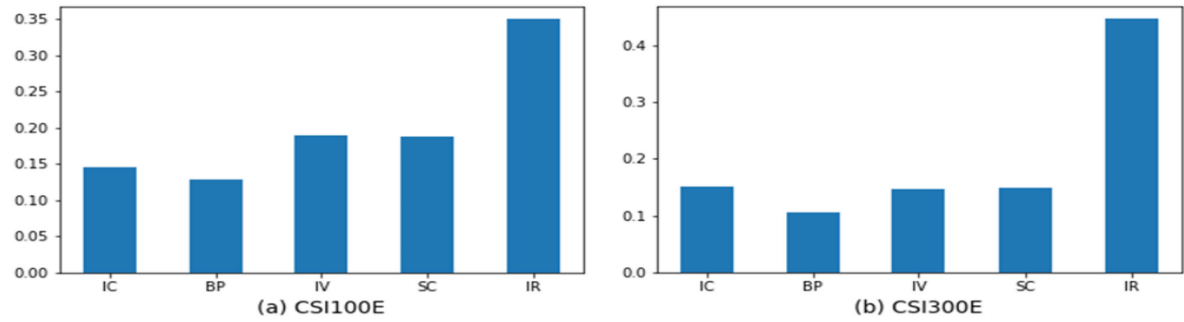
Security measures, including access controls and data protection, should be rigorously implemented. Robust monitoring and logging mechanisms should be established to track system performance and detect anomalies.

Furthermore, contingency plans should be in place to address unforeseen issues during the transition. Finally, the handover process should involve comprehensive training for operations

teams and thorough documentation to ensure smooth ongoing system operation and maintenance



**Fig. 4.6 Sensitivity to parameters  $T$  and  $h$ .**



**Fig. 4.6 The presentation of the learned attention scores of DANSMP on CSI100E and CSI300E. Here, IC denotes the industry category; BP stands for the business partnership; IV denotes the investment; SC is the supply chain; IR denotes the implicit relation.**

## 5.0 MODULUS :

```
# Set the number of days used for prediction
prediction_days = 60

# Initialize empty lists for training data input and output
x_train = []
y_train = []

# Iterate through the scaled data, starting from the prediction_days index
for x in range(prediction_days, len(scaled_data)):
    # Append the previous 'prediction_days' values to x_train
    x_train.append(scaled_data[x - prediction_days:x, 0])
    # Append the current value to y_train
    y_train.append(scaled_data[x, 0])

# Convert the x_train and y_train lists to numpy arrays
x_train, y_train = np.array(x_train), np.array(y_train)

# Reshape x_train to a 3D array with the appropriate dimensions for the LSTM model
x_train = np.reshape(x_train, (x_train.shape[0], x_train.shape[1], 1))

# Plot the actual prices using a black line
plt.plot(actual_prices, color='black', label='Actual (COMPANY) price')

# Plot the predicted prices using a green line
plt.plot(predicted_prices, color='green', label='Predicted (COMPANY) price')

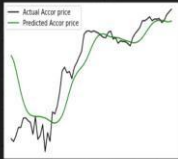
# Set the title of the plot using the company name
plt.title(f'{COMPANY} share price')

# Set the x-axis label as 'time'
plt.xlabel('time')

# Set the y-axis label using the company name
plt.ylabel(f'{COMPANY} share price')

# Display a legend to differentiate the actual and predicted prices
plt.legend()

# Show the plot on the screen
plt.show()
```




### Training

```
model = LSTM_model()
model.summary()
model.compile(
    optimizer='adam',
    loss='mean_squared_error'
)
```

(\*)

Model: "sequential"

| Layer (type)        | Output Shape   | Param # |
|---------------------|----------------|---------|
| lstm (LSTM)         | (None, 60, 50) | 10400   |
| dropout (Dropout)   | (None, 60, 50) | 0       |
| lstm_1 (LSTM)       | (None, 60, 50) | 20200   |
| dropout_1 (Dropout) | (None, 60, 50) | 0       |
| lstm_2 (LSTM)       | (None, 50)     | 20200   |
| dropout_2 (Dropout) | (None, 50)     | 0       |

```
# Extract the last 'prediction_days' values from the model inputs
real_data = [model_inputs[len(model_inputs) + 1 - prediction_days:len(model_inputs + 1), 0]]

# Convert the real_data list to a numpy array
real_data = np.array(real_data)

# Reshape real_data to a 3D array with the appropriate dimensions for the LSTM model
real_data = np.reshape(real_data, (real_data.shape[0], real_data.shape[1], 1))

# Generate a prediction using the LSTM model with the real_data input
prediction = model.predict(real_data)

# Invert the scaling applied to the prediction to obtain the actual value
prediction = scaler.inverse_transform(prediction)

# Print the prediction result to the console
print(f"Prediction: {prediction[0][0]}")
```

Prediction: 40.48432540893555

## REFERENCES:-

- [file:///C:/Users/Visitor/Desktop/Paper\\_109.pdf](file:///C:/Users/Visitor/Desktop/Paper_109.pdf)
- <https://onlinelibrary.wiley.com/doi/pdf/10.1002/9781119197652.oth1>
- <http://thestockmarketwatch.com/learn/stocks-basicsconclusion/>
- <https://www.datacamp.com/community/tutorials/stm-pythonstock-market>
- [http://shodhganga.inflibnet.ac.in/bitstream/10603/25949/14/14\\_chapter%208.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/25949/14/14_chapter%208.pdf)
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- <https://www.scribd.com/document/110661247/Conclusion>
- <https://www.pantechsolutions.net/stock-market-predictionusing-machine-learning>
- <https://www.ijeat.org/wpcontent/uploads/papers/v8i4/D6321048419.pdf>