G H RAISONI INSTITUTE OF ENGINEERING AND TECHNOLOGY, NAGPUR

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RAISONI GROUP
a vision beyond

Department of Mechanical Engineering

Project Quality Assurance Initiative 2023-24

On

Stock Price Prediction using Reinforcement Learning

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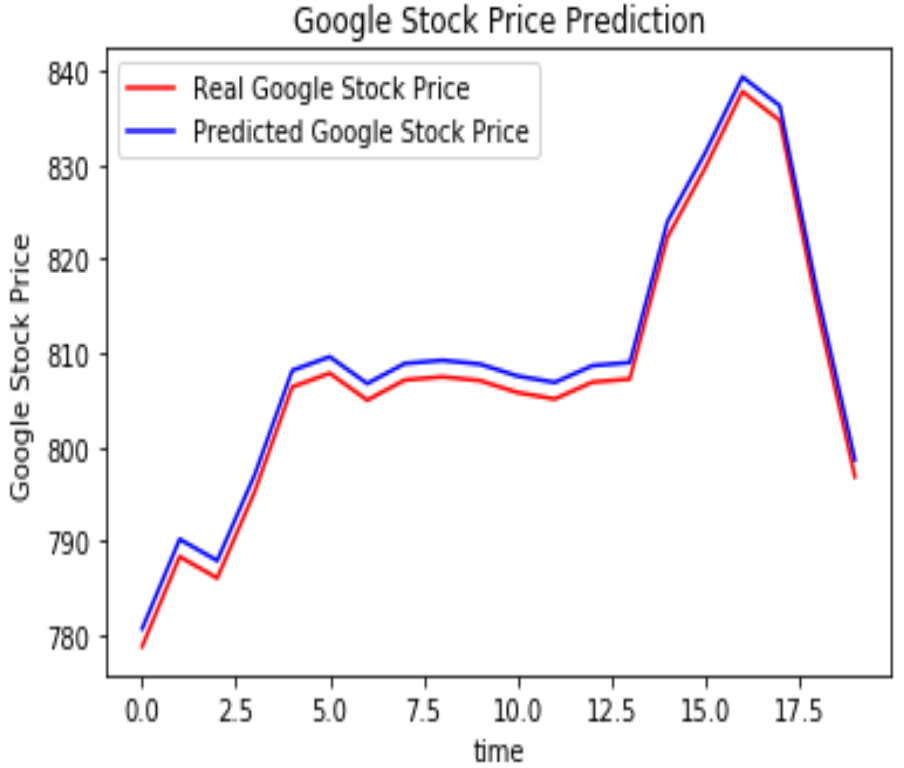
Introduction

Stock Price prediction using Reinforcement learning (Q-agent)



- Stock price prediction is a challenging task due to the complex and noisy nature of financial markets.
- Traditional methods, such as time series analysis and machine learning techniques, have limitations in capturing intricate patterns and adapting to market dynamics.
- This has led to the exploration of more advanced techniques, such as reinforcement learning, which can learn optimal actions directly from interacting with the environment.

Literature Survey

Sr. No.	Paper title	Details of Publication	Findings
1	Stock Price Prediction using deep learning and frequency decompotion	2021,Hadi Rezaei, Hamidreza Faaljou	LSTM as a state-of-the-art model and CNN which are deep learning models yield good results in the analysis of stock market.
2	A stock price prediction method based on deep learning technology	2020,Xuan Ji, Jiachen Wang and Zhijun Yan	Using deep learning algorithms use to improve the accuracy of the model.
3	S_I_LSTM: stock price prediction based on multiple datasources and sentiment analysis	2020,Shengting Wu, Yuling Liu	The pro-posed method incorporated investor sentiment and technical indicators into the stockprice prediction.
4	Analysis of look back period for stock price prediction with RNN variants	2020, Arjun Singh Sauda, Subarna Shakya	The results showed that using the look-back period value more than 15 is just wastage of model training time and prediction time.
5	A Hybrid Stock Price Prediction Model Based on PRE and Deep Neural Network	2022,Srivinay, B.C. Manujakshi,Nagaraj	The proposed model overcomes the instability in the model by tuning hyper parameters mannually for better accuracy
6	A Survey of Forex and Stock Price Prediction Using Deep Learning	2021,Matloob Khushi	The hybrid networks are showing promising signs.

PROBLEM STATEMENTS

- **Problem**: In the realm of financial markets, accurate stock price predictions are essential for informed decision-making.
- Stock trading is a continuous process of testing new ideas, getting feedback from the market, and trying to optimize trading strategies over time.
- However, traditional prediction models often struggle to capture the dynamic and nonlinear nature of market behavior.

- **Justification**: Conventional prediction methods rely heavily on historical data and predefined assumptions, l limiting their adaptability to changing market conditions.
- Reinforcement learning, specifically Q-learning, offers a novel approach by enabling an agent to learn optimal actions through trial and error.
- By incorporating real-time data and adjusting strategies based on immediate rewards, the Q-agent can potentially outperform traditional methods.
- This innovative approach aims to address the challenge of achieving more accurate and adaptable stock price predictions, leading to improved investment strategies.

OBJECTIVES OF THE PROJECT

- **Develop Q-Agent Framework**: Build a Q-learning agent framework capable of making stock trading decisions based on historical data and market trends.
- **Data Collection and Preprocessing**: Gather relevant historical stock data and preprocess it to create a suitable dataset for training and testing the Q-agent.
- **Feature Engineering**: Identify and engineer meaningful features from the stock data, enabling the Q-agent to learn patterns and trends.
- **Implement Reinforcement Learning**: Apply Q-learning algorithm to enable the agent to learn optimal strategies for trading actions like buy, sell, or hold.
- **Reward Design**: Define appropriate reward structures that encourage the agent to make profitable decisions while considering risk and transaction costs.
- **Model Training**: Train the Q-agent using historical data, allowing it to learn from different market conditions and trends.
- **Performance Evaluation**: Quantitatively assess the Q-agent's performance by measuring its ability to generate profits compared to a baseline.

Proposed Methodology

1. Data Collection: Gather historical stock price data using the Yahoo Finance API, specifying the stock symbol and date range.

2. Agent Design and Implementation: Create a Q-learning-based trading agent in Python, defining state representation, actions (buy, sell, hold), and neural network architecture.

3. Training and Fine-Tuning: Train the agent using historical data, optimizing key parameters (learning rate, discount factor).

4. Real-World Constraints: Incorporate practical trading constraints such as transaction costs, slippage, and liquidity limitations.

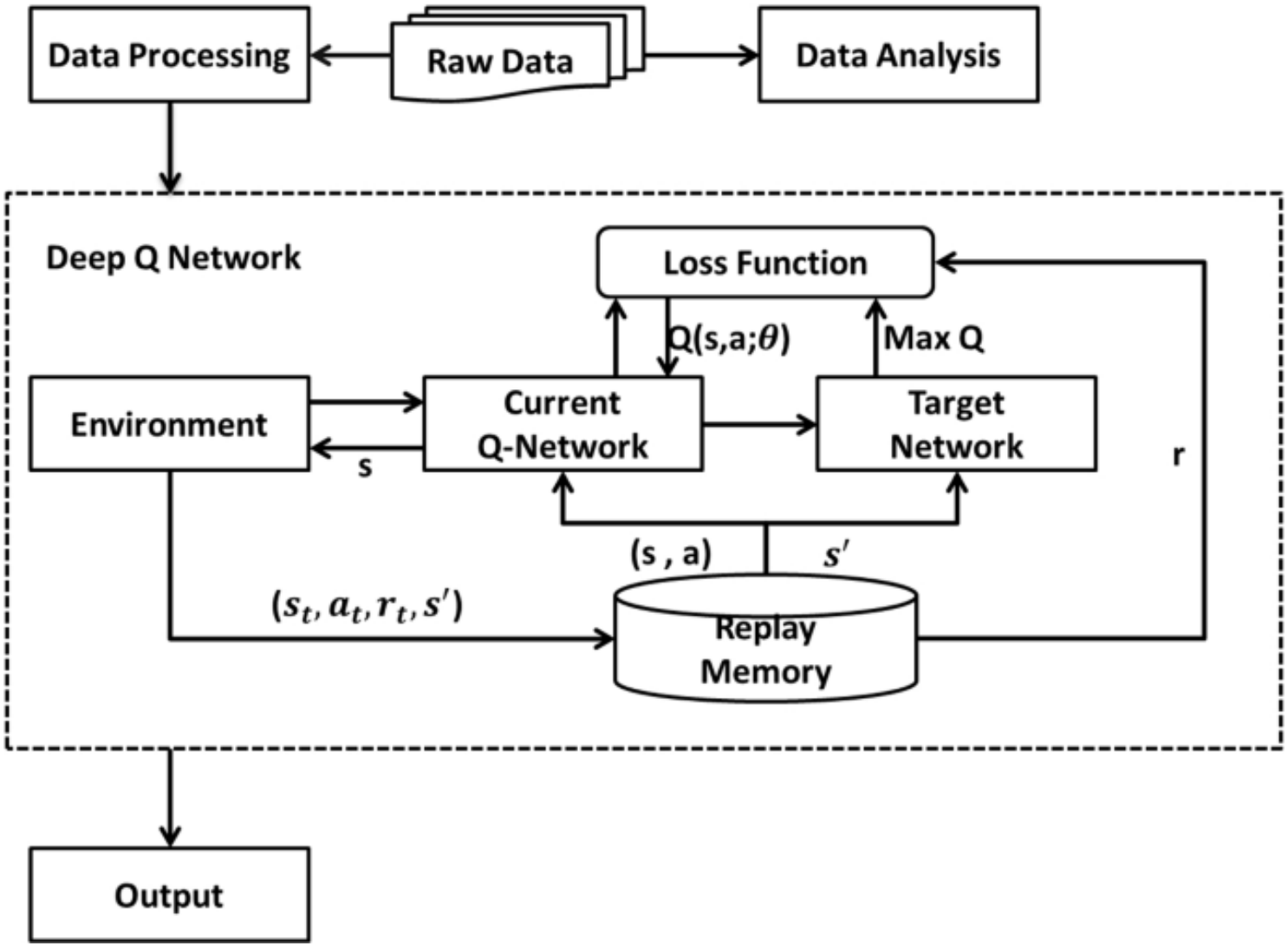
5. Visualization: Visualize agent actions using stock price charts for performance analysis.

6. Evaluation: Assess the agent's performance with metrics like total gains and investment returns.

7. Real-World Applicability: Evaluate the agent under real-world trading conditions.

8. Contributions: Highlight contributions to algorithmic trading and encourage further research.

Implementation



Work – Plan

Months Activities	JUL'23	AUG'23	SEPT'23	OCT'23	NOV'23
Literature Reviews	√	√			
Component Identification & Selection		√			
Designing			√		
Fabrication			√		
Experimental Analysis			√	√	
Testing and Debugging				√	
Preparation of Project Report				√	
Thesis and Poster Submission					√

Results


total gains -418.773438, total investment -4.187734%
buying signal
selling signal
400
375
350
325
300
275
250
225
200
0
50
100
150
200

Conclusion & Future Scope

Conclusion

This project has delved into the exciting realm of stock trading using reinforcement learning, exemplifying the potential of artificial intelligence in financial markets. The implementation of a Q-learning-based trading agent has allowed us to explore the power of algorithms in decision-making processes.

Through meticulous data collection, training, and evaluation, the agent exhibited its capacity to adapt and make informed buy and sell decisions. The project's focus on parameter tuning and real-world constraints, such as transaction costs and slippage, ensured a more realistic trading environment.

The results of this research have demonstrated that reinforcement learning can be a promising approach to algorithmic trading. The agent's ability to navigate complex market dynamics and generate total gains showcases the potential for its practical application.

Future Work: The field of reinforcement learning in stock price prediction is still evolving. Future work may involve more advanced algorithms, ensemble methods, or hybrid models that combine reinforcement learning with other machine learning techniques.

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[1]
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set()
!pip install yfinance --upgrade --no-cache-dir
from pandas_datareader import data as pdr
import yfinance as yf
from collections import deque
import random
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()
```

```
Requirement already satisfied: yfinance in /usr/local/lib/python3.10/dist-packages (0.2.31)
Requirement already satisfied: pandas>=1.3.0 in /usr/local/lib/python3.10/dist-packages (from yfinance) (1.5.3)
Requirement already satisfied: numpy>=1.16.5 in /usr/local/lib/python3.10/dist-packages (from yfinance) (1.23.5)
Requirement already satisfied: requests>=2.31 in /usr/local/lib/python3.10/dist-packages (from yfinance) (2.31.0)
Requirement already satisfied: multitasking>=0.0.7 in /usr/local/lib/python3.10/dist-packages (from yfinance) (0.0.11)
Requirement already satisfied: lxml>=4.9.1 in /usr/local/lib/python3.10/dist-packages (from yfinance) (4.9.3)
Requirement already satisfied: appdirs>=1.4.4 in /usr/local/lib/python3.10/dist-packages (from yfinance) (1.4.4)
Requirement already satisfied: pytz>=2022.5 in /usr/local/lib/python3.10/dist-packages (from yfinance) (2023.3.post1)
Requirement already satisfied: frozendict>=2.3.4 in /usr/local/lib/python3.10/dist-packages (from yfinance) (2.3.8)
Requirement already satisfied: peewee>=3.16.2 in /usr/local/lib/python3.10/dist-packages (from yfinance) (3.17.0)
Requirement already satisfied: beautifulsoup4>=4.11.1 in /usr/local/lib/python3.10/dist-packages (from yfinance) (4.11.2)
Requirement already satisfied: html5lib>=1.1 in /usr/local/lib/python3.10/dist-packages (from yfinance) (1.1)
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Requirement already satisfied: six>=1.9 in /usr/local/lib/python3.10/dist-packages (from html5lib>=1.1->yfinance) (1.16.0)
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Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=1.3.0->yfinance) (2.8.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests>=2.31->yfinance) (3.3.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests>=2.31->yfinance) (3.4)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests>=2.31->yfinance) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests>=2.31->yfinance) (2023.7.22)
```

```
yf.pdr_override()
stock= input("Enter Stock name: ")
```

```
Enter Stock name: TSLA
```

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Thank you !