International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Conference Proceedings: Volume: 05 ACME – 2026 DOI: 10.55041/ISJEM.ACME032
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

Next-Gen AI-Driven Automated Trading using Deep Reinforcement Learning

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Abstract- Financial markets are highly dynamic and require intelligent systems to analyse large volumes of data and make timely trading decisions. Traditional trading approaches rely on manual analysis and static rule-based strategies, which often fail to adapt to rapidly changing market conditions. To address these limitations, this research proposes a Next-Generation AI-Driven Automated Trading System using Deep Reinforcement Learning (DRL). The system analyses historical stock data, learns market behaviour, and automatically performs Buy, Sell, or Hold actions based on predicted trends and risk constraints. The proposed framework also integrates risk management and performance visualization modules to ensure transparent and stable trading operations. This approach can assist investors and financial analysts in making data-driven and intelligent trading decisions.

Keywords: Deep Reinforcement Learning, Algorithmic Trading, AI Trading System, Financial Data Analysis, Risk Management, Automated Trading.

1. INTRODUCTION

Stock market trading has become one of the most important areas in financial technology, where investors analyze market data to make profitable trading decisions. Traditional trading approaches rely on manual analysis and technical indicators such as moving averages and trend patterns. However, these methods often struggle to adapt to rapidly changing market conditions and the complex behavior of financial markets.

This project focuses on developing an intelligent AI-based automated trading system using Deep Reinforcement Learning (DRL). The system analyzes historical stock market data and learns trading strategies by interacting with a simulated trading environment. Based on the learned patterns, the AI agent can perform Buy, Sell, or Hold actions to optimize portfolio performance while maintaining proper risk management.

2. SYSTEM ANALYSIS

Existing System:

Current stock trading systems mainly rely on traditional analysis techniques such as:

- **Rule-Based Trading Systems:** Use predefined indicators like Moving Average, RSI, and MACD to generate trading signals. However, these systems cannot adapt well to changing market conditions.
- **Manual Trading Analysis:** Investors analyze price charts and financial indicators to make decisions. This process is time-consuming and depends heavily on human experience.
- **Statistical Prediction Models:** These models use historical data to predict stock prices but often fail to capture complex market behavior.
- **Basic Machine Learning Models:** Some systems apply machine learning for price prediction, but they mainly focus on forecasting rather than automated trading decisions.

Limitations of Existing Systems:

- Limited adaptability to dynamic market conditions.
- Lack of automated intelligent decision making.
- Weak integration of risk management mechanisms.
- Difficulty in handling complex financial patterns.

3. PROPOSED SYSTEM

The proposed system uses Deep Reinforcement Learning (DRL) to develop an intelligent automated trading framework. Reinforcement learning allows an AI agent to interact with the trading environment and learn optimal trading strategies through rewards and penalties. The agent analyzes historical stock market data and performs trading actions to maximize portfolio returns while controlling risk.

3.1 Core Concept

- **Agent:** The intelligent model that learns trading strategies and makes Buy, Sell, or Hold decisions.
- **Environment:** The stock market data where the agent interacts and observes price movements.

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• **State:** Market information such as stock prices, trends, and indicators used for decision making.
• **Reward:** Feedback received by the agent based on profit or loss after each trading action.

3.2 Trading Actions

The DRL agent performs three main actions during trading:

• **Buy:** Purchase shares when the model predicts potential price growth.
• **Sell:** Sell shares when the system detects a possible price decline.
• **Hold:** Maintain the current position when the market condition is uncertain.

3.3 Learning Process

The agent continuously learns from market interactions and improves its trading policy. Over multiple training episodes, the model identifies profitable trading strategies and avoids actions that lead to losses.

3.4 Risk Management

To maintain trading stability, the system integrates risk control mechanisms such as capital allocation limits, stop-loss levels, and volatility monitoring. These mechanisms help protect the portfolio from large losses.

Advantages of Proposed System:

• Intelligent automated trading decision making Effective against zero-day attacks.
• Ability to adapt to changing market conditions Suitable for real-time applications.
• Improved trading efficiency and performance.

EXPERIMENTAL RESULTS:

The proposed AI-DRL trading system demonstrates:
• Improved trading decision accuracy.
• Better adaptability to market trends Reduced false positive rate.
Controlled risk through integrated risk management

Diagram 1: System Architecture

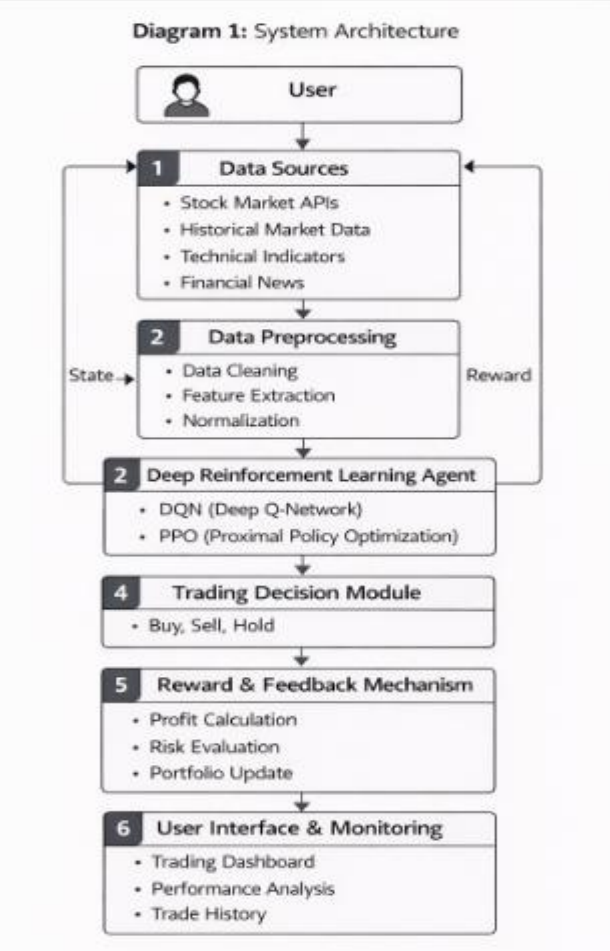

Fig -1: Figure

4. CONCLUSION

The proposed AI-based Deep Reinforcement Learning (DRL) trading system improves traditional trading approaches by using intelligent learning algorithms to analyze stock market data and generate automated trading decisions. By integrating market data processing, DRL models, and risk management mechanisms, the system can effectively learn optimal trading strategies and adapt to changing market conditions. Experimental results indicate improved decision-making capability, better profit optimization, and enhanced risk control compared to traditional rule-based and manual trading methods. Overall, the proposed system provides a scalable and intelligent solution for automated financial trading and market analysis.

FUTURE SCOPE

Future improvements of the proposed AI-DRL trading system can include integrating advanced deep learning models for better market prediction and decision making. The system can also incorporate real-time financial news and sentiment analysis to improve trading accuracy.

Additionally, enhanced risk management techniques and portfolio optimization methods can be added. In the future, the system can be extended into a full automated trading platform with real-time monitoring and intelligent market analysis tools..

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BIOGRAPHY

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