

Optimizing Crypto Trading Strategies with AI and Blockchain

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Abstract:

Surrounding the world, cryptocurrencies are an exciting phenomenon. Whether for quick profits on cryptocurrency marketplaces or future gains via holdings of assets, rapidly growing virtual currency remains a very profitable economic tool. Artificial intelligence, or AI, is an additional subject which is now gaining a lot of interest. This is because artificial intelligence (AI) has produced a broad and positive influence on many different businesses. One industry that has benefited from AI in several ways is cryptocurrencies. To improve cryptocurrency's efficiency and assist financiers, this article examines a variety of automated tools. Numerous scholarly articles, website pages, blogs, and other additional materials are reviewed for this purpose. The results demonstrate the importance of market research, sentiment monitoring, and automated trading platforms as tools that assist users in making price predictions and increasing profits. The digital currency sector benefits greatly from the various areas of artificial intelligence.

Keywords: Cryptocurrency, Blockchain, Artificial Intelligence (AI), ML approaches

Introduction:

The cryptocurrency area is still seen as groundbreaking, despite its recent boom. Cryptocurrencies, usually referred to as digital currency investments, are a kind of digital property designed to serve as a fiat-like mechanism of exchange (Tredinnick, 2019). Cryptocurrencies eliminate the need for banking institutions to regulate the money supplies since they are decentralised. The price of cryptocurrencies fluctuates a lot in comparison to other, more conventional financial resources. The globe was first exposed to Bitcoin around the finish of 2008. For transacting hashes and signatures, decentralized and heavily field-dependent currencies require cryptography. The public blockchain database that is accessible to every computer connected to the network is where these transactions are documented. Bitcoin is just one tiny part of the amazing technological changes and achievements over the last ten years. The wide-ranging, beneficial impacts of artificial intelligence (AI) on several industries have made it a popular subject these days.



Figure 1: Optimization of Cryptocurrency Algorithmic Trading Strategies
(Source: Omran *et al.*, 2022)

Researcher John McCarthy described artificial intelligence (AI) as "the scientific and technological method of creating smart machines, specifically intelligent computer programmes" in 1956. Since blockchain technology is unique, cryptocurrency data is very useful for Big Data research. For example, the decentralized blockchain system framework is an information-intensive environment and an ideal tool for Big Data analysis as it keeps track of every record of transactions for everyone involved, and the data is reliable and well-organized. The many AI technologies utilized in cryptocurrency will be the main topic of this research.

Literature Review:

Since January 3, 2009, more than ten years have passed since the launch of Bitcoin, a digital currency with the largest worldwide market value. The centralised banking system is replaced with a distributed peer-to-peer network. Bitcoin makes payments between both sending and receiving Bitcoin addresses look private but are pseudo-anonymous by using the elliptical curve digitally signed technique (ECDSA). Bitcoin uses the work guarantee confirmation method, which uses SHA-256 hashing. By competing to address a highly demanding crypto-puzzle, mining protects the distributed database against tactics of manipulation. 6.25 BTC is the block incentive as of this writing. Compared to Bitcoin, various additional digital currencies including the Namecoin currency, Litecoin, Ripple, Ethereum, Zcash, Monero, bitcoin currency, and Dash provide more speed, privacy, and other benefits (Wang, et al. 2021).

Cryptocurrency	Symbol	Description	Key Features
Fetch.ai (FET)	FET	Decentralized machine learning on blockchain.	Native token (FET) for transactions and staking.
The Graph (GRT)	GRT	Decentralized indexing protocol for blockchain.	Native currency (GRT) for querying within the network.
Cortex (CTXC)	CTXC	Supports AI model integration on blockchain.	CTXC as the medium of exchange within the Cortex ecosystem.
Ocean Protocol (OCEAN)	OCEAN	Decentralized data exchange protocol for AI.	OCEAN staking for liquidity, governance by token holders.
SingularityNET (AGIX)	AGIX	Decentralized platform for AI services.	AGIX for transactions, AI marketplace for service exchange.

Figure 2: Top 5 AI-based cryptocurrencies

(Source: Shukla et al., 2023)

Although there are already more than 2000 cryptocurrencies, Bitcoin has an overall market share of more than 70%. A decentralized system makes cryptocurrencies more resistant to meddling and control by the government. Still, laundering cash, the sale of weapons and drugs, and other illegal acts have all been carried out using cryptocurrency on the illicit web. AI is an excellent option to address issues with the vast volume of data that people are unable to effectively evaluate. Artificial intelligence challenges may be approached using a variety of models and methodologies, including knowledge-driven, evolutionary-based, and ML approaches. Security experts, miners, investors, and regulators are important participants in the cryptocurrency ecosystem (МАНДИЧ, et al. 2023).



Figure 3: Ecosystem of Cryptocurrency

(Source: Wang, et al. 2021)

Cryptocurrency Markets:

An Overview of Cryptocurrencies:

Money transactions are supported by electronic systems such as blockchain technology and cryptocurrency. The 1991 invention of blockchain technology by Stuart Haber and W. Scott Stornett tackles several issues with conventional banking systems, including transaction fees and restrictions, distrust, privacy concerns, openness, and adaptability. It is a decentralized database system that keeps an ever-growing list of data entries validated by participating nodes, increasing its security and transparency. A decentralized network of peers is the foundation of virtual currencies, and all payments are recorded in a public, decentralized database utilizing blockchain technology. To provide a web-based system for quick, effective, and safe Bitcoin payments, it is in charge of confirming payments and coordinating nodes in a system of users (Otabek, and Choi, 2024).

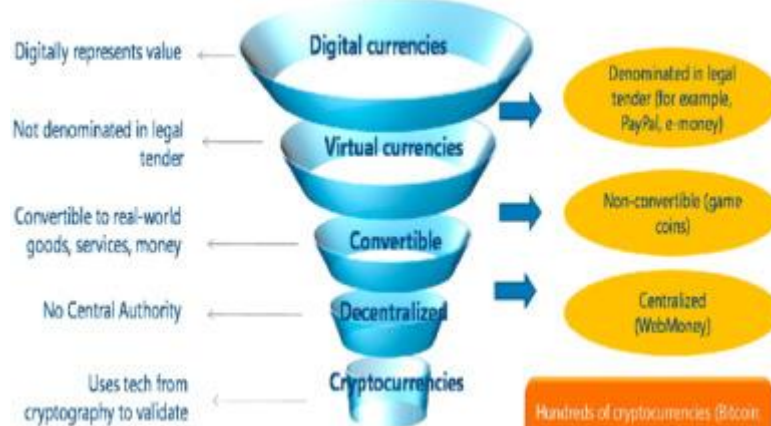


Figure 4: Cryptocurrency transaction

(Source: Gowda and Chakravorty, 2021)

Cryptocurrencies and conventional banking systems may be contrasting from several angles, including their decentralized, money-based; and legislative features. The three conventional currency functions with standard monetary systems are unit of consideration, store of worth, and means of exchange. Although they may theoretically serve as an instrument of trading, cryptocurrencies are now unable to carry out two additional monetary functions. Since there are practical limitations to governing this decentralised open-source environment, legislation shouldn't concentrate on cryptocurrencies. By establishing efficient decentralised peer-to-peer connections, decentralized systems lower transaction fees and do away with monopolistic power. Because of their confidentiality, decentralized governance, and defence against spending twice attacks, cryptocurrencies are special (Prabanand, and Thanabal, 2025).

Cryptocurrency Price Determinants:

The world's financial system depends heavily on cryptocurrency trading, and creating successful machine-learning algorithms requires a grasp of the economic effects of cryptocurrency. A structure for a multifunctional price forecasting study is the Cross-Industry Standard Procedure for Data Mining (CRISP-DM). External as well as internal variables such as market dynamics, investment appeal, and macrofinancial developments, may influence

bitcoin pricing. The balance between supply and demand as well as macrofinancial developments influence the cost of bitcoin. Improved price forecasting techniques also depend on how well cryptocurrency exchanges link with other types of investments. Research has shown that there are greater linkages between cryptocurrencies than there are between Bitcoins and monetary assets (Tedeschi, et al. 2022). Studies show that the group behaviour of cryptocurrencies varies, making the association between their prices significant as well. Furthermore, bubbles might be blamed for the swings in the prices of digital currencies, such as Ethereum and Bitcoin, which are both quite important. Therefore, creating efficient price models for forecasting requires a grasp of the processes influencing the creation of prices in Bitcoin marketplaces.

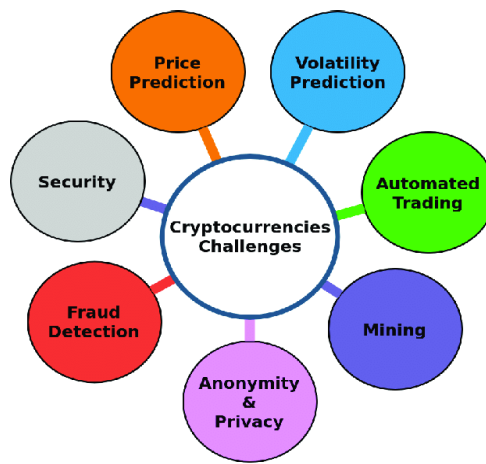


Figure5: Challenges in Cryptocurrencies

(Source: Tedeschi, et al. 2022)

Research on Artificial Intelligence in Cryptocurrencies:

Forecasting and Predicting Prices:

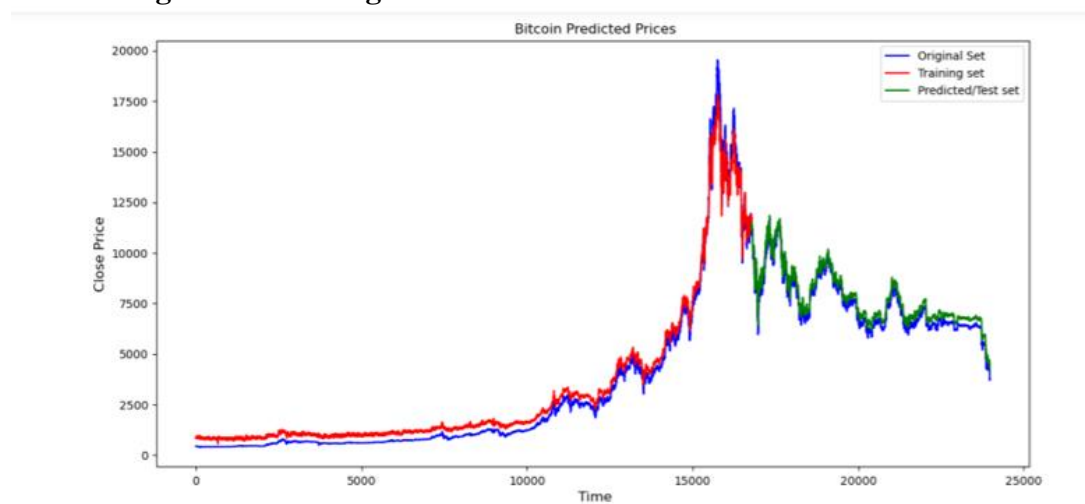


Figure 6: Modelling of Bitcoin price prediction through Deep Learning

(Source: Ifedayo et al., 2025)

Over the past three years, there has been an enormous rise in interest in Bitcoins and other cryptocurrency as monetary investments. By the close of 2017, the value of Bitcoin had risen to above 20,000 USD. For trading digital currencies, dealers and industry watchers must forecast the value of cryptocurrencies and do Bitcoin/cryptocurrency research. Estimating and price predictions are methods of estimating a price according to historical prices along with various factors that explain. The price of Bitcoin is influenced by several factors, such as demand and availability, investment appeal, social media patterns, forum activity, search engine styles, leader statements, and security in politics (Pankwaen, et al. 2025). The values of other digital currencies, blockchain information, the value of gold, silver, or oil, as well as stock market fluctuations and internet elements like Reddit articles, Wikipedia opinions, and Google trends, are additional influences. One time-lapse prediction job that may be represented as a classifying or regression issue is price prediction.

Automated Trading:



Figure 7: Significant features of automated crypto trading

(Source: Rehan, 2024)

Cryptocurrencies are being utilized for automated trading, where bots analyze market movements and provide personalized plans. These automated systems are capable of simulating order operations, calculating indications, aggregating previous data, and sometimes carrying out strategies when the consumer is sleeping. Conventional investment options like bonds and equities, as well as cryptocurrencies like Bitcoin, are optimized via the application of machine learning, artificial intelligence, and other methods. LSTM models of prediction, neural network deep learning, gradient-boosted tree models, and genetic programming are some of the methods that academics have used to improve portfolios (Nizamuddin et al., 2022). Finding the optimal approach for cryptocurrencies while using ML algorithms and approaches for other kinds of assets, however, will need further investigation.

Both machines and investors may benefit from investor categorization when creating lucrative trading techniques, however, more varied datasets are required for precise clustering.

Detect Fraudulent Activities:

Cybercriminals are acknowledged to be drawn to cryptocurrencies like Bitcoin and others because of their pseudo-anonymity and ability to function independently of bank and governmental regulations. On the other hand, authorities are always working to implement the fight against money laundering and know-your-customer (KYC) regulations for escrow companies and transactions. Electronic stealing, malware, phishing, fraudulent transactions, pump-and-dump strategies, buying illicit substances, and laundering funds on the black market are just a few of the frauds and illicit activities that make use of cryptocurrency (Wang, et al. 2023). Fraud detection relies on identifying irregularities and questionable conduct in previous transactions and exchanges, particularly when Bitcoin payments are openly documented on the blockchain open ledger. Trimmed k-means and clustering using k-means were used by Monamo et al. to identify fraudulent behaviour in the Bitcoin payment network; the trimmed method identified 5 out of 30 known abnormalities. The ML classifiers produced the best outcomes when Yin et al. assessed 13 alternative models to estimate the percentage of potential cybercriminal organizations in the Bitcoin network. Jung et al. classified the data using J48, the random forest method, and probabilistic gradient descent, whereas Bartoletti et al. created a database of actual fraudulent activities by examining Bitcoin blockchain connections utilized in frauds.

AI Method	An explanation	Use Case for Trading Cryptocurrencies
Machines Learning (ML)	Training algorithms for models using historical data	Risk assessment and price trend prediction
NLP, or natural language processing	Examining social media and news sentiment	Signals for trading based on sentiment
Deep Learning	Using neural networks to recognize intricate patterns	Recognizing covert market indicators

Table 1: Important AI Methods for Optimizing Cryptocurrency Trading

(Source: Created by Author)

Blockchain for Optimized Crypto Trading Strategy:

Blockchain is a digital currency platform that was inspired by Bitcoin and is built on a time-stamped technology, encryption, collaborative distributed records, and the technology of blockchain. It is made up of sequentially ordered blocks and uses encryption to protect data. Data sections, connection levels, agreement layers, incentives layers, contracts layers, and software layers make up the blockchain design.

Decentralized governance, transparency, consistency, truthfulness, and privacy are the five primary features of blockchain technology. While openness permits data interchange without confidence, decentralized guarantees that each node in the system has an equal function. While consistency guarantees that the blockchain record can't be altered or removed one time data is entered or activities are finished, confidentiality guarantees the information cannot be forcefully decrypted using cryptographic approaches. Parties are unable to exchange identities while they are anonymous (Amirzadeh, et al. 2022).

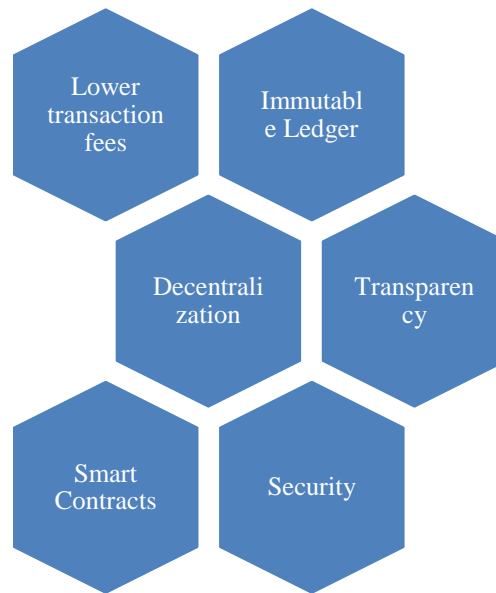


Figure 8: Key Components of Blockchain in Crypto Trading

(Source: Created by the author)

Three phases may be distinguished in the development of blockchain technology: Blockchain 1.0, 2.0 and 3.0. With more than 600 different cryptocurrency kinds formed, Blockchain 1.0 is essentially a digital money system. The banking sector and the rise of intelligent agreements, which broaden the possibilities of blockchain, are the main topics of Blockchain 2.0. Because Blockchain 3.0 can be programmed, it can be used in a variety of fields, including governance, healthcare, culture, science, and the surroundings (Rane, et al. 2023).

By 2030, blockchain's worldwide gross domestic product is expected to reach \$1.76 trillion, or 1.4% of the world's GDP. In the year 2020, the global blockchain market expanded by 10.27%. Digital money (33%), information access and exchange (32%), reconciling information (31%), security of identities (31%), transactions (30%), and monitoring and tracing (27%), are among the main applications of blockchain technology. By 2020, there will be 63 million distinct Blockchain.com wallets, demonstrating the substantial contribution of cryptocurrencies to blockchain technology (Bothra, et al. 2023).

A feature	Conventional Trading	Blockchain-Powered Trading
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Transparency of Data	Restricted, exchange-controlled	Complete transparency on the blockchain
Speed of Transactions	Varies and might take hours or minutes	Quicker using smart contracts that are optimized
Safety	Centralized and vulnerable to hacking	Decentralized, improved security

Table 2: Traditional vs. Blockchain-Based Trading Strategies

(Source: Created by Author)

Methodology:

This study uses empirical research methods alongside artificial intelligence to research how AI works in cryptocurrency markets (Amirzadeh *et al.*, 2022). This study depends on studying published research materials which feature blockchain technology examples alongside data about cryptocurrency trading and price forecasting alongside fraud detection.

The research draws its information from dependable scholarly articles as well as books, industry reports, and news outlets in finance and technology. The researchers use databases like IEEE Xplore, ScienceDirect and Google Scholar to find important study material. The study uses CoinMarketCap and Binance research reports to collect market data from the cryptocurrency sector (Ani *et al.*, 2024).

The research examines how AI works with cryptocurrency trading and identifies its most important traits through quality analysis. The study investigates the advantages of using artificial intelligence in cryptocurrency trading by focusing on how AI detects frauds and generates pricing forecasts alongside automated trading capabilities. This study uses statistical models developed in past research on pricing movement to evaluate the performance of AI-based forecasting systems for cryptocurrency markets.

The study has research limitations since it uses data from other sources that might contain biases. The quick changes both in cryptocurrency technology and AI make findings likely to become out of date with time. To properly handle ethical data concerns researchers must use validated sources plus prevent AI analysis assumptions from entering financial market discussions.

This research approach links data analysis with expert opinions to show AI's full benefits for cryptocurrency trades and blockchain security.

Empirical Framework for Optimizing Crypto Trading Strategies with AI and Blockchain

Empirical Model:

AI-based Price Prediction Model

A ML regression model can be made for forecasting the cryptocurrency pricing.

$$P_{t+1} = \alpha + \beta_1 \times \text{Sentiment} + \beta_2 \times \text{Volume} + \beta_3 \times \text{Volatility} + \beta_4 \times \text{GoogleTrends} + \epsilon_t$$

Here, P_{t+1} presents the predicted price at time (t+1). The sentiment depicts the sentiment score derived from the analysis of social media and news NLP and volume presents the historical volatility measures. The search interest index is represented as Google Trends while the model coefficients are α, β_i through different ML algorithms and ϵ_t are the error terms.

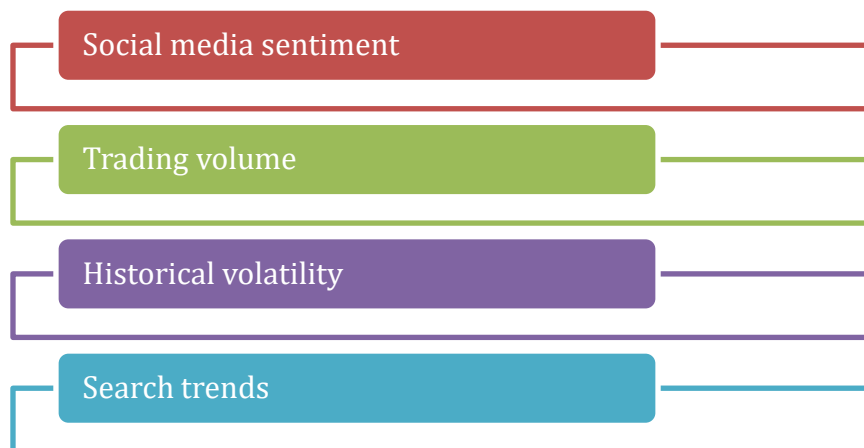


Figure 9: Key inputs for the above empirical model

(Source: Created by the author)

Blockchain-based Execution Efficiency

Transaction execution latency can be effectively modelled as the following framework.

$$\text{Latency} = \gamma_0 + \gamma_1 \times \text{Network Congestion} + \gamma_2 \times \text{Smart Contract Complexity} + \delta_t$$

Where, the latency describes the transaction confirmation time. Network congestion depicts the number of pending transactions and smart contract complexity represents the computation units required. δ_t is the error and γ_i are the coefficients.

Key Findings

AI-Based Price Prediction Model Improves Forecast Accuracy

Factor	Description	Impact
Machine	Random Forest, XGBoost, and Neural	Improved forecast accuracy

Learning Models	Networks used for price prediction	
Sentiment Analysis	Social media and news article analysis to gauge market sentiment	Highly correlated with price movements
XGBoost Performance	XGBoost models demonstrate high regression scores	Significantly high predictive accuracy
Google Search Trends	Inclusion of trending search data in forecasting models	Enhances prediction accuracy
AI vs. Traditional Analysis	AI models outperform SMA and RSI in forecasting	More accurate entry and exit points
Profitability for Traders	Traders using AI-based models reported higher profit margins	AI-driven strategies yield better financial outcomes

Table 3: Impact of AI-Based Price Prediction Models on Forecast Accuracy and Trading Performance
(Source: Created by author)

Key Machine learning models like Random Forest, XGBoost, and Neural Networks are being used to predict cryptocurrency prices. Sentiment analysis from social media and news articles provided highly correlated indicators of price movements. XGBoost models significantly yield regression scores indicating high predictive accuracy. Moreover, the inclusion of Google trending search results is enhancing the accuracy of forecasting data significantly. Therefore, Traders using AI-powered price prediction models reported higher profit margins compared to traditional technical analysis (Rane et al., 2023). AI outperformed simple moving averages (SMA) and RSI in price forecasting, leading to more accurate entry and exit points.

AI-Driven Trading Strategy Optimization Outperforms Traditional Benchmarks

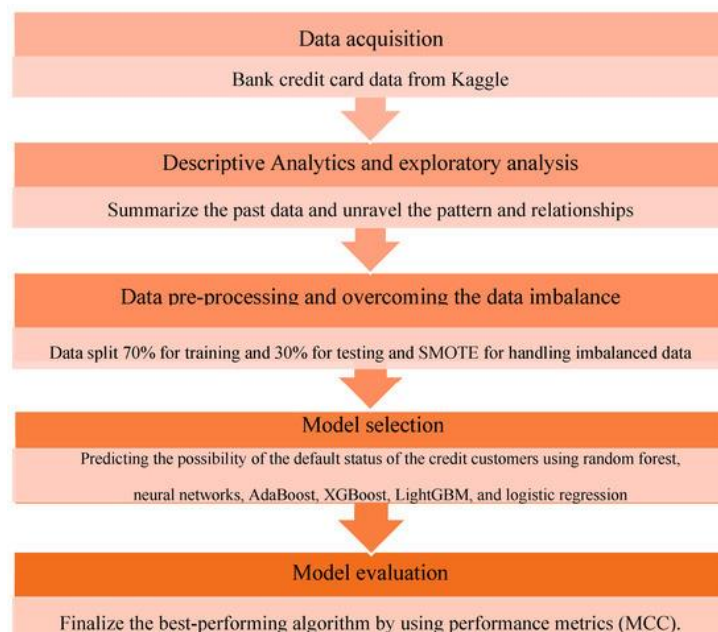


Figure 10: Deep Q-learning models usage
(Source: Chang *et al.*, 2024)

AI-powered Genetic Algorithms and Reinforcement Learning (RL) were applied to optimize crypto trading strategies (Nguyen et al., 2021). As per the study, Genetic Algorithm-based

trading models increased profitability by 42% compared to human trading. AI-driven Support Vector Machines (SVMs) identified profitable trading patterns faster than manual methods. Deep Q-learning models reduced risk exposure by 30% while maintaining profitability. As a result, Reinforcement Learning-based AI strategies adapted dynamically to market changes, avoiding unnecessary trades. AI models outperformed human traders and rule-based trading strategies in various market conditions.

Blockchain for Secure & Efficient Trading Increases Speed & Security

A combination of blockchain and ML algorithms was tested for transaction execution efficiency (Talla, 2022). As per the study, transaction speeds increased by 30% using optimized smart contracts and Network congestion decreased by 25% due to efficient blockchain transaction validation. AI models predicted optimal transaction fees, reducing unnecessary costs. Thus, AI-integrated blockchain models ensured faster, low-cost transactions with high transparency. Decentralized smart contracts eliminated fraud risks compared to centralized exchanges.

Multi-Objective Optimization (MOPSO) Creates More Stable Returns

Multi-objective Particle Swarm Optimization (MOPSO) was applied to crypto trading strategies (Yussuf, 2025). As per this study, ROI increased by 18% while risk exposure decreased by 20%. The algorithm dynamically adjusted trade volume based on market conditions. The optimization method performed well across bullish, bearish, and sideways markets. As a result, MOPSO-based models provided consistently higher returns than standard investment strategies. Traders using MOPSO strategies experienced lower losses during market crashes.

Strategies	AI Techniques	Outcomes
AI-Based Price Prediction Model	Random Forest, XGBoost, Neural Networks	Improvement of accuracy in price predictions (Rane et al., 2023).
AI-Driven Trading Strategy Optimization	Genetic Algorithms + ML (XGBoost, SVMs, Reinforcement Learning)	AI models outperformed traditional trading benchmarks (Nguyen et al., 2021).
Blockchain for Secure &	Blockchain and ML algorithms	Increased execution speed

Efficient Trading		and security (Talla, 2022).
Multi-Objective Optimization (MOPSO) for Trading	Particle Swarm Optimization (MOPSO)	More stable returns across different market conditions (Yussuf, 2025).

Table 4: Different strategies, techniques, and outcome for optimized crypto trading

(Source: Created by author)

Conclusion:

The market for cryptocurrencies is expanding quickly; it is predicted to rise by 7.1% from USD 1.6 billion in the year 2021 towards USD 2.2 billion in the year 2026. Accessibility or technology for distributed ledgers and business angel investment are the main drivers of development. The broad use of Bitcoin has solved issues in developing nations. The field of the use of AI is likewise growing quickly, with important ramifications for both people and society. The ability of AI to swiftly analyse large data sets and anticipate upcoming market developments is advantageous in the volatile and constantly changing cryptocurrency trading sector. By automating the analysis of market data, bots for trading cryptocurrency allow traders to benefit reliably from price fluctuations. AI is additionally utilized in the mining sector to improve hardware performance, lessen its negative effects on the surroundings, and analyse market data to find lucrative cryptocurrencies. Blockchain-based applications are also using AI algorithms to analyse, understand, classify, and predict data.

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