A Multi-agent System Based On LLM For Trading Financial Assets

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Abstract

In this paper, we propose an agent-based system including Large Language Models (LLM). It depicts a multi-agent system architecture for cryptocurrency trading, consisting of five distinct agents: an Analyst, a Data Scientist, a Strategy Developer, a Trading Advisor, and a Risk Manager. Each agent performs a specific task using search and scraping tools to gather necessary information. These agents then collaborate to manage all aspects of the trading process. The OpenAI API is utilized to generate outputs from the agents. Three trading scenarios are proposed: moderate risk tolerance with position trading, high risk tolerance with scalping, and low risk tolerance with swing trading. Experimental results show that each agent effectively contributes to the trading strategy. For instance, position trading benefits from comprehensive risk analysis and mitigation strategies, scalping relies on detailed execution plans and risk management protocols, and swing trading focuses on market trends and regulatory impacts.

Key words: AI, multi-agent system, cryptocurrency, trading strategies, risk management
J.E.L. classification: G12, D81, G32

1. Introduction

Trading Bitcoin and other cryptocurrencies involves buying and selling digital assets to profit from price fluctuations (Aalborg, Molnár and de Vries, 2019). Cryptocurrency markets are decentralized and operate 24/7, allowing traders to buy and sell at any time. Popular cryptocurrencies include Bitcoin, Ethereum, Ripple and Litecoin. There are various trading strategies to consider. Day trading involves buying and selling within a single day to capitalize on short-term price movements. Swing trading holds cryptocurrencies for several days or weeks to benefit from medium-term trends. Scalping makes multiple trades within a day to profit from small price changes, while position trading holds cryptocurrencies for extended periods, often months or years, based on long-term market trends. Selecting a reliable cryptocurrency exchange is essential. Binance is known for its extensive range of cryptocurrencies and low trading fees. Coinbase offers a user-friendly interface and high security, making it suitable for beginners. Kraken provides various trading pairs and advanced features, while Bitfinex is known for high liquidity and margin trading options. When it comes to wallets and security, hot wallets are online wallets convenient for frequent trading but more vulnerable to hacks. Cold wallets, such as hardware wallets like Ledger and Trezor, offer enhanced security by storing assets offline. Security practices such as enabling two-factor authentication (2FA), using strong passwords and being cautious of phishing attempts are essential.

Technical analysis for trading involves studying historical price charts and trading volumes to predict future price movements (Hong and Zhang, 2023), (Bâra, Oprea and Panait, 2024). Key tools and indicators include candlestick charts, which visually represent price movements within a specific time frame, moving averages that smooth out price data to identify trends, the Relative Strength Index (RSI) that measures the magnitude of recent price changes to evaluate overbought or oversold conditions and the MACD, which combines moving averages to show potential buy and sell signals (Day et al., 2023), (Bâra and Oprea, 2024). Short-, medium- and long-term predictions are also

important. It is recommended to assess the models during a period of market turmoil and test during bear market conditions to determine their robustness even when market trends change between validation and test phases (Sebastião and Godinho, 2021). Fundamental analysis evaluates the intrinsic value of a cryptocurrency based on project fundamentals, market news and adoption rates. This involves analyzing the technology, team and roadmap of the cryptocurrency, studying regulatory developments, partnerships and market sentiment (Wei, Sermpinis and Stasinakis, 2023), (Feng, Wang and Zhang, 2018), and tracking the usage and acceptance of the cryptocurrency in real-world applications. Effective risk management as in any market is important to avoid significant losses. Setting stop-loss orders automatically sells a cryptocurrency when it reaches a certain price to limit losses. Diversifying investments across different cryptocurrencies helps mitigate risk. Position sizing determines the appropriate amount to invest in each trade based on risk tolerance. Cryptocurrency trading regulations vary by country, and it is important to know local regulations. Utilizing various resources and tools can enhance trading strategies (Fakharchian, 2023). News websites like CoinDesk, CoinTelegraph and CryptoSlate provide the latest market news. Data platforms like CoinMarketCap and CoinGecko offer market data and analysis. Trading bots such as 3Commas and Cryptohopper execute trades based on predefined strategies. Trading Bitcoin and other cryptocurrencies bring financial benefits, but it also require thorough knowledge and planning. Understanding the market, utilizing technical and fundamental analysis, managing risks effectively and studying regulatory and psychological factors can improve chances of success in the volatile world of cryptocurrency trading (Oprea, Georgescu and Bâra, 2024), (Băra et al., 2024).

For the multi-agent system architecture, we propose five distinct agents (workers) initiated by (Moura, 2024): an Analyst, a Data Scientist, a Strategy Developer, a Trading Advisor and a Risk Manager. Each agent is responsible for a specific task, utilizing searching and scraping tools to gather the necessary information. These agents then collaborate, with each focusing on their respective roles, to form a cohesive team that effectively handles all aspects of the trading process. Three trading scenarios are proposed and interpreted. The OpenAI API key is used to generate the output of the entire crew.

2. Literature review

Several research papers aimed to evaluate the effectiveness of three widely-used algorithmic trading strategies: RSI, Moving Average Convergence Divergence (MACD) and Pivot Reversal (PR) in the context of Bitcoin trading. Using daily Bitcoin price data spanning from 2013 to 2018, the study employed particle swarm optimization to fine-tune these strategies. The findings reveal that the RSI strategy underperformed compared to the traditional buy-and-hold approach. Conversely, the MACD and PR strategies outperformed the buy-and-hold strategy. Furthermore, the optimization process enhanced the performance of these strategies even further, yielding superior results. This study presents a hybrid trading strategy that combines machine learning techniques with traditional trading strategies. The authors argue that their approach generates significantly higher returns than conventional methods. They also emphasize the importance of sentiment analysis, extracting reliable information from narratives to inform their trading models (Cohen, 2021).

Despite advancements in technical analysis and machine learning, developing effective Bitcoin trading strategies remains challenging. Deep reinforcement learning algorithms have recently shown promise, yet current studies fall short in simultaneously maximizing profits, minimizing risk, and maintaining high trade activity (Otabek and Choi, 2024). This study introduced a multi-level deep Q-network (M-DQN) that used historical Bitcoin price data and Twitter sentiment analysis. The authors proposed a novel preprocessing pipeline and reward function designed to meet the three critical objectives. Their experimental results showed a 29.93% increase in investment value and a Sharpe Ratio above 2.7.

Another paper detailed the NLP-CIMAT team's system for the PAN 2023 shared task (Villa-Cueva et al., 2023). The task involves three classification subtasks with limited data: predicting influencer magnitude, classifying interests, and predicting tweet intent. The authors' approach used pre-trained language models with two training frameworks: traditional fine-tuning and entailment-based fine-tuning. Traditional fine-tuning trains a transformer encoder to directly predict tweet classes, while entailment-based fine-tuning reframes the classification as an entailment problem,

benefiting low-resource scenarios. Both methods performed well, so the authors combined their strengths using a soft-voting ensemble. They also used data augmentation by generating synthetic tweets with ChatGPT. Their system ranked first in the second subtask and performed competitively in the other two, securing first place overall.

Cryptocurrencies, often poorly regulated and anonymous, have seen a rise in fraudulent tokens that exploit hype to raise funds and then vanish, harming investors and legitimate projects (Ueno et al., 2023). This study aimed to detect fraudulent cryptocurrencies using natural language processing (NLP) and machine learning techniques on whitepapers. The authors analyzed 250 whitepapers (150 fraudulent, 100 legitimate), extracting features and applying various machine learning methods for classification. Their best model achieved an F1 score of 0.841. K-Means clustering also showed potential in detecting fraud where criteria are undefined. Findings indicated that fraudulent whitepapers use more business and finance terms, while legitimate ones focus on technical blockchain terms. This demonstrated that NLP and machine learning can effectively identify fraudulent cryptocurrencies, aiding investors and regulators.

Blockchain has revolutionized finance, boosting cryptocurrency adoption. Social media sentiment greatly influences cryptocurrency markets, making sentiment analysis crucial for predicting trends (Wahidur et al., 2024). Another paper examined fine-tuning large language models to enhance sentiment analysis. Experiments showed a 40% performance gain in zero-shot tasks post fine-tuning. Larger models, with instruction-based tuning, achieved 75.16% accuracy, while smaller models might struggle with generalization. Short, simple instructions improve accuracy by 12% over complex ones, with optimal performance at a corpus size of 6,000 data points. Microsoft's MiniLM exceled in data efficiency, and Google's FLAN-T5 performed consistently well. This study emphasized model scale, instruction complexity, and corpus size in improving sentiment analysis for cryptocurrency market predictions.

An analysis of AI-themed crypto assets revealed notable abnormal returns, peaking at 41% over the two weeks following ChatGPT's debut (Ante and Demir, 2024). Additionally, 90% of these tokens showed positive abnormal returns. This indicated that the increased focus on ChatGPT and AI positively influenced cryptocurrency markets, boosting prices for AI-related cryptocurrencies. These findings highlighted a significant spillover effect, where the popularity and media coverage of ChatGPT enhanced investor sentiment and interest in AI-themed crypto assets, leading to substantial price impacts.

3. Research methodology

For the multi-agent system architecture, we propose 5 agents: Analyst, Data scientist, Strategy developer, Trading advisor and Risk manager. These agents perform 5 tasks (one task for each agent) using searching and scraping tools to search and extract the required information. Then, they form a crew of 5 agents with 5 tasks as in Figure 1.

Figure no. 1. Workflow of trading agents
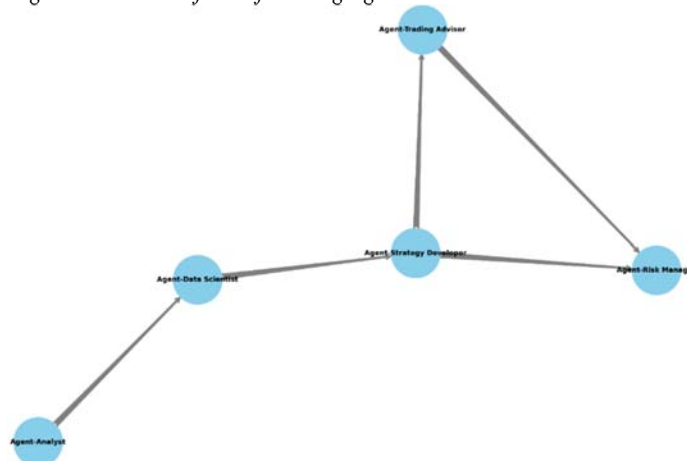
Source: the authors

The agent-analysist monitors, analyzes and displays market data in real-time to identify trends and predict market movements. The agent-data scientist predicts market movements and displays prediction results. This agent employs statistical modeling, machine learning and deep learning to deliver medium- and short-term predictions. The agent-strategy developer tests various trading strategies based on insights from the agent-analyst, exemplifying diverse trading approaches. This agent evaluates the performance of different approaches to determine the most profitable and risk-averse options. The agent-trading advisor suggests optimal trade execution strategies based on approved trading strategies, demonstrating how the optimal strategy is chosen. This agent specializes in analyzing the timing, price and logistical details of potential trades. By evaluating these factors, it provides well-founded suggestions for when and how trades should be executed to maximize efficiency and adherence to strategy. The fifth agent - agent-risk manager evaluates and provides insights on the risks associated with potential trading activities, displaying the risks.

OpenAI (model="gpt-3.5-turbo") is used to generate the suggestions provided by the 5 agents. To exemplify how these agents work together, three scenarios are proposed: Scenario 1 - moderate risk tolerance with position trading; Scenario 2 - high risk tolerance with scalping; Scenario 3 - low risk tolerance with swing trading.

In Scenario 1, the trader selects Bitcoin with an initial capital of 3 BTC. They have a *moderate risk* tolerance and prefer the *position trading strategy*, which involves holding positions for several months to years to capitalize on major price movements. This strategy requires extensive research and analysis, combining technical and fundamental analysis. The trader is also highly attentive to news impacts, adjusting their positions based on significant news events affecting the cryptocurrency market. The expected approach involves long-term holding periods, low trade frequency and balanced risk management using stop-loss orders and diversification.

In Scenario 2, the trader again selects Bitcoin with an initial capital of 3 BTC but has a *high risk* tolerance and prefers the *scalping strategy*. Scalping involves making numerous trades to profit from small price changes within minutes or hours. This strategy demands continuous market monitoring and quick reactions to news events, relying primarily on technical analysis with real-time data. The trader's news sensitivity is extremely high, as news can cause rapid price movements, necessitating quick trade adjustments. The expected approach involves very short-term holding periods, very high trade frequency and tight stop-loss orders for risk management.

In Scenario 3, the trader selects Bitcoin with an initial capital of 3 BTC, exhibiting a *low risk* tolerance and preferring the *swing trading strategy*. Swing trading involves holding positions for several days to weeks to capitalize on expected market swings, balancing between short-term and medium-term gains. This approach combines technical analysis for short-term trends and fundamental analysis, with a cautious stance towards news impacts. The trader adjusts their positions based on impactful news and employs conservative risk management strategies, such as stop-loss orders and careful position sizing. The expected approach involves short to medium-term holding periods, moderate trade frequency, and a cautious, balanced approach to risk.

The settings of the trading are provided in Table 1.

Table no. 1. Trading scenarios

Scenario 1	Scenario 2	Scenario 3
trading_inputs = {'selection':'Bitcoin', 'initial_capital':'3', 'risk_tolerance': 'Moderate', 'trading_strategy_preference':'Position Trading', 'news_impact_consideration': True}	trading_inputs = { 'selection':'Bitcoin', 'initial_capital':'3', 'risk_tolerance':'High', 'trading_strategy_preference':'Scalping', 'news_impact_consideration': True}	trading_inputs = { 'selection':'Bitcoin', 'initial_capital':'3', 'risk_tolerance':'Low', 'trading_strategy_preference':'Swing Trading', 'news_impact_consideration': True}

Source: the authors

In Scenario 1, the trader selects Bitcoin with an initial capital of 3 BTC. They have a moderate risk tolerance and prefer the position trading strategy, which involves holding positions for several months to years to capitalize on major price movements. This strategy requires extensive research and analysis, combining technical and fundamental analysis. The trader is also highly attentive to

news impacts, adjusting their positions based on significant news events affecting the cryptocurrency market. The expected approach involves long-term holding periods, low trade frequency and balanced risk management using stop-loss orders and diversification. An example trade sequence might look like this: In January, the trader buys 1 BTC at $30,000. In March, after market analysis, the trader buys another 1 BTC at $28,000. He holds both BTCs as the market trends upwards, ignoring minor fluctuations. In July, major regulatory news causes a temporary dip to $26,000, but the trader holds through the dip. Finally, in December, after a significant upward trend, he sells the 2 BTC at $50,000.

In Scenario 2, the trader again selects Bitcoin with an initial capital of 3 BTC, but has a high risk tolerance and prefers the scalping strategy. Scalping involves making numerous trades to profit from small price changes within minutes or hours. This strategy demands continuous market monitoring and quick reactions to news events, relying primarily on technical analysis with real-time data. The trader's news sensitivity is extremely high, as news can cause rapid price movements, necessitating quick trade adjustments. The expected approach involves very short-term holding periods, very high trade frequency, and tight stop-loss orders for risk management. An example trade sequence might include buying 0.1 BTC at $30,000 and selling it at $30,100 within an hour. Next, traders might buy 0.1 BTC at $30,050 and sell it at $30,120 after 30 minutes. They could then buy 0.1 BTC at $30,110 and sell it at $30,150 within 15 minutes. A quick reaction to positive news might lead to buying 0.1 BTC at $30,200 and selling it at $30,350 within minutes. This pattern of small, rapid trades would continue throughout the day.

In Scenario 3, the trader selects Bitcoin with an initial capital of 3 BTC, exhibiting a low risk tolerance and preferring the swing trading strategy. Swing trading involves holding positions for several days to weeks to capitalize on expected market swings, balancing between short-term and medium-term gains. This approach combines technical analysis for short-term trends and fundamental analysis, with a cautious stance towards news impacts. The trader adjusts their positions based on impactful news and employs conservative risk management strategies, such as stop-loss orders and careful position sizing. The expected approach involves short to medium-term holding periods, moderate trade frequency, and a cautious, balanced approach to risk. An example trade sequence might begin with buying 0.5 BTC at $30,000 in January. In February, after a short-term upward trend, they sell 0.5 BTC at $35,000. In March, after a dip, they buy another 0.5 BTC at $32,000. Following positive market news in April, they hold through the upward trend. Finally, in June, after market analysis indicates a peak, they sell 0.5 BTC at $40,000.

These example trades illustrate how each trading strategy operates in different market scenarios. Position trading involves fewer trades with longer holding periods, focusing on significant price movements and major trends, with trades based on thorough market analysis and news impacts. Scalping involves numerous quick trades to capitalize on small price changes, requiring constant market monitoring and quick reactions to news events. Swing trading balances short to medium-term holding periods with fewer trades than scalping but more than position trading, capitalizing on market swings and adjusting based on news and technical analysis. When it comes to trading strategies in stock markets, investors often exhibit diverse preferences based on their risk tolerance, investment goals and market outlook. Several commonly preferred trading strategies are displayed in Table 2.

Table no. 2. Trading strategies description

Trading strategies	Definition	Preference	Risk
Day Trading	Day traders buy and sell stocks within the same trading day to capitalize on short-term price movements	This strategy is preferred by traders looking for quick profits and willing to monitor the markets continuously	High, due to rapid market changes
Swing Trading	Swing traders hold stocks for several days to weeks, aiming to profit from expected market swings	Favored by those who want to capitalize on market volatility without the need for constant monitoring	Moderate, influenced by broader market trends
Value Investing	Value investors seek undervalued stocks that are trading below their intrinsic value, aiming for long-term appreciation	Suitable for investors with a long-term horizon who believe in fundamental analysis	Lower, though depends on the accuracy of the intrinsic value assessment
Growth Investing	Growth investors focus on companies expected to grow at an above-average rate compared to others	Ideal for those looking to invest in innovative companies with high growth potential	High, due to the speculative nature of growth projections

Momentum Trading	Momentum traders buy stocks showing an upward price trend and sell them when the momentum starts to decline	Chosen by investors looking to exploit market psychology and trends	High, as it relies on continuous market movement
Dividend Investing	Dividend investors focus on stocks that pay regular dividends, providing a steady income stream	Preferred by income-focused investors and those seeking lower-risk investments	Lower, given the stability of dividend-paying stocks
Index Investing	Index investors buy index funds or ETFs that track a market index like the S&P 500	Suitable for passive investors looking for broad market exposure with lower management fees	Moderate, as it mirrors the overall market performance
Algorithmic Trading	Uses algorithms and automated systems to execute trades based on predefined criteria	Embraced by those with access to technology and data analytics, seeking to leverage speed and precision	Varies, depending on the algorithm's robustness and market conditions
Contrarian Investing	Contrarian investors go against prevailing market trends by buying stocks that are out of favor and selling those that are popular	Chosen by investors who believe markets overreact and misprice assets	High, as it involves betting against market sentiment

Source: the authors

Other trading preferences can be followed, such as position trading consisting in holding positions for several months to years to profit from major price movements. Its key features refer to long-term, trend following, lower frequency of trades, moderate risk. Position trading is a long-term trading strategy where investors hold positions in securities for an extended period, typically ranging from several months to years. The primary goal of position trading is to profit from major price movements or trends in the market. Position traders maintain their investments for longer periods, unlike day traders or swing traders who operate on shorter time frames. They aim to capitalize on significant price trends rather than short-term fluctuations. This strategy relies heavily on identifying and following long-term trends. Traders use technical analysis, fundamental analysis or a combination of both to identify potential entry and exit points based on trend patterns. Position traders execute fewer trades compared to day traders or swing traders. The focus is on making substantial gains from a few well-researched positions. Extensive research and analysis are essential for position traders to identify promising opportunities. They often look at economic indicators, company financials, industry trends and other macroeconomic factors. Position trading involves holding positions for long periods, which can expose traders to various risks, including market volatility and economic changes. Effective risk management strategies, such as stop-loss orders and diversification, are essential to protect against significant losses. Position traders need to stick to their strategy, even during market corrections or short-term volatility. They must be able to withstand market fluctuations without reacting impulsively. They often focus on assets with strong fundamental value and potential for long-term growth.

On the other hand, scalping consists in making numerous trades to profit from small price changes and is related to very short-term, high frequency, high risk. Penny stock trading consists in trading low-priced, small-cap stocks, characterized by high risk, potential for significant gains, requires thorough research. Pairs trading means simultaneously buying and selling two correlated stocks to profit from the relative price movement. It is market neutral and relies on statistical analysis, moderate risk. Sector rotation consists of moving investments between sectors based on economic cycles on medium to long-term and it requires understanding of economic indicators, having moderate risk. Technical trading consists of using technical analysis tools and charts to make trading decisions on short-term or long-term; it relies on patterns and indicators, variable risk. Fundamental trading consists of making trading decisions based on fundamental analysis of a company's financial health and performance in the long term. It focuses on intrinsic value with lower risk. Arbitrage consists of exploiting price differences of the same asset in different markets in short-term. It relies on price inefficiencies with low risk (if executed correctly). News trading consists of making trades based on market-moving news and events in the short term. It requires quick reaction to news and has a high risk. Options trading consists of using options contracts to speculate or hedge in the short-term or long-term using various strategies (e.g., calls, puts, spreads). It is characterized by high risk. Quantitative trading consists of using quantitative analysis and mathematical models to make trading decisions. It relies on data and algorithms, can be short-term or long-term, variable risk.

Each of these strategies caters to different investor preferences, risk tolerances and market. Choosing the strategy depends on individual goals, investment horizon and the amount of time one can dedicate to managing their investments (Ferko et al., 2023). Many of these trading strategies are valid and can be applied to Bitcoin trading and other cryptocurrencies. Table 3 shows how they translate to the context of Bitcoin trading.

Table no. 3. Trading strategies applied to cryptocurrencies

	Description	Key Features
Day Trading	Buying and selling Bitcoin within the same trading day	Quick profits, high frequency of trades, requires constant monitoring
Swing Trading	Holding Bitcoin for several days to weeks to capitalize on expected market swings	Medium-term, exploits market volatility, moderate risk
Value Investing	Investing in Bitcoin when it is perceived to be undervalued	Long-term, based on perceived intrinsic value, lower risk
Growth Investing	Investing in Bitcoin based on its potential for future growth and adoption	Long-term, focus on growth potential, higher risk
Momentum Trading	Buying Bitcoin when its price is trending upwards and selling when momentum declines	Short to medium-term, trend following, high risk
Dividend Investing	Not applicable to Bitcoin as it does not pay dividends	-
Index Investing	Investing in cryptocurrency indices or ETFs that include Bitcoin	Long-term, passive investment, moderate risk
Algorithmic Trading	Using algorithms and automated systems to trade Bitcoin based on predefined criteria	Can be short-term or long-term, relies on technology, variable risk
Contrarian Investing	Investing in Bitcoin against prevailing market trends	Long-term, requires strong conviction, high risk
Position Trading	Holding Bitcoin for several months to years to profit from major price movements	Long-term, trend following, lower frequency of trades, moderate risk
Scalping	Making numerous trades to profit from small price changes in Bitcoin.	Very short-term, high frequency, high risk.
Penny Stock Trading	Not directly applicable to Bitcoin, but similar strategies can be applied to low-cap cryptocurrencies	-
Pairs Trading	Simultaneously buying and selling two correlated cryptocurrencies, such as Bitcoin and Ethereum	Market neutral, relies on statistical analysis, moderate risk
Sector Rotation	Rotating investments between different types of cryptocurrencies based on market conditions	Medium to long-term, requires understanding of market trends, moderate risk
Technical Trading	Using technical analysis tools and charts to trade Bitcoin	Can be short-term or long-term, relies on patterns and indicators, variable risk
Fundamental Trading	Making trading decisions based on the fundamental analysis of Bitcoin's market conditions, adoption rate, and technological developments	Long-term, focuses on intrinsic value, lower risk
Arbitrage	Exploiting price differences of Bitcoin on different exchanges	Short-term, relies on price inefficiencies, low risk (if executed correctly)
News Trading	Making trades based on market-moving news and events related to Bitcoin	Short-term, requires quick reaction to news, high risk
Options Trading	Using Bitcoin options to speculate or hedge	Can be short-term or long-term, various strategies (e.g., calls, puts, spreads), high risk
Quantitative Trading	Using quantitative analysis and mathematical models to trade Bitcoin	Relies on data and algorithms, can be short-term or long-term, variable risk

Source: the authors

These strategies can be adapted to Bitcoin and other cryptocurrencies, though it is important to consider the unique characteristics and higher volatility of the crypto market. More specific trading preference strategies for Bitcoin are: (a) ICO investing that consists in investing in Initial Coin Offerings (ICOs) of new cryptocurrencies. It is suitable for investors looking to get in early on potentially high-growth projects. The risk is very high, due to the speculative nature and potential for scams; (b) Staking means holding and "staking" cryptocurrencies to earn rewards or interest. It is preferred by those seeking passive income from their crypto holdings. The risk is moderate, as it depends on the stability and security of the staking platform; (c) Yield farming consisting of providing liquidity to DeFi protocols in exchange for interest or token rewards. It is ideal for investors looking to maximize returns from their crypto assets. The risk is high, due to smart contract vulnerabilities and market fluctuations; (d) Margin trading consists of using borrowed funds to trade larger positions in cryptocurrencies. It is suitable for experienced traders looking to amplify their gains. The risk is very high, as it involves the risk of liquidation and significant losses.

4. Findings

The following output is produced by the proposed crew of agents (as in Table 4).

Table no. 4. Results with the proposed crew of agents

Crew output for Scenario 1
The following output is produced by the crew: After conducting a comprehensive risk analysis of the proposed trading strategies for Bitcoin, here are the detailed insights on potential risks and effective mitigation strategies: 1. Regulatory Risk: Uncertainty around cryptocurrency regulations can impact trading strategies. Mitigation: Stay informed about regulatory developments and adjust strategies accordingly. 2. Security Risk: Potential hacking, malware, and operational glitches can threaten the security of Bitcoin transactions. Mitigation: Use secure wallets and exchanges, implement strong security measures, and stay vigilant against cyber threats. 3. Insurance Risk: Cryptocurrencies like Bitcoin are not insured by traditional entities like SIPC or FDIC, leaving investments vulnerable. Mitigation: Opt for exchanges with insurance coverage to protect investments. 4. Fraud Risk: Despite blockchain security measures, fraudulent activities can still occur in the cryptocurrency market. Mitigation: Exercise caution, verify sources, and be wary of potential scams to minimize the risk of fraud. 5. Market Risk: The volatile nature of Bitcoin prices poses a significant market risk for traders and investors. Mitigation: Diversify investments, stay updated on market trends and news events, and be prepared for price fluctuations by implementing risk management techniques like stop-loss orders. By considering these risks and implementing the suggested mitigation strategies, traders and investors can navigate the dynamic Bitcoin market effectively, maximize profits, and manage risks efficiently.
Crew output for Scenario 2
After conducting thorough research and analysis, I have compiled detailed execution plans for trading Bitcoin during an uptrend. Utilizing Moving Averages, Buying the Dips, HODLing, Dollar-Cost Averaging, Trend Following, Oversold in Uptrend Approach, and Exploring Various Trading Strategies. It is crucial to closely monitor market movements, adapt strategies accordingly, and prioritize risk management to optimize trading outcomes for Bitcoin. In evaluating the risks associated with these strategies, some potential risks include market volatility leading to unexpected price movements, regulatory changes impacting the cryptocurrency market, security breaches and hacking incidents, liquidity issues affecting trade execution, and the potential for market manipulation. To mitigate these risks, it is recommended to implement strict risk management protocols, including setting stop-loss orders, diversifying the portfolio, staying informed on market news and developments, utilizing secure trading platforms, and continuously reassessing and adjusting strategies based on market conditions. By following these recommendations and prioritizing risk management, the team can navigate the Bitcoin market with confidence and efficiency, maximizing trading outcomes during the uptrend period.
Crew output for Scenario 3
After evaluating the risks associated with the proposed trading strategies and execution plans for Bitcoin, it is evident that the imminent launch of spot ether ETFs in the U.S. and the SEC suing Consensys over MetaMask staking and broker allegations pose significant challenges and opportunities for the cryptocurrency market, including Bitcoin. 1. Impact of Spot Ether ETFs Launch: The approval of spot ether ETFs by the U.S. Securities and Exchange Commission (SEC) could lead to substantial net inflows into the cryptocurrency market, potentially affecting the price dynamics of Ethereum and other cryptocurrencies. This influx of capital may create increased volatility in the market, impacting trading strategies for Bitcoin. It is crucial to monitor the developments closely and adjust trading plans accordingly to capitalize on potential opportunities while managing market risks. 2. SEC Lawsuit Against Consensys: The SEC's lawsuit against Consensys over MetaMask staking and broker allegations highlights the regulatory scrutiny faced by cryptocurrency platforms and services. The allegations of violating federal securities laws and collecting fees through crypto asset transactions and staking services underscore the legal risks associated with operating in the cryptocurrency space. This legal action could have broader implications for the regulatory environment and market sentiment, influencing trading strategies and risk exposure for Bitcoin. It is essential to assess the potential implications of the lawsuit on the cryptocurrency market and adjust risk management strategies accordingly. Mitigation Strategies: To mitigate the risks associated with the proposed trading strategies and execution plans for Bitcoin, the following strategies are recommended: 1. Diversification: Consider diversifying the trading portfolio to reduce concentration risk and exposure to specific market events, such as the launch of spot ether ETFs and regulatory actions against cryptocurrency platforms. 2. Risk Hedging: Implement risk hedging strategies, such as options contracts or futures, to protect against adverse price movements and market uncertainties resulting from external events like regulatory actions and market inflows. 3. Regulatory Compliance: Stay informed about regulatory developments and ensure compliance with relevant laws and guidelines to mitigate legal risks and maintain the integrity of trading activities. 4. Continuous Monitoring: Monitor market trends, news updates, and regulatory announcements to adjust trading strategies promptly in response to changing market conditions and risk factors. By incorporating these mitigation strategies into the trading plans and execution strategies for Bitcoin, it is possible to navigate the risks effectively and capitalize on market opportunities while safeguarding the investment portfolio against potential challenges.

Source: the authors

The interpretation of Scenario 1: moderate risk tolerance with position trading is given in this paragraph. The crew's output for Scenario 1 fits well with the chosen strategy. Position trading, which involves holding positions for several months to years, requires a comprehensive understanding of potential risks and mitigation strategies. The crew's insights into regulatory risk, security risk, insurance risk, fraud risk and market risk align perfectly with the needs of a position trader. By staying informed about regulatory developments, using secure wallets and exchanges, opting for insured exchanges, exercising caution against fraud and diversifying investments, the trader can effectively manage risks. These strategies ensure that the trader can navigate the dynamic Bitcoin market, maximize profits and manage risks efficiently over the long term.

The interpretation of Scenario 2: high risk tolerance with scalping is the following: in Scenario 2, the crew's output emphasizes detailed execution plans for trading Bitcoin during an uptrend, which is crucial for a scalper. The use of techniques such as Moving Averages, Buying the Dips, HODLing, Dollar-Cost Averaging, Trend Following and the Oversold in Uptrend Approach, along with exploring various trading strategies, provides a solid foundation for a high-frequency trading strategy. The crew also identifies potential risks such as market volatility, regulatory changes, security breaches, liquidity issues and market manipulation. To mitigate these risks, they recommend implementing strict risk management protocols, setting stop-loss orders, diversifying the portfolio, staying informed on market news and using secure trading platforms. These recommendations ensure that the scalper can optimize trading outcomes while effectively managing risks in a highly volatile environment.

The interpretation of Scenario 3: low risk tolerance with swing trading is given in this paragraph. For Scenario 3, the crew's output addresses the imminent launch of spot ether ETFs and the SEC lawsuit against Consensys, highlighting their potential impact on the cryptocurrency market, including Bitcoin. The crew's focus on diversification, risk hedging, regulatory compliance and continuous monitoring aligns with the swing trading strategy, which involves holding positions for several days to weeks to capitalize on market swings. By considering the impact of major events and adjusting trading plans accordingly, the swing trader can navigate increased market volatility and regulatory scrutiny. The crew's recommendations to diversify the portfolio, implement risk hedging strategies, stay informed about regulatory developments and continuously monitor market trends ensure that the trader can capitalize on opportunities while managing risks effectively.

5. Conclusions

This study introduces a multi-agent system architecture for cryptocurrency trading, composed of five specialized agents: Analyst, Data Scientist, Strategy Developer, Trading Advisor, and Risk Manager. Each agent focuses on a distinct task, employing advanced tools to gather and analyze data, thereby forming a cohesive team that addresses all aspects of the trading process. The use of the OpenAI API to generate outputs from these agents further enhances the system's capabilities. Key findings from our experiments highlight the effectiveness of this multi-agent approach across various trading scenarios: (1) Position Trading (Moderate Risk Tolerance): The comprehensive risk analysis and mitigation strategies provided by the agents align well with the needs of position traders. By addressing regulatory, security, insurance, fraud and market risks, the agents help position traders navigate the dynamic Bitcoin market, ensuring long-term profitability and effective risk management; (2) Scalping (High Risk Tolerance): The detailed execution plans and risk management protocols tailored for high-frequency trading prove crucial for scalpers. Techniques such as Moving Averages, Buying the Dips, HODLing, and Dollar-Cost Averaging, combined with real-time market monitoring, enable scalpers to optimize trading outcomes while managing the high volatility and risks associated with this strategy; (3) Swing Trading (Low Risk Tolerance): The focus on major market events, like the launch of spot ether ETFs and regulatory actions, underscores the importance of diversification, risk hedging, regulatory compliance, and continuous market monitoring.

By distributing specialized tasks among dedicated agents, traders can achieve better decision-making, improved risk management, and optimized trading performance. This approach not only caters to different trading preferences and risk tolerances but also provides a robust framework for adapting to the evolving landscape of cryptocurrency markets. Therefore, the crew's outputs for each scenario fit well with the respective trading strategies. For the moderate-risk position trader in

Scenario 1, the focus on long-term risk management and mitigation strategies is crucial. The high-risk scalper in Scenario 2 benefits from detailed execution plans and risk management protocols to handle market volatility. The low-risk swing trader in Scenario 3 is supported by insights into regulatory impacts and strategies to manage market risks. Each output provides customized insights and recommendations that align with the trader's risk tolerance, strategy preference and the dynamic nature of the Bitcoin market.

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7. References

- Aalborg, H.A., Molnár, P. and de Vries, J.E., 2019. What can explain the price, volatility and trading volume of Bitcoin? *Finance Research Letters*. https://doi.org/10.1016/j.frl.2018.08.010.
- Ante, L. and Demir, E., 2024. The ChatGPT effect on AI-themed cryptocurrencies. *Economics and Business Letters*. https://doi.org/10.17811/ebl.14.1.2024.29-38.
- Băra, A., Georgescu, I.A., Oprea, S.V. and Cristescu, M.P., 2024. Exploring the Dynamics of Brent Crude Oil, S&P500 and Bitcoin Prices Amid Economic Instability. *IEEE Access*. https://doi.org/10.1109/ACCESS.2024.3370029.
- Bâra, A. and Oprea, S.-V., 2024. An ensemble learning method for Bitcoin price prediction based on volatility indicators and trend. *Engineering Applications of Artificial Intelligence*, [online] 133, p.107991. https://doi.org/https://doi.org/10.1016/j.engappai.2024.107991.
- Bâra, A., Oprea, S.-V. and Panait, M., 2024. Insights into Bitcoin and energy nexus. A Bitcoin price prediction in bull and bear markets using a complex meta model and SQL analytical functions. *Applied Intelligence*. [online] https://doi.org/10.1007/s10489-024-05474-2.
- Cohen, G., 2021. Optimizing Algorithmic Strategies for Trading Bitcoin. *Computational Economics*. https://doi.org/10.1007/s10614-020-09972-6.
- Day, M.Y., Cheng, Y., Huang, P. and Ni, Y., 2023. The profitability of Bollinger Bands trading bitcoin futures. *Applied Economics Letters*. https://doi.org/10.1080/13504851.2022.2060494.
- Fakharchian, S., 2023. Designing a forecasting assistant of the Bitcoin price based on deep learning using market sentiment analysis and multiple feature extraction. *Soft Computing*. https://doi.org/10.1007/s00500-023-09028-5.
- Feng, W., Wang, Y. and Zhang, Z., 2018. Informed trading in the Bitcoin market. *Finance Research Letters*. https://doi.org/10.1016/j.frl.2017.11.009.
- Ferko, A., Moin, A., Onur, E. and Penick, M., 2023. Who trades bitcoin futures and why? *Global Finance Journal*. https://doi.org/10.1016/j.gfj.2022.100778.
- Hong, H. and Zhang, C., 2023. Bitcoin trading, economic growth, energy use, and CO2 emissions: An advanced panel study of emerging market economies. *International Review of Economics and Finance*. https://doi.org/10.1016/j.iref.2023.06.003.
- Moura, J., 2024. *Multi AI Agent Systems with crewAI*. [online] Coursera. Available at: <https://www.coursera.org/projects/multi-ai-agent-systems-with-crewai> [Accessed 15 June 2024].
- Oprea, S.V., Georgescu, I.A. and Bâra, A., 2024. Is Bitcoin ready to be a widespread payment method? Using price volatility and setting strategies for merchants. *Electronic Commerce Research*. https://doi.org/10.1007/s10660-024-09812-x.
- Otabek, S. and Choi, J., 2024. Multi-level deep Q-networks for Bitcoin trading strategies. *Scientific Reports*. https://doi.org/10.1038/s41598-024-51408-w.
- Sebastião, H. and Godinho, P., 2021. Forecasting and trading cryptocurrencies with machine learning under changing market conditions. *Financial Innovation*. https://doi.org/10.1186/s40854-020-00217-x.
- Ueno, M., Sano, T., Honda, H. and Nakamura, S., 2023. Detecting Fraudulent Cryptocurrencies Using Natural Language Processing Techniques. *Transactions of the Japanese Society for Artificial Intelligence*. https://doi.org/10.1527/tjsai.38-5_E-N34.
- Villa-Cueva, E., Valles-Silva, J.M., López-Monroy, A.P., Sanchez-Vega, F. and Lopez-Santillan, R., 2023. Few Shot Profiling of Cryptocurrency Influencers using Natural Language Inference & Large Language Models. In: *CEUR Workshop Proceedings*.

- Wahidur, R.S.M., Tashdeed, I., Kaur, M. and Lee, H.N., 2024. Enhancing Zero-Shot Crypto Sentiment With Fine-Tuned Language Model and Prompt Engineering. *IEEE Access*. https://doi.org/10.1109/ACCESS.2024.3350638.
- Wei, M., Sermpinis, G. and Stasinakis, C., 2023. Forecasting and trading Bitcoin with machine learning techniques and a hybrid volatility/sentiment leverage. *Journal of Forecasting*. https://doi.org/10.1002/for.2922.