

AI-Driven Blockchain Career Guidance Systems: Literature Review and Future Directions

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ABSTRACT

Career guidance systems have gone through major changes with the help of artificial intelligence (AI) and blockchain technologies. These new technologies help solve old problems like lack of personalization, security concerns, and scalability issues. This review looks at the combination of AI based career assessment tools and blockchain security systems in educational technology. We studied 25 research papers from 2020 to 2025, grouping them into five main topics: AI-based career prediction, blockchain security in education, psychometric AI and emotional intelligence, decentralized data storage and privacy, and hybrid AI-blockchain systems. Our analysis shows that there are still big gaps in using these technologies together for complete career guidance platforms. The Mentor Chain system is designed to fix these issues by using several machine learning models for career prediction and blockchain for secure credential checks and privacy. This review helps the field by showing trends in research, comparing existing methods, and suggesting future directions for using AI and blockchain in career guidance systems.

General Terms

Machine Learning, Blockchain Technology, Educational Systems, Security, Privacy, Decentralized Systems

Keywords

Artificial Intelligence, Blockchain, Career Guidance, Machine Learning, Educational Technology, Decentralized Systems, Psychometric Assessment

1. INTRODUCTION

The fast-changing job market in the digital age has made it necessary to have better methods for career guidance and counseling. Traditional systems often have problems like subjective judgments, not enough personalization, security risks in handling data, and not being able to keep up with changing market conditions [2]. Using AI and blockchain technologies offers new ways to deal with these issues and create more effective, secure, and personalized career guidance platforms.

Career guidance systems are important in schools and professional development groups, helping people make smart choices about their careers. However, traditional methods typically use static questionnaires, limited data, and central data storage systems that can be insecure and not private [4],[13].

The rise of AI, especially machine learning and natural language processing, has led to the creation of data-driven career assessment tools that can look at many aspects of a person's profile, including academic performance, personality, skills, and interests [5],[16].

At the same time, blockchain technology has shown great promise in education for making sure data is accurate, providing unchangeable proof of credentials, and allowing decentralized access control [1],[6]. Combining these technologies offers a unique chance to create full career guidance platforms that use the power of AI for predictions and the security and transparency of blockchain systems. The Mentor Chain system is a new way to provide career guidance that uses multiple machine learning models for individualized career predictions and blockchain for secure data management and verifying credentials. This research helps the growing area of AI and blockchain in education technology by giving a detailed review of the literature and suggesting new solutions to existing problems.

2. SURVEY OF LITERATURE

2.1 AI-Based Career Assessment Foundation

Artificial intelligence has changed how careers are assessed by allowing automatic analysis of complex behaviors and academic patterns. Machine learning algorithms, especially classification models like Decision Trees, Random Forest, and Naive Bayes, have been widely used to predict suitable careers based on student profiles [20]. Adding natural language processing has made these systems better at handling text data from resumes, social media, and academic records [5].

Recent advances in deep learning, especially using BERT (Bidirectional Encoder Representations from Transformers) and LSTM (Long Short-Term Memory) networks, have shown better performance in understanding the context of career information [23].

2.2 Blockchain Security in Educational Technology

Blockchain has become a big solution for fixing security and trust issues in education. The unchangeable nature of blockchain ensures data is not altered, and provides clear, verifiable records of academic achievements and professional

credentials [1],[6]. Smart contracts allow automatic execution of educational processes without needing central authorities, reducing security risks.

Decentralized storage options, especially those that use blockchain with the Inter Planetary File System (IPFS), have proven effective in managing large educational data while keeping privacy and accessibility [1]. These methods tackle the weaknesses of traditional storage systems and improve the system's ability to protect against breaches and failures.

2.3 AI-Based Career Prediction and Assessment

The research shows major progress in AI-powered career guidance systems in recent years. Lokam et al. [5] created an AI-based career guidance system using machine learning and natural language processing algorithms to give personalized career recommendations based on user profiles and market trends. Their method used cosine similarity algorithms to match user characteristics with suitable careers, proving how effective data-driven recommendations can be. Aher and Ingole [19] suggested an approach combining personality analysis using the Big Five Model with sentiment analysis of social media data. Their mixed method deals with both psychological traits and current interests, offering a more complete assessment framework. The system shows how important it is to look at multiple aspects in career guidance.

Suganya et al. [20] conducted a comparative study of three machine learning algorithms—Decision Tree, Random Forest, and Naive Bayes—for career classification based on academic performance, personality, and interests. Their findings indicated Random Forest as the most accurate classifier, contributing valuable insights into algorithm selection for career prediction systems.

2.4 Psychometric AI and Emotional Intelligence

Wang and Ji [8] developed Psychor, a psychometric-inspired benchmark for evaluating general-purpose AI systems. Their work tackles the shortcomings of current task-focused evaluation methods and provides a more complete framework that can be used in career guidance systems requiring comprehensive intelligence assessment.

Wang et al. [18] did experimental testing of machine learning models for measuring emotional intelligence using eye-tracking techniques. Their study with 218 participants showed high prediction accuracy (50-90%) for emotional intelligence traits, introducing new biometric methods for psychological assessment in career guidance systems.

3. COMPARATIVE ANALYSIS

Table 1. Comparative Analysis of AI and Blockchain Approaches

Study	Methodology	Accuracy	Scalability	Limitations
Lokam et al. [5]	ML + NLP	High	Moderate	Limited real-time data

Aher & Ingole [19]	Big Five + Sentiment Analysis	Moderate	Low	Privacy concerns
Suganya et al. [20]	Comparative ML algorithms	High (Random Forest)	Moderate	Limited to academic data
Saif et al. [1]	Blockchain + IPFS	N/A	High security	Computational overhead
Wang et al. [6]	Smart contracts + CP-ABE	N/A	High security	Complexity

4. RESEARCH GAPS AND FUTURE DIRECTION

4.1 Identified Research Gaps

The literature review shows several important areas where current research is lacking. First, there is no complete system that effectively combines AI prediction with blockchain security in a real-world setting. Most existing works focus on AI or blockchain separately, and there is not much exploration of how they can work together [10],[25].

Second, scalability is a big issue for both AI and blockchain. Deep learning models need a lot of computing power [23], while blockchain systems have limits on how many transactions they can handle [6]. The combination of these issues in hybrid systems hasn't been well studied in the literature.

Third, there is not enough focus on making AI explainable in career guidance systems. While accuracy is important, users need to understand why a career recommendation is made to make good decisions. Most systems are like "black boxes," which makes users less trusting and less likely to use them.

4.2 Future Research Directions

Several promising areas for future research come from this analysis. Using advanced methods that combine different AI techniques could improve prediction accuracy and make the results easier to understand. Adding real-time market data through APIs and web scraping could make career recommendations more relevant [5].

Blockchain interoperability is another important area. Creating systems that allow educational credentials and career profiles to work across different blockchains could make these systems more widely used and integrated with existing educational systems [12],[15].

Privacy-protecting AI methods, like differential privacy and federated learning, could help with data protection while keeping model performance high [15],[25]. These methods are especially useful for systems that handle personal and academic information

5. PROPOSED CONTRIBUTION: MENTOR CHAIN

The Mentor Chain system tackles these gaps with a new design that brings together ensemble machine learning and blockchain

security. The system has four main parts: intelligent career prediction, secure credential management, and more.

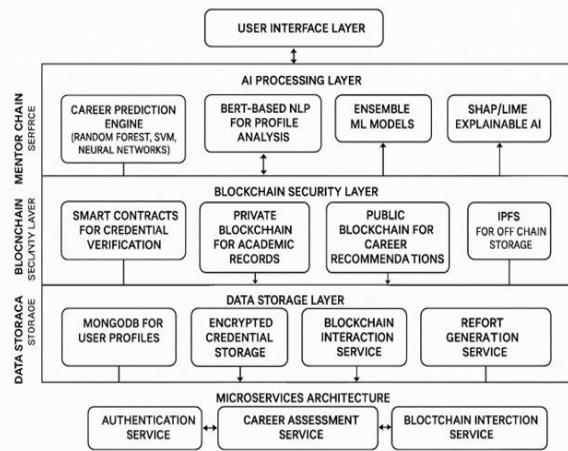


Fig. 1. Proposed Block Diagram of Mentor Chain System

5.1 Intelligent Career Prediction Engine

The career prediction engine uses an ensemble approach that combines several machine learning algorithms including Random Forest, Support Vector Machines, and Neural Networks. This multi-model approach helps overcome the limitations of using just one method [20], making the predictions more reliable. It also uses BERT-based natural language processing to analyze user profiles and market trends [23].

Getting real-time data from market APIs and job board scraping ensures that recommendations match current job market needs. This helps with the issue of outdated information found in existing systems [8],[13].

5.2 Blockchain-Based Security Framework

The security system uses a hybrid blockchain setup with both public and private networks. Academic credentials and achievements are stored on a permissioned blockchain to protect privacy while still allowing verification. Career assessments and recommendations are secured with advanced techniques like homomorphic encryption and zero-knowledge proofs.

Smart contracts automate the process of verifying credentials and offer detailed access control, solving the problem of centralized control in traditional systems [1],[6]. Using IPFS for off-chain storage ensures scalability and maintains data integrity through blockchain-based hash verification.

6. CONCLUSION

This in-depth literature review looks at how AI and blockchain can be combined in career guidance systems. It examines 25 research papers to understand current trends, methods, and challenges. The analysis shows that combining AI for personalization with blockchain for security has a lot of potential, though most current approaches focus on just one technology at a time.

Key findings indicate that while AI techniques are good at making accurate career predictions, scalability and explainability are still major challenges. Blockchain offers

strong security and decentralized features but has performance issues that affect real-world use. Combining these technologies opens up exciting possibilities for creating more effective, secure, and trustworthy career guidance platforms.

The proposed Mentor Chain system addresses these research gaps through the integration of ensemble machine learning, blockchain security, and explainable AI. By combining AI's ability to predict with blockchain's security features, Mentor Chain offers a major step forward in career guidance.

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