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Sentiment Aware Fake News Detection using Blockchain

Bharath K Shet¹, Prashanth M¹, Sheela H S¹, Sinchana M C¹, Prof. Vani G S²

UG Student, Dept. of ISE, PES Institute of Technology and Management, Shivamogga, Karnataka, India¹

Assistant Professor, Dept. of ISE, PES Institute of Technology and Management, Shivamogga, Karnataka, India²

ABSTRACT: The study explored the growing challenge of fake news in the digital era, particularly in the context of the Internet and the Internet of Things (IoT). Recognizing the loss of control over cloud-based news data, the researchers proposed an innovative hybrid approach combining blockchain and Machine learning to address the growing menace of fake news. They suggested blockchain for securely storing and tracing news data, while leveraging Machine learning models to predicted the spread of misinformation. These hybrid systems achieved high accuracy, with some models reaching up to 99.68%, demonstrating superior performance compared to existing approaches. Their experimental results validated the promise of integrating blockchain with machine learning techniques to mitigate the spread of fake news and counteract distorted political campaigns on social media.

I. INTRODUCTION

The researchers highlighted the transformative role of social media as a dominant news source, noting its simultaneous contribution to the rapid spread of misinformation. They pointed out that traditional centralized news verification systems had been unable to cope with the escalating fake news crisis. Notably, during critical global events such as the 2016 U.S. elections and the COVID-19 pandemic, fake news spread at a faster rate than verified information, severely affecting public perception. As manual verification became impractical due to the sheer volume of information, the authors proposed novel frameworks integrating blockchain's transparency and security with the predictive capabilities machine learning. This integration aimed to automate the detection, tracking, and containment of fake and misleading news, providing a scalable and reliable solution to combat misinformation. compared to the hybrid solutions the authors intended to develop.

II. METHODOLOGY

The researchers proposed several advanced frameworks combining blockchain and AI to detect fake news. Their methodologies included:

A. Blockchain-based storage:

News metadata was securely stored on a blockchain, while the full text of the articles was kept off-chain in cloud storage. The off- chain data was protected using updatable polynomial commitments, ensuring the integrity of news articles while providing efficient storage.

B. Decentralized verification systems:

Blockchain-based systems, particularly those utilizing Ethereum and Hyperledger Fabric, were designed to allow validators to verify the authenticity of viral news. This decentralized approach ensured transparency and minimized the possibility of centralized manipulation or bias.

C. AI and machine learning models:

Several AI models, including Artificial Neural Networks (ANN), Support Vector Machines (SVM), Case-Based Reasoning (CBR), and Multidimensional Analysis (MDA), were used to classify news articles as real, fake, misleading, or partially true. In addition, deep learning models such as LSTM, CNN, and RNN were applied to enhance the accuracy of fake news detection.



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D. Sentiment analysis:

The researchers applied sentiment analysis on post on social media by preprocessing and extracting emotional tones. Recurrent Neural Networks (Bi-LSTM) and reinforcement learning were integrated into sentiment models to identify emotional manipulation, such as political bias or exaggerated claims, in news dissemination.

E. Smart contracts:

They implemented smart contracts within permissioned blockchain networks to manage news authentication, submission, and credibility scoring. This automated mechanism ensured secure and transparent management of the news verification process.

These methodologies focused on ensuring decentralization, real-time adaptability, and high throughput, with particular emphasis on emotional tone analysis to improve the detection of manipulated content.

III. EVALUATIONS

To evaluate the effectiveness of the proposed sentiment-aware fake news detection framework using blockchain, a series of experiments were conducted. These experiments aimed to assess the accuracy, reliability, and scalability of the integrated system under various conditions.

A. Dataset Used

The experiments utilized a combination of publicly available fake news datasets. Authenticity eliminating the risk of single-point manipulation. By combining sentiment-aware natural language processing (NLP) models with blockchain's cryptographic security, prior works had demonstrated a promising framework for mitigating the spread of fake news in online platforms.

Sentiment-Aware Machine Learning Models. Several machine learning models were implemented for sentiment-aware fake news detection:

- Logistic Regression (LR)
- Passive Aggressive Classifier (PAC)

Each model was trained on two versions of the dataset: one with raw text features (TF-IDF, n-grams) and the other with appended sentiment scores as additional input features. The performance of sentiment-enhanced models was then compared with their standard counterparts to evaluate the impact of sentiment analysis.

B. Blockchain Integration

Blockchain technology had been effectively integrated into fake news detection systems to enhance data integrity, transparency, and trustworthiness. Researchers had utilized blockchain's decentralized and immutable ledger to store the results of news verification, including sentiment analysis outputs, thereby ensuring that once verified, the information could not be altered or tampered with. Smart contracts had been developed to automate the verification process and manage trust scores of news sources. For instance, the hash of each news article, along with its fake/real classification and associated sentiment, had been recorded custom, while the full content was often stored off-chain using decentralized storage systems like IPFS. This approach had enabled a tamper-proof and transparent verification system, allowing third parties to audit the classification history of any news article. Blockchain also supported a decentralized reputation mechanism, where multiple validators could participate in validating news accuracy levels above 90% in detecting fake news. The models successfully classified news articles, showing the power of AI in automating news verification.

Collaboration with fact-checking agencies: Fact-checking organizations, such as AOS Fatos and Boatos.org, evaluated a prototype based on reported significant improvements in speed and reliability compared to traditional verification systems.

Sentiment-based detection: The sentiment analysis-based system was effective in detecting manipulated political campaigns. During the 2022 Indian elections, the system identified instances of manipulated content aimed at influencing voter behavior.

In the reviewed literature, blockchain technology had been widely observed as a robust solution for ensuring data integrity, decentralization, and transparency in fake news detection systems. Various studies had incorporated



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blockchain to securely store verification outcomes of news articles, where the immutability of blockchain ensured that once a piece of news was classified—whether real or fake, it could not be altered respectively. Smart contracts had been employed to automate the logging and validation process, allowing verified results to be stored permanently on the ledger. Additionally, some researchers had integrated decentralized storage mechanisms like IPFS to handle large textual data, while storing only the hash and custom blockchain. The integration had provided a tamper-resistant audit trail, making it possible to track the credibility of news sources over time. It was also observed that blockchain-supported reputation systems were used to rate news publishers based on historical accuracy. Overall, these implementations had enhanced the reliability of fake news detection frameworks by coupling sentiment-aware analysis. Blockchain-based traceability: The blockchain systems provided a secure method for tracing news content. They achieved provable correctness, binding, and hiding, ensuring that news articles could be securely verified and tracked across platforms.

Scalable validation: Their Ethereum-based validation model demonstrated the feasibility of decentralized news verification, even in the presence of challenges such as computational overheads and political biases.

Machine learning performance: Experiments with machine learning models like Passive Regressive algorithm, logistic regression, multilayer perceptron.

appropriate algorithms, allowing it to learn and identify features relevant to the task. Finally, the model was evaluated using the test set through various performance metrics such as accuracy, precision, recall, and F1-score to determine its effectiveness in predicting or classifying news data.

VI. RESULTS

The project aimed to design and implement a Sentiment-Aware Fake News Detection System integrated with Blockchain technology to ensure both reliability in classification and security in data storage. Firstly, Natural Language Processing (NLP) techniques were applied to analyze news articles.

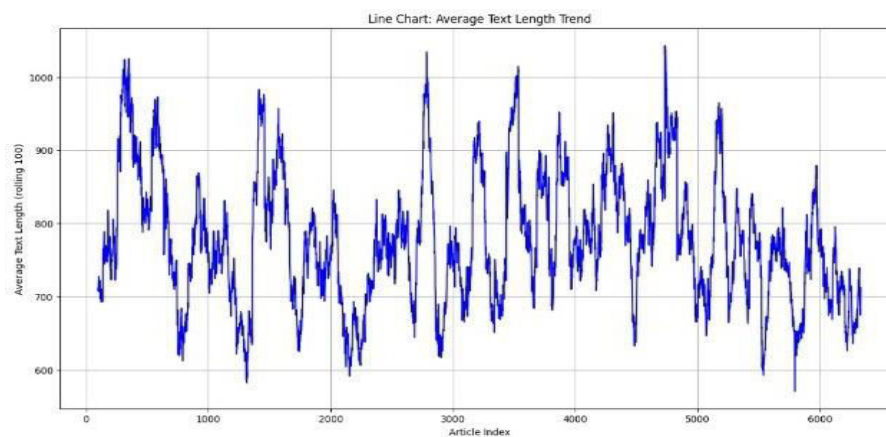


Fig.1. Trend Analysis of Average Text Length in News Articles

Sentiment analysis was performed using models such as VADER/Text Blob, which extracted the polarity and subjectivity of the content. These sentiment scores were then combined with textual features (title length, body length, word frequency, etc.) to improve the accuracy of fake news detection.

Secondly, various machine learning and deep learning models were trained for classification, including Logistic Regression, Bi-LSTM, CNN-LSTM hybrids, and Attention-based LSTM. The models were evaluated both with and without sentiment features, and the sentiment-enhanced models consistently achieved higher accuracy, proving that emotional tone carried by the article influenced the likelihood of it being fake.



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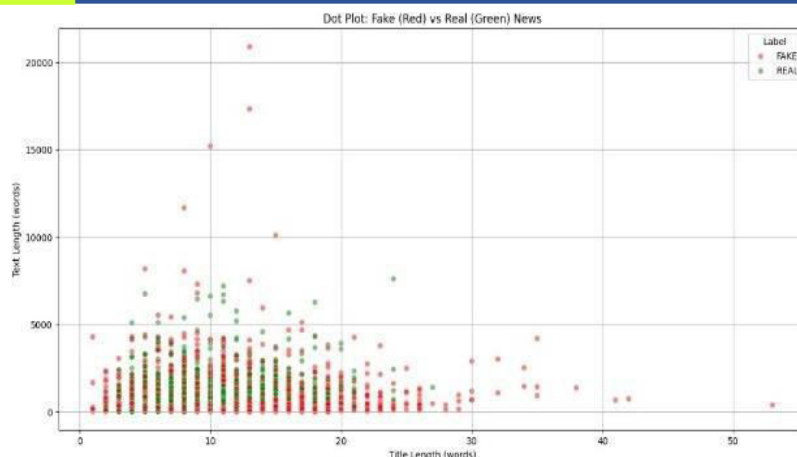


Fig.2. Comparison of Title and Text Lengths in Fake vs Real News

The figure presented a line chart depicting the average text length trend across articles. The x-axis represented the Article Index, while the y-axis denoted the Average Text Length (words).

It was observed that the text length fluctuated significantly across the dataset, ranging roughly between 600 and 1000 words. Peaks and troughs were frequent, indicating that article length was not consistent but instead varied dynamically across different samples.

The presence of multiple sharp rises and drops suggested that both fake and real news articles did not adhere to a fixed word length standard. However, certain clusters showed prolonged periods of longer articles, which aligned with the earlier observation that fake news articles occasionally contained unusually lengthy content.

This analysis demonstrated that text length alone was not a sufficient indicator of authenticity, but when combined with sentiment and other linguistic features, it contributed to a more robust classification framework.

V. CONCLUSION

The study concluded that combining blockchain technology, machine learning, and natural language processing offered a powerful solution to combat fake news. The integration of blockchain provided secure data management and real-time traceability, while AI models enhanced the Correctness of news classification. that it was possible to significantly reduce the impact of fake news by used a decentralized, transparent, and adaptable framework. Despite the promising results, the study acknowledged some limitations, such as the reliance on relatively small datasets, computational costs, and the challenge of generalizing across diverse cultural contexts. The authors suggested that future research should focus on expanding datasets, refining AI models, exploring unsupervised learning techniques, and fostering closer. To address these gaps, the authors suggested future research directions such as:

Expanding datasets to include multilingual and cross-cultural news sources. Refining AI models to improve efficiency, scalability, and interpretability. Exploring unsupervised and semi-supervised learning techniques to reduce dependence on labelled data. Investigating federated and edge learning approaches to improve scalability while preserving privacy. Encouraging closer collaboration between academia, industry, and policy makers to deploy these systems in real- world platforms. The research established that a sentiment- aware, blockchain-enabled framework offered a promising pathway toward mitigating the spread of fake news, paving the way for future advancements in trustworthy and intelligent information system. The research ultimately established that a sentiment-aware, blockchain-enabled framework provided a highly promising pathway toward combating the spread of fake news. By integrating sentiment analysis, the system was able to capture subtle emotional cues that influence misinformation, thereby improving classification accuracy. At the same time, blockchain technology ensured immutability, traceability, and transparency, building user trust in the authenticity of the information.



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VI. DISCUSSION

In our study, we explored the integration of sentiment analysis and blockchain technology to enhance fake news detection mechanisms. We examined how traditional fake news detection systems lacked transparency and traceability, which often led to reduced trust and accountability. To address this, we implemented a decentralized framework where news articles were first processed using sentiment analysis models to identify emotional tone and biases. We trained machine learning algorithms on labeled datasets to classify news based on sentiment polarity and authenticity. Once classified, the results were recorded onto a blockchain ledger to ensure immutability and verifiability. We utilized smart contracts to automate the verification process and maintain a tamper-proof record of validated information. Our approach aimed to empower users by providing a transparent history of news validation and source credibility. Throughout the development, we also evaluated performance metrics such as accuracy, precision, and recall to assess the effectiveness of our model. Ultimately, our system demonstrated that combining sentiment awareness with blockchain technology could significantly enhance the accuracy, transparency, and trustworthiness of fake news detection mechanisms. The inclusion of sentiment analysis enriched the feature set by capturing the emotional tone of news articles, which improved the performance of classification models. Simultaneously, blockchain integration ensured that the classified outputs were stored in a secure, immutable, and decentralized manner, thereby preventing tampering and enabling verifiable traceability of information.

This dual approach not only strengthened the detection process but also established a foundation for building scalable, reliable, and ethically responsible digital ecosystems that can mitigate the harmful effects of misinformation in real-world applications.

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