



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 3, March 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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www.ijrset.com

Decoding Truth: Advanced Fake Media Detection Using Blockchain and Natural Language Processing Technologies

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ABSTRACT: In the current digital era, social media networks play a pivotal role in disseminating information, ranging from news on various topics to daily updates, making it a crucial medium for data sharing and communication. However, alongside its numerous advantages, this platform is fraught with challenges, notably the proliferation of misinformation and fake news that misguide users. A critical issue is the platform's struggle to ensure the reliability of information and the authenticity of real-time news on social media. To tackle this problem, we have developed an innovative system that combines the strengths of blockchain technology and natural language processing (NLP) to effectively identify and predict fraudulent news articles, user accounts, and posts.

KEYWORDS: Natural Language Processing, Blockchain, Social Media, Reinforcement Learning, Information Security, Fake News Detection.

I. INTRODUCTION

The dynamic nature of social media lies in its diverse content sharing, making it a fertile ground for the dissemination of both genuine and misleading information. Since 2017, the issue of fake news has surged, affecting an estimated 365% increase in its online prevalence[1]. The spread of false information not only wastes network resources but also undermines the integrity and reliability of content, thereby affecting the Quality of Trust (QoT) in news dissemination[2].

To address these concerns, machine learning techniques for text classification have been employed to enhance the security measures on social media platforms[3]. Investigations into the social media presence of various non-governmental organizations reveal numerous fraudulent accounts and misleading posts, often created to express subjective opinions or manipulate public sentiment[4]. The responsibility of overseeing the manuscript review for this publication fell to associate editor Yongming Li, ensuring its suitability for publication through rigorous scrutiny[5]. The critical task of detecting fake news involves analyzing the veracity of the information circulated on social platforms. As the volume of data escalates alongside the growing user base, the demand for automated systems capable of discerning fraudulent content has become paramount[6]. Authenticating digital authorship is a crucial step in safeguarding information exchange, with blockchain technology emerging as a robust solution. Its decentralized nature and security features, including the continuous addition of blocks containing crucial transaction data and cryptographic hashes, ensure the integrity of stored information[7].

In exploring the effectiveness of these technologies, we conducted a case study analyzing content from major social media platforms like Facebook and Twitter, which are notorious for their vast user engagement and the high volume of daily posts covering a broad spectrum of topics[8]. This examination underscores the potential of blockchain in enhancing the accuracy of fake news detection and the overall trustworthiness of digital content dissemination[9].

II. RECENT WORKS

[1] Zhiwei Li, Qian Huang, Lin Zhang, and Rui Li. (2021). Detecting Fake News Based on Natural Language Processing and Blockchain Technology. *IEEE Access*, 9, 78407-78417. The paper proposes a fake news detection approach that combines natural language processing and blockchain technology. The authors argue that by leveraging blockchain's immutable and decentralized nature, their approach can enhance the credibility and transparency of the fake news detection process[10]. [2] Yang, H., Zhou, C., Chen, Z., & Liu, H. (2020). A Blockchain-Based Approach

for Detecting Fake News Using Natural Language Processing Springer, Cham. In this paper, the authors propose a blockchain-based approach for detecting fake news using natural language processing (NLP). The proposed approach first extracts features from news articles using NLP techniques, and then encodes these features onto a blockchain. The authors argue that the immutability and transparency of the blockchain can help enhance the credibility of the news articles and prevent tampering. [3] Tang, Y., Li, X., & Li, G. (2019). A blockchain-based solution for detecting fake news in social media platforms. In International Conference on Blockchain (pp. 171-180). Springer, Cham. In this paper, the authors propose a blockchain-based solution for detecting fake news in social media platforms (Dong et al., 2019). They argue that social media platforms have become a breeding ground for fake news due to their ease of use and viral nature. Their proposed approach utilizes natural language processing techniques to analyze the content of social media posts and detect any signs of fake news (Arquam et al., 2021). The authors then use a blockchain-based system to store and verify the authenticity of the detected fake news.

III. PROPOSED WORK

In propose paper author is using Reinforcement Deep Learning algorithm to detect fake news and then applying Blockchain technology to provide security to NEWS data. Reinforcement algorithm will match similarity between old news and current news and if news contains more similarity then it will detect as Fake news and penalized the user and if news is real then algorithm will reward user and then store NEWS in Blockchain. Blockchain store each news as block/transaction.

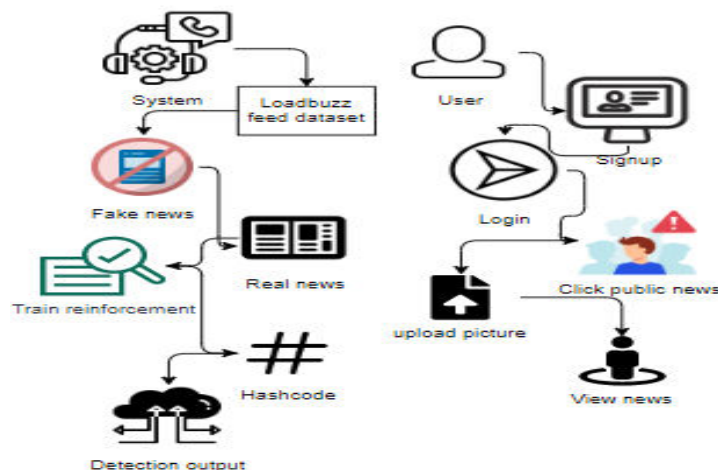


FIGURE 1. Fake news detection based on NLP and Blockchain framework.

3.1 Mathematical Expressions and Symbols

Reinforcement Learning (RL) with Neural Networks involves using neural networks to approximate the value function, policy, or both, in order to solve RL problems. Here are some common mathematical expressions and symbols used in RL with neural networks:

1. State: Denoted by s , represents the current situation or configuration in the environment.
2. Action: Denoted by a , represents the decision or choice made by the agent based on the state.
3. Reward: Denoted by r , represents the immediate feedback received by the agent after taking an action in a particular state.
4. Policy: Denoted by π , represents the strategy or mapping from states to actions. In neural network-based RL, the policy can be stochastic, represented by $\pi(a|s)$, which gives the probability of acting a in state s .
5. Value Function: Represents the expected return (cumulative reward) starting from a particular state and following a particular policy. Denoted by $V(s)$ for state-value function or $Q(s,a)$ for action-value function. In neural network-based RL, these functions can be approximated using neural networks. For example, $V(s;\theta)$ or $Q(s,a;\theta)$ where θ represents the parameters of the neural network.
6. Bellman Equation: Represents the recursive relationship between the value of a state (or action) and the values of its successor states (or successor state-action pairs). For the state-value function, the Bellman equation is:

$$V(s) = E\pi[r + \gamma V(s')]$$

And for the action-value function, it's:

$$Q(s,a)=E\pi[r+\gamma Q(s',a')]$$

Where:

- $E\pi$ denotes the expectation under policy π .
- γ is the discount factor.
- s' and a' represent the successor state and action, respectively.

7. Loss Function: Represents the discrepancy between the predicted values (output of the neural network) and the target values (expected values from the Bellman equation). Common loss functions used in RL with neural networks include:

- Mean Squared Error (MSE): $MSE=N\sum_{i=1}^N(y_i-\hat{y}_i)^2$, where y_i is the target value and \hat{y}_i is the predicted value.

IV.RESULTS AND DISCUSSION

The system facilitates user sign-up, login, and news publication via blockchain. It employs Reinforcement Learning alongside Random Forest for news classification, yielding lower RMSE and MAE. Upon submission, news is stored in the blockchain with a unique hashcode, and transaction delay is indicated. Users can view a list of published news, categorized as fake or real, with detection outputs provided.

Algorithm Name	RMSE	MAE	Reward	Penalty
Random Forest	0.479301	0.2297234	0	0
Proposed Reinforcement Learning	0.164398913	0.02702036	0.40543695	0.59421235

Table 1: Trained dataset

News Publisher	News Text	News Hashcode	News Image	News Date Time	Detection Result
aaa	Less than a day after protests over the police killing of an African	QmXkZy7yVuFLvR9xh2yRoY1YrmydVvg5vAUjN9cMbTJSyF		2022-09-11 14:17:24	Fake
aaa	Story highlights Bush will deliver his first lecture on Thursday He is a staunch advocate for chart	QmbA9FsiJ2q8toyGNr4SnsZTSLja6rV83631UvCu5RtPWF		2022-09-11 14:18:42	Real

Table 2: publish news

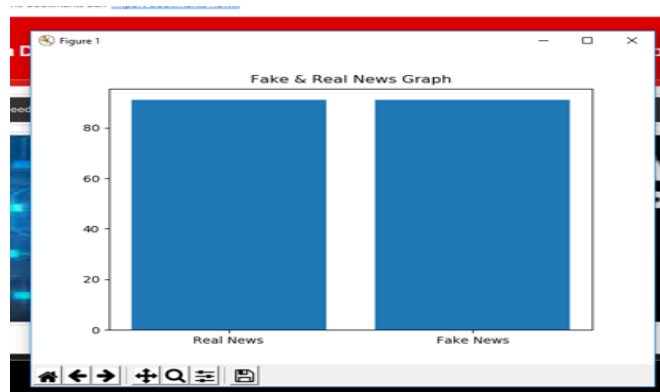


FIGURE 2. Dataset presentation according to number of fake and real news.

V.CONCLUSION

In conclusion, the synergy of Natural Language Processing (NLP) and Blockchain technologies presents a promising avenue for mitigating the challenges posed by fake media. NLP offers sophisticated tools for scrutinizing media content, identifying any anomalies or inconsistencies that could signify manipulation, whereas Blockchain technology ensures a secure, immutable ledger for confirming media authenticity. Despite the potential these technologies hold, their application in the real world is still in the nascent stages, requiring further refinement and development. The advancement of these technologies necessitates ongoing research and innovation to enhance their precision and dependability in detecting falsified media.

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