Fake News Detection using Machine Learning Algorithms

LITERATURE REVIEW

The digital age has brought about a substantial problem regarding fake news which affects public sentiment while damaging trust in media institutions. Scientific scholars now prefer to utilize machine learning algorithms as a method to detect and fight against misleading information effectively. The analysis investigates multiple machine learning strategies which detect fake news along with their operational framework while detailing operational difficulties and performance outcomes.

The initial attempts to detect fake news relied on traditional machine learning approaches. The detection algorithms use three models namely Naive Bayes, Support Vector Machines (SVM) and Decision Trees to analyze textual data and identify linguistic markers that separate truthful messages from deceptive ones(Abdulrahman, A., & Baykara, M. (2020)). The detection models depended heavily on expert-generated feature engineering techniques that allowed selection of word frequency analysis and sentiment detection and syntax pattern matching for classifier instruction. This foundation proved critical for detection but quality-limiting factors in both features and models prevented them from grasping complex contextual meanings (Baarir, N. F., & Djeffal, A. (2021)).

Deep learning transformed the approaches toward fake news detection at a substantial level. Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) along with other deep learning models became powerful tools for automatic pattern detection in data without requiring extensive manual feature construction efforts. The application of CNNs addresses text analysis by detecting local patterns together with hierarchical patterns in news material (Hager, A., & Alharbi, S. H. (2021)). The LSTM network type along with its RNN relatives have shown success in recognizing sequence relations which makes them ideal for processing sequential information found in news articles. The models have achieved better results in detecting fake news through their capability to build complex textual data representations (Mahara, G. S., & Gangele, S. (2022)).

Expanding fake news detection requires the integration of social context analysis with textual evaluations because researchers identify this combination as fundamental. Researchers implement user engagement metrics which include user credibility and social network propagation analysis and evaluation of user sentiment in their studies. Graph Neural Networks (GNNs) prove useful because they efficiently detect relations between entities within networks. The GNN-based structure for news dissemination tracking allows the model to understand user-content relationships better which benefits detection capabilities. The method views fake news dispersion as a social phenomenon that can be correctly detected through understanding network structures (Guo Z., et al., (2023)).

The recent technological advancement in fake news detection has not eliminated various persistent barriers in the field. Model obsolescence frequently happens because fake news evolves constantly in this domain. High-quality labeled datasets remain insufficient which results in an obstacle preventing capable model development. Researcher ability to create standard datasets for fake news becomes complicated because interpretive elements within fake news content leads to biased categorization (Hiremath, P., et al., (2023)). The concept of adversarial attacks in online space matches with threat methods since malicious agents manufacture dishonest news which has the ability to bypass defensive systems. The continuous model updates and adaptable algorithm development for restricted data generalization represent essential requirements because of existing challenges (Zhou, X., & Zafarani, R. (2018)).

Recent research demands two approaches which combine ensemble methods and transfer learning to resolve the identified problem. Pre-trained model architectures from extensive text domains enable modern fake news detection to process fresh data without being negatively affected by little training examples. Multiple different models join into a consolidated system through ensemble methods to produce superior complete performance. The detection system operates at its best potential by linking content analysis models and social context assessment models together. Research demonstrates that such approaches boost the dimensional and efficient operation of fake news detection systems.

Machine learning algorithms used for fake news detection moved from simple traditional classifiers working with manual features to sophisticated automated models capable of detecting complex patterns.

LITERATURE GAP

Abdulrahman, A., & Baykara, M. (2020). Machine learning together with deep learning algorithms detect fake news in this 2020 International Conference on Advanced Science and Engineering (ICOASE).

The present research fails to achieve its defined target accuracy of 85% due to its continued use of traditional machine learning approaches (SVM, Naïve Bayes, Logistic Regression, and RNN) while omitting recent deep learning models LSTM or BERT (Objective 2). There is no integration of interpretability methods like SHAP or LIME that can support transparent model prediction explanation (Objective 3). The system does not include any mention of real-time verification platforms that include browser plugins or web dashboards (Objective 4). The model's effectiveness needs to be proved through an empirical evaluation against state-of-art methods (Objective 5) but no such assessment is provided.

Baarir, N. F., & Djeffal, A. (2021). Fake News detection Using Machine Learning. 2020 2nd International Workshop on Human-Centric Smart Environments for Health and Well-Being (IHSH).

The current application uses Count Vectorizer alongside traditional machine learning algorithms but its accuracy and reliability remain limited. The detection capabilities need improvement which can be achieved through implementing deep learning models such as LSTM or BERT. Predictions should be made transparent through the use of interpretability techniques such as SHAP and LIME. The project needs a web-based dashboard for true-time verification which should be developed as a solution to this gap. The evaluation lacks thorough performance comparisons with state-of-the-art fake news detection methods because it needs experimental benchmarks against first-rate detection systems.

Guo, Z., Yu, K., Jolfaei, A., Li, G., Ding, F., & Beheshti, A. (2023). The proposed research presents a mixed graph neural network structure for detecting fake news in sustainable vehicular social networks. IEEE Transactions on Intelligent Transportation Systems: A Publication of the IEEE Intelligent Transportation Systems Council, 24(12), 15486–15498. https://doi.org/10.1109/tits.2022.3185013

The presented study detects fake content in Vehicular Social Networks (VSN) through mixed Graph Neural Networks yet struggles to directly apply this method for multiple domains. The system lacks explicit targets to reach 85% accuracy through BERT technology or similar deep learning methods for enhanced performance. Due to its absence of SHAP and LIME techniques the model fails to deliver transparent classification methods. The system does not present a web-based application for conducting real-time verifications. Our work develops an optimized deep learning approach and implements explainability frameworks alongside providing real-time verification tools.

Hager, A., & Alharbi, S. H. (2021). OPCNN-FAKE: Optimized convolutional neural network for fake news detection. IEEE Access, 9, 129471–129489.

The study introduces OPCNN-FAKE for fake news detection yet fails to resolve each of the predetermined goals. The research needs to add explainability through SHAP or LIME techniques to achieve Objective 3. The study lacks BERT as part of its configuration which could enhance robustness of classification (Objective 2). A web-based interface and real-time functionality for real-time applications are lacking from the proposed system (Objective 4). The research requires more advanced benchmarking of cutting-edge models to obtain empirical results (Objective 5). The analysis gaps can be solved through combining explainability techniques with real-time functionality and the implementation of BERT-based models.

References

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