***Literature review***

**Introduction**

The rapid proliferation of online news and social media has significantly altered the way information is disseminated and consumed. However, this digital transformation has also facilitated the widespread circulation of fake news, which poses serious social, political, and economic threats. Fake news, often characterized by misleading or false information presented as factual reporting, has become a major challenge in the digital era (Toledano, Guerrero Rojas and Ardèvol-Abreu, 2024). The ability to automatically detect and classify fake news is crucial in mitigating the negative impacts of misinformation.

Machine learning (ML) and deep learning (DL) have emerged as powerful tools in combating fake news. By leveraging natural language processing (NLP) techniques, these models analyze linguistic patterns, textual features, and credibility indicators to distinguish between real and fake news. Several benchmark datasets, such as WELFake and FakeNewsNet, provide valuable resources for training and evaluating ML and DL models in fake news classification.

This literature review explores various ML and DL techniques applied to fake news detection, analyzing their effectiveness, challenges, and future research directions. The review begins with an overview of traditional ML methods, including Logistic Regression, Support Vector Machines (SVM), and Random Forest. It then delves into advanced DL approaches, such as Long Short-Term Memory (LSTM) networks and Bidirectional Encoder Representations from Transformers (BERT). Furthermore, the review discusses the role of feature engineering, dataset selection, and evaluation metrics in developing robust fake news detection systems.

**Machine Learning Approach**

Study by Baarir and Djeffal, (2021) presents a machine learning-based approach using TF-IDF with bag of words and n-grams for feature extraction and Support Vector Machine (SVM) for classification. A newly proposed dataset of fake and real news is utilized for training, demonstrating the model’s efficiency. The findings highlight the effectiveness of ML techniques in identifying misinformation and enhancing automated fake news detection systems. The spread of fake news has intensified with the rise of the internet and social media, making misinformation a significant challenge. During the Covid-19 pandemic, false information spread rapidly, misleading the public. This study explores machine learning and deep learning techniques, including Naïve Bayes, SVM, Decision Trees, CNNs, and LSTMs, to enhance fake news detection. Using a Covid-19 dataset with over 1.3 million tweets, the research aims to improve prediction accuracy and counter misinformation effectively (Sudhakar and Kaliyamurthie, 2024).

The rapid spread of fake news has led to social unrest, highlighting the need for effective detection methods. This study compares LightGBM and Logistic Regression for fake news classification using a dataset of 23,481 fake and 21,417 real news articles. The models are evaluated based on accuracy, precision, recall, F1-score, and Matthews’s correlation coefficient. The research aims to assess the effectiveness of these techniques in combating misinformation (Mary et al., 2024). The research by (Ferawaty Ferawaty, Mangasa Manullang and Hanitio, (2024)) explores the use of SVM and Logistic Regression methods for classifying fake news, a growing concern in the digital age. The study utilizes a dataset of 5932 news articles, including both fake and real news. Through preprocessing and TF-IDF transformation, the models achieve impressive results, with a classification accuracy of 96.4%, precision of 96.7%, sensitivity of 95.7%, and an F1-score of 96.2%. These findings demonstrate the effectiveness of these methods in detecting and classifying fake news.

The research introduces a novel hybrid model combining Support Vector Machines (SVM) and K-Nearest Neighbours (KNN) to detect fake news on social media, addressing the shortcomings of traditional methods. By considering the complex relationships between individuals, content, and social networks, the model incorporates various machine learning classifiers like SVM, Random Forest, Logistic Regression, CART, and Neural Networks. Rigorous cross-validation enhances the model's robustness, providing an innovative, multifaceted solution to combat the evolving challenge of fake news detection in the digital age (P. Dedeepya et al., 2024).

This study addresses the significant issue of fake news detection, particularly in the political sphere, were misinformation spreads rapidly through social media. By employing a random forest machine learning algorithm and using TF-IDF for feature extraction, the study successfully analyses a dataset of 20,761 fake news records. After data preprocessing to remove unnecessary characters and whitespace, the model achieved an impressive accuracy of 88.24%. This research highlights the effectiveness of machine learning in combating the growing problem of fake news (Najwan Thair Ali et al., 2024).

Social media platforms like Facebook, Twitter, and Instagram have revolutionized communication, but they also facilitate the spread of fake news, which can have harmful effects, especially during critical events like the COVID-19 pandemic. To combat this, a novel lightweight convolutional random forest-based honey badger (LCRF-HB) approach is proposed for fake news detection. The method involves data preprocessing, feature selection using the honey badger optimization algorithm, and classification with LCRF. The model achieved 98.7% accuracy, 98.3% precision, and 97.6% recall, demonstrating superior performance compared to other methods (S. Selva Birunda, Devi and M. Muthukannan, 2024).

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| Study | Dataset Size | Approach | Machine Learning Techniques | Key Metrics | Accuracy |
| Baarir and Djeffal (2021) | Fake and real news dataset (newly proposed) | TF-IDF, Bag of Words, N-grams, SVM | SVM | Efficiency of ML techniques in detecting fake news | --- |
| Sudhakar and Kaliyamurthie (2024) | 1.3 million COVID-19 tweets | ML and deep learning (Naïve Bayes, SVM, CNN, LSTM) | Naïve Bayes, SVM, Decision Trees, CNN, LSTM | Improved prediction accuracy for COVID-related misinformation | --- |
| Mary et al. (2024) | 23,481 fake news, 21,417 real news articles | LightGBM and Logistic Regression | LightGBM, Logistic Regression | Accuracy, Precision, Recall, F1-Score, Matthews’s correlation coefficient | --- |
| Ferawaty, Mangasa, and Hanitio (2024) | 5,932 fake and real news articles | SVM and Logistic Regression | SVM, Logistic Regression | Accuracy: 96.4%, Precision: 96.7%, Sensitivity: 95.7%, F1-Score: 96.2% | 96.40% |
| P. Dedeepya et al. (2024) | --- | Hybrid Model (SVM, KNN) | SVM, KNN, Random Forest, Logistic Regression, CART, Neural Networks | Cross-validation enhancing robustness of model | ---- |
| Najwan Thair Ali et al. (2024) | 20,761 fake news records | Random Forest, TF-IDF | Random Forest | Accuracy of 88.24% | 88.24% |
| Selva Birunda, Devi, and Muthukannan (2024) | ----- | Lightweight Convolutional Random Forest-based Honey Badger (LCRF-HB) | LCRF, Honey Badger Optimization | Accuracy: 98.7%, Precision: 98.3%, Recall: 97.6% | 98.70% |

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