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Machine Learning Techniques for Identifying Fake News: An Overview

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***Abstract*:** Fake news, which is defined as material that has been shared with the intention of defrauding people, has been growing quickly and widely recently. This kind of misinformation is dangerous to social cohesion and wellbeing because it exacerbates political polarisation and public mistrust of authority figures. As a result, false news is an issue that has a big impact on our social lives, especially in politics. To combat this issue, this study proposes innovative approaches grounded in machine learning (ML) and deep learning (DL) for enhancing fake news detection systems. This investigation encompasses a thorough examination of established machine learning algorithms such as Naïve Bayes, Convolutional Neural Networks, Long Short-Term Memory networks, Neural Networks, and Support Vector Machines. These algorithms are explored in the context of identifying and mitigating fake news across various social media platforms, including Facebook, WhatsApp, Twitter, and more. This review offers a comprehensive overview that includes perspectives from data mining, evaluation metrics, and representative datasets, contributing to a deeper understanding of the strategies employed to combat the proliferation of fake news.

Keywords: Fake News, Machine Learning, Deep Learning, Neural Network, Convolutional Neural Network, Detection.

1. Introduction

Technology advancements have made knowledge widely available to all people. The internet offers a tonne of information, but its reliability depends on a variety of circumstances. Daily, a huge amount of information is released in print and online media, but it can be difficult to determine if the information is accurate or not. It necessitates a thorough examination and analysis of the narrative, which involves verifying the accuracy of the material by evaluating the sources used to support it, identifying the information's original source, determining the veracity of the authors, etc. The purpose of fabricating information is to intentionally harm or benefit a group, person, or entity's reputation. It can also be done for pure financial or political gain. The phrase "Fake News" was created to describe this type of manufactured information that deceives people. [1] We notice a lot of these falsified messages, news stories, and altered images spreading on social media throughout the Indian election campaigns.

These days, incorrect information is quickly distributed using social media. "A falsehood gets halfway across the world before the truth has a chance to get its pants on," is a famous Wiston Churchill quotation. Because there are so many people using social media, gossip and false information travel quickly. The reaction to this type of news may prove to be the deciding element in whether it is considered to be "fake" or "genuine."[2]. This approach-based classification would be a huge step in the right direction. I ran an experiment to see how often words connected to "fake" appeared in the responses in order to substantiate this claim. The term "deception," which is frequently used to refer to "fake news" in modern times, is defined as false or incorrect information that may be given with the intention of misleading the people who read it. Data or opinions that you can't help but disagree with might not actually be wrong.[3] Although the term "fake news" is frequently used as a derogatory in news reporting nowadays, this is an unreliable use of the phrase. To be sure, labelling reality-based reporting "deception" because it contradicts your political views might perhaps be considered lie in and of itself. Can we trust the majority of the news we read on social media and on ostensibly "legitimate" news websites? It is incredibly simple for anyone to post whatever they want, and while that may be acceptable, there is the idea of going too far. For example, posting false information online to incite panic, using lies to influence another person's decision, or essentially anything else that can have long-lasting effects, are all examples of going too far. [4] There is so much information available online that separating fact from fiction is becoming impossible. Consequently, this results in the issue of fake news.

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Figure 1: Example of fake news on social media sites

2. Machine Learning for Fake News Detection

Machine learning, a subset of computer science, is a potent tool in the fight against fake news. By harnessing its capabilities, systems can be developed to identify and prevent the spread of false information on social media. Machine learning has applications in numerous sectors, from finance and healthcare to social media and gaming. For fake news detection, three types of machine learning techniques can be utilized:

Supervised Learning: In this approach, the outcome is predetermined, with the program operating based on developer guidance. It involves training a model with a labeled dataset and then making predictions based on that. It functions like a teacher-student dynamic.

Unsupervised Learning: This method doesn't rely on a labeled dataset, so the outcomes aren't strictly defined. Its primary function is to uncover hidden patterns within the data. The algorithm continually seeks new patterns and relationships, and the dataset evolves as it learns.

Reinforcement Learning: This is a unique and increasingly popular technique where algorithms make autonomous decisions. They learn from mistakes and experiences, continuously improving over time. It's adaptive and can adjust outcomes as necessary, with applications like autonomous vehicles serving as prime examples..

3. Research Methodology

The research methodology adopted for this paper is presented below in Figure 2.

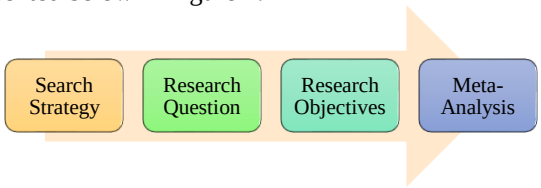

Figure 2: Research Methodology

3.1 Search Strategy

In this step, specified research topic are searched from different resources such as IEEE Xplore, ScienceDirect, and Springer from the past 10 years from 2012 to 2022. As presented in figure 3, graphical representation of research contribution for fake news detection. The following combinations of search phrases were used to get relevant articles for this article: "FAKE NEWS" AND "DETECTION" AND "MACHINE LEARNING". The phases from the research methodology through the reporting of the results will be guided by the research questions (RQ).

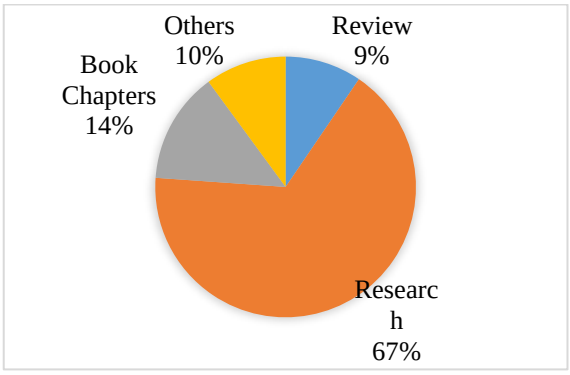

Figure 3: Research Articles for Fake News Detection

3.2 Research Questions

1. How machine learning is suitable for fake news detection?
2. How user profile information is related for prediction of fake news?
3. What are the challenges faced during machine learning implementation and how to overcome these challenges?

3.3 Research Objectives

1. To design a framework for fake news detection by analysing users activities.
2. To implement deep learning algorithms for accurate and efficient classification of news as fake or real.
3. To improve performance parameters.

3.1 Meta-analysis

In this section, we are going to describe a general framework for fake news identification as presented in figure 3.

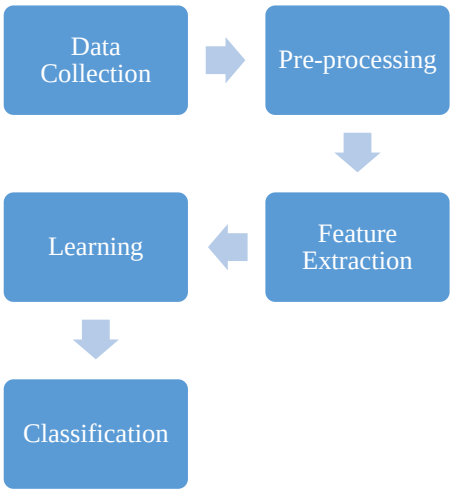

Figure 3: Flow Chart of Proposed Work

The flowchart indicates the methodological approach employed by researchers for detecting fake news. This section highlights several notable works in this domain. Babu et al. [6] proposed a multi-path CNN structure for deepfake detection. This CNN consists of three modules, including a dual-path approach with Resnet and Densenet components. This technique demonstrated impressive accuracy and F1-score values when benchmarked against four deep learning models.

Toumi et al. [7] introduced an ensemble model using CNN, LSTM, and C-LSTM for fake news identification, leveraging both the ISOT and LIAR datasets. Choudhary et al. [10] developed an ImageFake ensemble model that employs a series of pre-trained models, like VGG-16 and ResNet-101, for fake news categorization. This model showcased a promising training and validation accuracy.

Kar et al. [13] introduced a BERT-enhanced model to detect false tweets, adding relevant Twitter information. This model excelled in detecting false tweets in multiple languages, including Bengali and Hindi. Meel et al.[15] crafted a system relying on several machine-learned classifiers, with the SVM classifier showing the highest accuracy on a specific dataset.

Pham et al. [17] put forward an approach for Vietnamese Fake News Detection using the PhoBERT pre-trained language model combined with CNN for feature extraction. Rani et al.[18] tackled the rumor detection challenge by considering contextual data, with their model surpassing baseline results. Verma et al.[20] created the WELFake dataset and achieved better classification accuracy than other popular models.

Xi et al. [21] designed a COVID-19 fake news detection system utilizing CNN, LSTM, and attention-based transformer models. The attention-based model excelled due to its notable accuracy and AUC score. Other models, like the Nave Bayes Classifier and the Recurrent Neural Network, also showed impressive accuracy metrics on specific datasets.

Patel et al. delved into diverse machine learning methodologies. They discussed models like MOSES and hybrid CNN-RNN models, both showcasing promising accuracies. Islam et al. [24] focused on Bengali fake news categorization, understanding its significance in South Asia. Their web interface, backed by a classifier, could verify Bengali news articles. Mansoui et al. [25] employed deep learning for fake news detection, harnessing a convolutional neural network in a semi-supervised setting. Their model outperformed others in several metrics.

Table 1 below offers a consolidated view of these research contributions, while Figure 4 presents a performance comparison.

Table 1. Recent Research Contributions

Ref	Technique used	Tool Used	Dataset used	Results
[6]	CNN,RESNET	Python	Kaggle	Accuracy 0.940
[7]	CNN ,LSTM	Python	LIAR	Accuracy 89.16 F1-score 95.03
[10]	CNN,VGG-16,VGG-19	Python	MediaEval 2015	Accuracy training 96 Accuracy validation 97
[13]	BERT model	Python	Kaggle	F1 score 81
[14]	LDA ,CNN	Python	Kaggle	Accuracy 95.5
[15]	SVM	Python	Fake news detection	Accuracy 96.61
[17]	CNN	Python	ReINTEL	AUC 0.9538
[18]	CNN and BILSTM	Python	Kaggle	F1 score 0.939 accuracy 90.93
[20]	CNN	Python	WELFake	Accuracy 96.73
[21]	CNN	Python	Kaggle	Accuracy 75.9 AUC score 0.774
[24]	Random Forest	Python	South Asian context	Accuracy 85

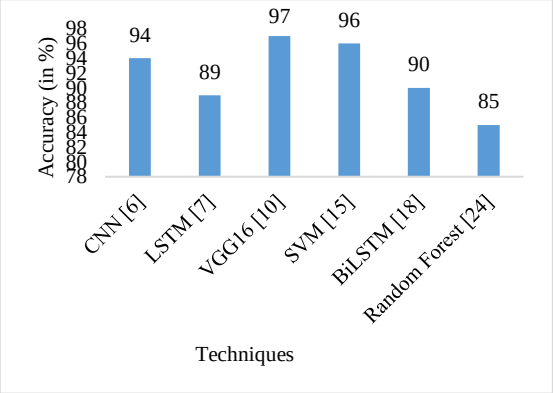

Figure 4: Performance of Machine Learning in Detection Process

4. Conclusion and Future Work

This study introduces a system to ascertain the authenticity of news articles. We monitor user behavior and profiles, determining a credibility score for each user based on their interactions and information. This assessment combines statistical methodologies with deep learning techniques within a unified platform to boost efficiency. The models are honed using training datasets and validated on testing datasets. Recognizing the prevalence of misleading information on social platforms, it's imperative to have tools that can sift out untruths or, at a minimum, to approach digital content with skepticism. By enhancing discernment, we aim to enable individuals to make

enlightened choices, safeguarding them from potential manipulations.

Conflict of Interest: If two or more Authors: The corresponding author, on behalf of all authors, confirms that there are no conflicts of interest to disclose.

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