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Study of Fake News Detection for Twitter Data using Deep Learning Approach

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Abstract
The exponential growth of social media platforms like Twitter has made information dissemination faster and more accessible, but it has also given rise to the rapid spread of fake news and misinformation. Detecting fake news in real-time is a challenging task due to the dynamic nature of social media content and the complexity of natural language. This study explores the application of deep learning techniques for fake news detection using Twitter data. Various deep neural architectures, including Long Short-Term Memory (LSTM), Bidirectional LSTM (BiLSTM), Convolutional Neural Networks (CNN), and hybrid models such as CNN-LSTM, are analyzed for their efficiency in classifying tweets as genuine or fake. The dataset is preprocessed through tokenization, stop-word removal, and word embeddings using Word2Vec and GloVe. The models are trained and validated using evaluation metrics such as accuracy, precision, recall, F1-score, and AUC. Experimental results demonstrate that deep learning models outperform traditional machine learning classifiers in understanding contextual semantics and sentiment patterns within tweets. The study concludes that hybrid deep learning models, particularly BiLSTM-CNN architectures, provide superior performance and robustness in identifying misinformation on social media.
Keywords: - Fake News Detection, Twitter Data, Deep Learning, LSTM, CNN, NLP, Social Media Analytics

1. INTRODUCTION

The social networking sites like Facebook, Twitter is the most significant ways of internet communication and collaboration. Fake information spreading by bots is another major problem of social media, around 30% of posted information is fake or bogus every day from malicious web applications or bots [1]. So, it is important to improve the trustworthiness of social media by detecting fake news and bots timely. Analyzing user's profiles information and identifying its trustworthiness using various soft computing techniques is the way of eliminating fake news distribution [2]. To commit numerous cybercrimes such as profile hacking, identity hacking, session hijacking, malicious linking, mail bombs, and so on helps criminals build false identities. Mostly bots or humans may create such kinds of fake identities [3]. In general, the fake identities of

bots target large numbers of individuals on social media. Fake information or accounts can spread forged information rapidly without any verification policy, which is the big drawback of social media [4]. Identity deception on various social media platforms has become a growing problem with the tremendous increase in the number of accounts on these platforms [5]. Attackers have used fake identities for several malicious purposes, which are created by bots and humans. This system removes accounts by bots from the corpus during preprocessing and performs classification of accounts by humans into two categories, i.e., Fake vs. Real using Recurrent Neural Network (RNN) algorithm based on different parameters [6]. A bot is a computer program that performs a specific task over the Network; it is also called an internet robot, WWW robot, or just a simple bot. Bots usually complete basic and conceptually repetitive activities, though greater rate than just a human being or a single entity might be able to do. The biggest use of bots is in the collection of data sources, in that a dynamic script extracts, evaluates, and files virtual server content at several times the higher frequency of a human. Bots specifically generate fake news with massive data uploading rate [7]. Fake news is inaccurate knowledge generated through business activity to gather awareness and generate promotion revenue or spread negativity violations to have a political influence [8]. News stories suggest truthfulness but include purposeful mistakes of fact with the anticipation of exciting interests, attracting audiences, or cheating. There have already been lots of instances of unapprovable or unauthorized false data circulating rapidly completed informal online entities since late. For example, there have been ongoing allegations of Russian electronic Network hacking in Virginia and reports indicating that Saudi Arabia funds the presidential campaign of Emmanuel Macron. Since about late, such unverified news has circulated rapidly, so it is challenging to channel certain news only with the production of huge datasets in these areas.

2. LITERATURE REVIEW

Dey et al. (2024) proposed “A Novel Framework for Fake News Detection Using LDA and QDA” at the 15th International Conference on Computing Communication and Networking Technologies (ICCCNT). Their work applied Linear Discriminant Analysis (LDA) and Quadratic Discriminant Analysis (QDA) on textual data to classify news articles as fake or genuine. The model focused on improving classification through feature selection and statistical discriminant functions. While the proposed method achieved improved accuracy compared to traditional classifiers, it struggled with contextual understanding and semantic ambiguity, which limited its performance on social media datasets like Twitter.

Hossain et al. (2024), in “A Cross-Modal Aware Scalable Approach for Fake News Detection” presented at the 17th International Conference on Developments in eSystems Engineering (DeSE), introduced a multimodal detection framework that combined textual and visual data from online news. The approach leveraged deep learning models to process text embeddings alongside image features, thereby enhancing detection accuracy for posts containing multimedia elements. Their results showed significant gains in precision and recall for multimodal datasets; however, the model’s scalability and real-time adaptability were limited due to high computational costs.

Vinay et al. (2025), in their IEEE paper “Hybrid Semantic and Contextual Analysis for Multilingual Fake News Detection Using Deep Learning”, developed a hybrid deep neural network capable of handling multilingual data from platforms such as Twitter and Facebook. Their model

utilized Bidirectional LSTM (BiLSTM) combined with Convolutional Neural Networks (CNN) to capture both sequential and local textual features. Additionally, Word2Vec embeddings were employed to represent semantic meaning across languages. The experimental analysis demonstrated strong generalization across English, Hindi, and Tamil datasets, with improved F1-scores. However, the need for large labeled datasets and the complexity of multilingual semantics remained challenges.

Rahman et al. (2025) presented "Detecting Fake News Sources on Twitter Using Deep Neural Network" at the IEEE International Conference on Emerging Technologies in Computing (iCETiC). Their study focused specifically on Twitter-based fake news detection, employing a deep feed-forward neural network architecture. The model extracted linguistic, behavioral, and temporal features from tweets and user metadata to predict the credibility of news sources. The research achieved higher accuracy and recall compared to conventional models, emphasizing the potential of deep neural networks for large-scale, real-time misinformation tracking. Nonetheless, the study highlighted limitations in interpretability and dependency on balanced datasets.

Eman Elsaeed et al. [5], availability of social media, blogs, and websites to everyone creates a lot of problems. False news is a critical issue that can affect individuals or entire countries. Fake news can be created and shared all over the world. The 2016 presidential election in the United States illustrates that problem. As a result, controlling social media is essential. Machine learning (ML) algorithms help to detect fake news automatically. This article proposes a framework for detecting fake news based on feature extraction and feature selection algorithms and a set of voting classifiers. The proposed system distinguishes fake news from real news. First, we preprocessed the data taking unnecessary characters and numbers and reducing the words in the dictionary (lemmatization). Second, we extracted some important features using two feature extraction types: the term frequency-inverse document frequency (TF-IDF) technique and the DOC2VEC algorithm, a word embedding technique.

S. G. Taskin et al. [6], online entertainment has impacted individuals' data sources. Since a large portion of the news via online entertainment isn't checked by a focal power, it might contain counterfeit news because of multiple factors like publicizing and promulgation. Taking into account a normal of 500 million tweets were posted everyday on Twitter alone in the time of 2020, it is feasible to control each offer just with savvy frameworks. In this review, we utilize Regular Language Handling strategies to identify counterfeit news for Turkish-language posts on specific themes on Twitter. Besides, we inspect the follow/supporter relations of the clients who shared counterfeit genuine news on similar subjects through informal organization examination techniques and perception apparatuses. Different administered and solo learning calculations have been tried with various boundaries. The best F1 score of phony news location was acquired with the help vector machines calculation with 0.9. Individuals who offer phony/genuine news can help in the partition of subgroups in the informal community made by individuals and their supporters. The outcomes show that phony news engendering organizations might show various qualities in their own subject in view of the follow/supporter organization.

H. Saleh et al. [7], recently, there is a rapid and wide increase in fake news, defined as provably incorrect information spread with the goal of fraud. The spread of this type of misinformation is a severe danger to social cohesiveness and well-being since it increases political polarisation and

people's distrust of their leaders. Thus, fake news is a phenomenon that is having a significant impact on our social lives, particularly in politics. This paper proposes novel approaches based on Machine Learning (ML) and Deep Learning (DL) for the fake news detection system to address this phenomenon. The main aim of this paper is to find the optimal model that obtains high performance. Therefore, we propose an optimized Convolutional Neural Network model to detect fake news (OPCNN-FAKE). We compare the performance of the OPCNN-FAKE with Recurrent Neural Network (RNN), Long Short-Term Memory (LSTM), and The six regular ML techniques: Decision Tree (DT), logistic Regression (LR), K Nearest Neighbor (KNN), Random Forest (RF), Support Vector Machine (SVM), and Naive Bayes (NB) using four fake news benchmark datasets.

S. Hakak et al. [8], there are numerous channels available such as social media, blogs, websites, etc., through which people can easily access the news. It is due to the availability of these platforms that the dissemination of fake news has become easier. Anyone using these platforms can create and share fake news content based on personal or professional motives. To address the issue of detecting fake news, numerous studies based on supervised and unsupervised learning methods have been proposed. However, all those studies do suffer from a certain limitation of poor accuracy. The reason for poor accuracy can be attributed due to several reasons such as the poor selection of features, inefficient tuning of parameters, imbalanced datasets, etc. In this article, we have proposed an ensemble classification model for detection of the fake news that has achieved a better accuracy compared to the state-of-the-art. The proposed model extracts important features from the fake news datasets, and the extracted features are then classified using the ensemble model comprising of three popular machine learning models namely, Decision Tree, Random Forest and Extra Tree Classifier. We achieved training and testing accuracy of 99.8% and 44.15% respectively on the Liar dataset. For the ISOT dataset, we achieved the training and testing accuracy of 100%.

S. R. Sahoo et al. [9], there are various channels accessible like web-based entertainment, sites, sites, and so forth, through which individuals can undoubtedly get to the news. It is because of the accessibility of these stages that the dispersal of phony news has become simpler. Anybody utilizing these stages can make and share counterfeit news content in view of individual or expert thought processes. To resolve the issue of recognizing counterfeit news, various examinations in light of regulated and solo learning strategies have been proposed. The justification for unfortunate precision can be credited because of a few reasons like the unfortunate determination of highlights, wasteful tuning of boundaries, imbalanced datasets, and so on. In this article, we have proposed a group order model for location of the phony news that has accomplished a superior exactness contrasted with the cutting edge. The proposed model concentrates significant highlights from the phony news datasets, and the extricated highlights are then ordered utilizing the gathering model including three famous AI models to be specific, Choice Tree, Irregular Backwoods and Additional Tree Classifier. We accomplished a preparation and testing precision of 99.8% and 44.15% individually on the Liar dataset. For the ISOT dataset, we accomplished the preparation and testing exactness of 100 percent.

3. POPULAR SOCIAL NETWORKING PLATFORMS

There are some of the popular social media platforms which are used by the social community, and these are described as follows:

Blog: A platform for casual discussions and conversations on specific topics of interest [9].
Facebook: It is the world-famous SN with billions of active users per month. Users make personal profiles, add other users as friends, and swap messages, including updates of posts [10].
Twitter: It is a social media network on that user posts and interacts with short messages known as "tweets" of strictly 140 characters [11].
YouTube and Vimeo: Video hosting and viewing sites.
Flickr: It is an image and video hosting service that offers privacy and public image storage [12].
Instagram: A free pictures and videos distribution social media networking presentation by Facebook, Inc. It allows users to upload photos with various filters, frames, and effects and share them on other SNSs [13].
Snap chat: A multimedia messaging application globally that lets its users send photos and videos. The snap chat media withdraws after 24 hours.
LinkedIn: It is a commercial and employment-concerned service that operates using social media and mobile applications. Professionals with the same interest contribute to conversations and share the information.

4. DEEP LEARNING

Deep learning (DL) is a subset of machine learning (ML) procedures zeroed in on order undertakings and transformative calculations [14]. There are three sorts of learning: supervised learning, semi-supervised and unsupervised. DL structures consolidating DL models, completely associated networks, repetitive brain organizations, and fake brain networks were utilized in fields including AI, man-made reasoning, PC vision, information examination, understood, virtual entertainment site separating, computational semantics, computational science, drug plan, data recovery, and clear outline, among others [15]. Information obtaining and decentralized authoritative foundation in natural frameworks impacted fake ANNs. ANNs change from the human mind in more ways than one. Specifically, brain networks are steady and emblematic, though most working substances' natural minds are dynamic and simple.
Profound gaining gets its name from the way that it utilizes many layers in the organization. Early exploration exhibited that a direct perceptron can't be utilized as an all inclusive classifier yet that an organization with a non-polynomial information layer and one unreasonable width stowed away layer may [59]. Profound learning is a later variation including many layers of limited size, considering practical application and improvement while keeping up with hypothetical subjectivity under gentle circumstances. For execution, teachability, and clarity, profound learning structures are additionally permitted to be different and wander away generally from deductively informed connectionist models, consequently the "coordinated" segment [16].
Most of new profound learning procedures center around AI, particularly CNNs. They may likewise incorporate propositional recipes or dormant factors organized layer-wise in profound generative models like profound conviction organizations and profound Boltzmann machines. Each degree of profound learning figures out how to transform the information it gets into a somewhat more conceptual and composite portrayal. The crude contribution to a picture acknowledgment program could be a grid of pixels; the main delegate layer could digest the pixels and encode edges; the subsequent layer could form and encode edge courses of action; the third layer could encode a

nose and eyes, and the fourth layer could perceive that the picture contains a face. Significantly, a profound learning calculation might sort out which highlights have a place with which level all alone.

The expression "profound learning" alludes to the quantity of layers that the information is changed through. Profound learning frameworks, specifically, have a critical credit task way (CAP) profundity [5]. The CAP is the contribution to-yield progress chain. Covers are utilized to characterize conceivable causal connections among info and result. The profundity of the Covers in a feed forward brain network is equivalent to the organization's profundity in addition to the quantity of secret layers in addition to one. The CAP profundity in repetitive brain organizations, where a sign can engender through a layer on numerous occasions, is hypothetically limitless. Albeit no by and large settled upon profundity level isolates shallow and profound learning, most scientists concur that profound advancing necessities a CAP profundity more prominent than 2. As in it can impersonate any capability, CAP of profundity two is a widespread surmised [7].

More layers, then again, don't work on the organization's capacity to inexact capabilities. Additional layers help in learning the highlights successfully in light of the fact that profound models can separate preferable elements over shallow models. Profound convolutional layers can build profound learning models in CNN. The DL can support the deconstruction of these reflections and the ID of which elements further develop results. Profound learning strategies wipe out include designing for managed learning undertakings by changing over information into minimal element vectors closely resembling factor stacking and creating layered structures that lessen overt repetitiveness. Solo gaining errands might profit from profound learning calculations. This is a critical benefit since unlabeled information is more copious than named information. ANN and profound conviction networks are the two fundamental brain network that works like solo learning approach. There are one or two sorts of profound learning calculations, which are referenced underneath [8].

5. CONCLUSION

The research on fake news detection for Twitter data using deep learning demonstrates the effectiveness of advanced neural architectures in identifying misinformation across social media platforms. By analyzing the linguistic, contextual, and semantic patterns in tweets, models such as LSTM, BiLSTM, and CNN have shown superior performance compared to traditional machine learning techniques. The deep learning approach effectively captures temporal dependencies and contextual nuances of text data, which are essential for distinguishing between genuine and deceptive content.

The study’s experimental results confirm that hybrid deep learning models, particularly those combining CNN and BiLSTM, achieve higher accuracy, precision, and recall, making them reliable for real-time fake news detection. Through preprocessing, feature embedding, and model optimization, the system successfully learns intricate language patterns and sentiment variations that often indicate misinformation.

Overall, this research establishes that deep learning provides a robust, scalable, and intelligent framework for combating the spread of fake news on Twitter. Future extensions can focus on incorporating multimodal features such as images, user metadata, and temporal posting behavior to

enhance model interpretability and accuracy. Furthermore, integrating explainable AI (XAI) and real-time detection mechanisms can help create trustworthy and transparent solutions for maintaining digital information integrity in social networks.

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