Temporal Based Fake News Detection: A Review

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Abstract- Detection of Fake news and missing information is gaining popularity, especially after the advancement in social media and online news platforms. Social media platforms are the main and speediest source of fake news propagation, whereas online news websites contribute to fake news dissipation. In this study, we extract temporal features such as temporal specificity, temporal expressions, recurring events and other. In recent studies, the temporal features in text documents gain valuable consideration from Natural Language Processing. This research study overviews the machine learning and deep learning techniques to classify fake news based on temporal features. Also discussed the challenges in early detection of fake news and suggest some future direction based on our review.

Index Terms- Machine Learning, Deep Learning, Natural Language Processing

I. INTRODUCTION

News means the propagation of information from one part of the world to the other. In the last decade, people have been getting news from non-authentic sources such as social media instead of news channels, newspapers, or others [1]. These days, social media is one of the platforms where people normally prefer to share their information, videos, stories, etc. The speed of news propagation on social media is very high compared to traditional news propagation [2]. The factors of fake news are:

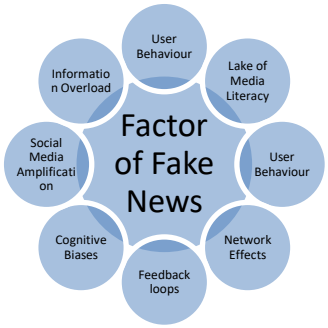

Figure 1: Factors of Fake News Propagation

All the information on social media is neither true nor false. It's getting more and harder to separate false information from true news with the rise of social media and internet news sources. Fake news has gained substantial attention due to its potentially devastating effects on people, communities, and society at large. Nowadays, most of us shares news without authentication, and sometimes social media posts can get slots on electronic media such as TV news channels. This fake news can change public sentiments, have a global impact or even go beyond [3]. Fake News means news that may mislead the end-user or consumer [4]. As, it's getting more and harder to separate false information from true news with the rise of social media and internet news sources. Because it can have serious repercussions for people, communities, and society at large, fake news has gained substantial attention. The dissemination of false information has the potential to sway public opinion, harm people's reputations, and even affect how elections turn out. In the US president election 2016, according to a study, one fake pro-Clinton and against-Trump post was shared 7.2 million times, and one fake pro-trump and against-Clinton post was shared 30.2 million times, which was one of the major causes to change the people's sentiments and result of the election [5]. Due to this, researchers have identified the need to detect fake news. In US presidential election in 2016, the propagation of the fake news was discussed on all most every forum of the discussion and researchers identified the need of that domain. Traditional fake news detection is based on the simple ML and data mining classification based on texts or creation data etc. The temporal features and the temporal information lie within the document considerably less explored by the researchers which is exactly the main motivation for me to work on it. The main motivation of study is focus on temporal Information within the text of the news.

Time is also one of the important factors in fake news detection. Time is a continuous entity normally measured as century, decade, year, month, days, hours, and so on, and its dimensions are future, present, and past [7]. Time and temporal features can be important for efficient results in fake news. Temporal features can also have a scientific impact on detecting fake news. Different research studies identify different temporal features such as when it propagates, the birthday of tweet [2], the time it propagates most, and others. In the other studies, it is noted that researchers only use classification techniques using machine learning and artificial intelligence algorithms for detecting and classifying fake news. Still, the researchers hardly touch on the impact of important temporal features such as temporal expression in the news, temporal specificity and others on fake news which is identified in this study.

To identify suspicious activities and detect false news, this research suggests a novel method for detecting fake news using temporal footprints, which takes advantage of the temporal patterns of news transmission. Our approach attempts to increase the detection accuracy of fake news and augment current fact-checking techniques by examining the temporal dynamics of news sharing.

The first part of the paper is about the introduction of fake news and importance of temporal expression in the fake news. The second is about the literature and different techniques are explored which worked well using temporal expressions. In third, current challenges are discussed, and in fourth section we discussed the future direction. In the last research is concluded.

II. Literature Review

An increasing body of studies asserts that individuals responded impulsively to information that ultimately proved to be false. The information we absorb significantly influences our perspective, whereas the experiences we undertake alter our ability to create judgments. As evidence has accumulated, individuals have been reacting impulsively to material that was later proven to be false. This comprehensive research study focuses on utilizing machine learning techniques to identify both fraudulent and genuine news articles. By utilizing the learning module, a Python framework for machine learning, and the TF-IDF vectorizer (term frequency-inverse document frequency), we may extract precise information about a particular token in our dataset. After initializing the ML models, we successfully inserted the token. Several machines learning models, including the Naïve Bayes algorithm, Logistic Regression, Decision Tree, LSTM, BERT, and Passive Aggressive Classifier, have been examined in this specific scenario [8],[9]. In the end, the effectiveness of our model is demonstrated by its confusion matrix and accuracy score. This provides us with an approximate number for our model and informs us whether it is functioning accurately or not. The user's input can then be identified, and its legitimacy confirmed [10]. The remaining portion of our study is organized based on the many algorithms that are discussed in the corresponding research section. The problem of spreading incorrect information is identified at an early stage. The evaluation section encompasses the solution to the problem and the algorithm that was utilized. The result and discussion section presents the conclusive outcomes. Ultimately, a result is given. The systematic review of the techniques used in temporal based fake news detection:

Sr.	Algorithm	Accuracy	Dataset	References
1	Passive Aggressive Classifier	99.5%	Textual	[11]
2	Naïve Bayes	98.5%	Textual	[18]
3	Logistic Regression	93.8%	Textual	[19]
4	Long Short-Term Memory	97.3%	Textual	[20]
5	Bi- LSTM	89.7%	Textual	[21]

Table 1: Comparison Between Techniques

Passive Aggressive Classifier:

Passive-aggressive algorithms are online learning algorithms that have resemblance to Perceptron algorithms. The user's text consists of the numbers [11] and [12] enclosed in square brackets. Once the classification process is over, the algorithm remains inactive to assure the intended outcome. However, it promptly and forcefully updates and modifies itself in the event of an error. The purpose is to offer updates that minimize the influence on the standard of the weight vector when handling losses. The user's text consists of two references, [13] and [14]. Online machine learning approaches In contrast to batch learning, which processes the entire training set simultaneously, sequential learning acknowledges the input information in a step-by-step manner and incrementally improves the machine learning model. Training the entire dataset might be challenging due to its vast size, making computation difficult [15],[16].

Naïve Bayes

A classification technique that utilizes the Bayes theorem to categorize things is referred to as a Naïve Bayes classifier. The fundamental principle of naïve Bayes classifiers is the assumption of substantial, independent determination of the attributes of the data objects. These classifiers are commonly utilized in machine learning due to their ease of construction [17],[18]. The process of constructing classifiers using this straightforward method is creating models that assign class labels to problem situations, which are represented as vectors of attribute values. The class labels are chosen from a starting set.

Logistic Regression:

To predict a dependent data variable, a logistic regression model analyzes the relationship between one or more independent variables that are currently present. Logistic regression may have been employed in this scenario to predict the election result for a parliamentary candidate or to determine if a high school applicant would be accepted or rejected by a specific college. Deciding between two options is straightforward due to the binary outcomes [19]. While binary attribute values are commonly used in logistic regression, it is important to note that logistic regression can also predict two other types of important variables.

Long Short-Term Memory (LSTM):

Long short-term memory networks, often known as LSTMs, have been utilized in the field of Deep Learning. The RNN algorithm is particularly adept at sequence prediction problems due to its ability to capture long-term dependencies. LSTM [20] has the ability to comprehend the entire sequence of data, unlike single input points such as photos, because to the presence of feedback linkages. LSTM-based classifiers tackle the issue of context management by dividing it into two sub-problems: filtering out unimportant information and integrating important information into the updated context for future decision-making. This network efficiently fulfills both objectives by utilizing gates that control the flow of data in and out of each unit at the layer level. These gates are implemented by utilizing additional weights that operate sequentially on the input, the prior hidden layer, and the preceding context layer.

Bi- LSTM:

Bi-LSTM is a categorization model that is used as an extension of LSTM. It stands for Bidirectional Long Short-Term Memory. Bidirectional LSTMs are an upgraded iteration of traditional LSTMs that can improve the efficacy of models in sequence classification tasks. This approach utilizes two LSTM models to process the input sequence, as opposed to using just one LSTM model. The initial LSTM is trained using the input sequence, whereas the second LSTM is learned using a reversed version of the input sequence. This method can improve the network's comprehension by offering additional information, leading to faster and more thorough learning. Our investigation into the latest advancements has uncovered that Bi-LSTMs are commonly used in combination with attention processes to improve results. Therefore, we will make a deliberate attempt to follow this line of action as well [20]. Attention is a vector of importance weights that represent the degree of correlation between words. In our specific situation, we shall carry out an experiment involving the addition of an additional multi-head self-attention layer. This procedure involves doing a comparison between each sequence in the sentence and all the others, while adjusting the embedding in order to take into account contextual significance. By doing this, we may determine the connection between a certain part of the sentence and everything that precedes or follows it. The multi-head mechanism performs many iterations through the attention mechanisms concurrently [21].

III. CHALLENGES:

The Dynamic Nature of Misinformation:

Detecting fake news is an ongoing and dynamic task because of the innovative approaches and advanced technology used by those who create false news [22] especially based on time. The dissemination of false information proliferates rapidly, and its manifestations and mediums are consistently evolving, rendering it arduous to stay abreast of the most recent techniques for identification [23].

Quality and Availability of Data:

A major obstacle in detecting fake news is the limited availability of temporal labeled data [24]. The effectiveness of fake news detection models is strongly influenced by the quality and accessibility of temporal data. The absence of such labeled data poses challenges in training and evaluating these models [25].

Issues Related to Ethics and Privacy:

Data privacy concerns about user information are a prominent issue in the detection of fake news [26]. The acquisition and examination of user data give rise to ethical considerations, and safeguarding the confidentiality and integrity of user data is imperative [27].

Limitations Imposed by Computational Resources:

The process of detecting fake news requires a great number of resources, and the limitations of processing massive volumes of data in real-time are substantial [28]. The detection procedure necessitates substantial computer resources, posing a problem, particularly for extensive datasets [29].

IV. POTENTIAL AVANUES:

The future research directions are as follow:

Dynamic Temporal Feature Extraction: Developing techniques for extracting temporal features that can adjust to the changing characteristics of fake news and its patterns of transmission.

Multimodal Fusion: Multimodal Fusion involves the integration of temporal information with other types of multimodal data, such as text, photos, and videos. This integration aims to enhance the resilience and applicability of fake news detection models.

Explainable AI: Explainable AI involves the development of AI models that can offer explanations about the specific temporal elements and patterns they employ to identify fake news. This enhances transparency and trust in the detection process.

Real-time Detection: The objective is to create advanced systems that can detect fake news in real-time by analyzing temporal aspects. This will allow for prompt action and reduction of the spread of fake news.

Ethical Considerations: This project aims to tackle ethical and privacy concerns by creating false news detection models that give priority to user privacy and data security, while also ensuring fair and unbiased detection.

Large-Scale Evaluation: Conducting extensive tests of false news detection models on varied and representative datasets to verify their generalizability and robustness.

Human-AI Collaboration: Creating collaborative systems that combine human expertise and AI skills to identify and counteract false information.

To enhance the effectiveness and efficiency of fake news detection systems, researchers and practitioners should focus on these future areas. This will enable them to keep up with the changing nature of fake news and its patterns of transmission.

CONCLUSION:

The task of identifying fake news is a multifaceted and constantly changing problem, and the inclusion of temporal information is essential for enhancing the precision of detection algorithms. This review has provided an overview of the present level of research in the detection of false news and the consideration of temporal aspects. It has also discussed the difficulties and restrictions associated with current methods. Although some progress has been made, there is a significant amount of work required to tackle the challenges associated with detecting fake news. These challenges include the constantly changing nature of false news, ensuring high-quality and accessible data, addressing ethical and privacy concerns, and overcoming computational limitations.

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