International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 9
Article Received: *25 July 2023* ***Revised:*** *12 September 2023* ***Accepted:*** *30 September 2023*

Review Paper on Enhancing COVID-19 Fake News Detection With Transformer Model

Shivani P. Pippal[1], Dr. Kamal Sutaria[2], Dr. Rachit Adhvaryu[3]
[1]Department of Computer Engineering
Parul University
Vadodara, Gujarat
vik439@gmail.com
[2]Department of Computer Engineering
Parul University
Vadodara, Gujarat
kamal.sutaria24554@paruluniversity.ac.in
[3]Department of Computer Engineering
Parul University
Vadodara, Gujarat
Rachit.adhvaryu24310@paruluniversity.ac.in

Abstract—The growing propagation of disinformation about the COVID-19 epidemic needs powerful fake news detection technologies. This review provides an in-depth examination of existing techniques, including traditional machine learning methods such as Random Forest and Naive Bayes, as well as sophisticated models for deep learning such as Bi- GRU, CNN, and LSTM, RNN, & transformer-based architecture such as BERT and XLM- Roberta, are also available. One noticeable development is the merging of traditional algorithmswith sophisticated transformers, which emphasize the quest of improved accuracy and flexibility.However, important research gaps have been identified. There has been little research on cross- lingual detection algorithms, revealing a substantial gap in multilingual false news detection, which is critical in the global context of COVID-19 information spread. Furthermore, the researchemphasizes the need of flexible methodologies by emphasizing the need for appropriate preprocessing strategies for various content types. Furthermore, the lack of common assessment measures is a barrier, underlining the need of unified frameworks for successfully benchmarking and comparing models. This analysis provides light on the changing COVID-19 false news detection environment, emphasizing the need for novel, adaptive, and internationally relevant approaches to successfully address the ubiquitous dissemination of disinformation during the current pandemic.

Keywords- COVID-19, fake news detection, transformer models, BERT, XLM-RoBERTa

I. INTRODUCTION

The fast proliferation of electronic communication has dissolved geographical borders in light of the COVID-19 outbreak. This has enabled the speedy broadcast of knowledge, but it has also encouraged the worrisome spread of disinformation. Various platforms have been swamped with false information on the disease, its treatments, preventative techniques, and causes, which has had a significant influence on the public view. This rush of false information has resulted in wide spread anxiety, uncertainty, and elevated perceptions of risk, which has contributed to an escalation of the difficulties faced by the epidemic. In addition, current research provides information on the growth in psychological discomfort, such as anxiety and depression that may be ascribed.

This psychological effect is inextricably linked to the stressful conditions that are preceding the epidemic. In these circumstances, fake news may flourish because it is fed by heightened emotions and uncertainties. Rarely are timely rebuttals successful, which enables the fast growth of misleading narratives, especially on platforms used by social media [1]. Because of this, the research and development of automatic detection systems for COVID-19 fake news has become an issue of critical importance, as was covered in. These tools enable preventative interventions in light of the pandemic conversations that are now dominating social media. Automated systems can quickly recognize erroneous information because they make use of sophisticated algorithms and machine learning methods. This paves the way for fast corrections and helps to prevent the spread of disinformation. This not only helps in managing the flow of information, but it also makes a substantial contribution to the efforts being made to improve public health by ensuring that factual information prevails and, as a result, reduces the psychological anguish that may be created by false news during critical times such as the current epidemic.

The COVID-19 epidemic has produced not only a global health disaster, but also an economic disaster, defined by a flood of information, including disinformation and false news [2]. This information crisis has had far-reaching consequences for public health, decision-making processes and societal stability. It is critical to solve this problem by improving COVID-19 false

news identification and increasing the distribution of factual information. According to studies, inaccurate and misleading information about COVID-19 has been extensively circulated, resulting to public uncertainty, anxiety, and possibly dangerous actions [3]. Misinformation about miraculous cures, conspiracy theories, and incorrect information about preventative measures, for example, has the potential to harm public health initiatives and endanger people's lives. Various measures, including manual fact-checking and verification, have been used to counteract the spread of false news. However, these old systems have scalability and efficiency constraints, particularly in light of the large volumes of information published on social media sites. Approaches based on machine learning emerged as a potential tool for automating false news identification

The goal of this study is to look at the usage of transformer models, a kind of neural network architecture noted for its capacity to capture complicated language patterns, in improving the Identification of COVID-19 false news. The BERT (Bidirectional Encoding Representation from Transformer) as well as GPT (Generative Pre-trained Transformers) model have excelled in a wide range of tasks related to natural language processing, include translating languages, sentiment analysis, and text categorization. This paper intends to give insights into the potential of transformer models in identifying and controlling the propagation of COVID-19 false news by evaluating current literature and research data.

A. Factors contributing to Rise of Fake News throughout the COVID-19 Pandemic

The COVID-19 epidemic has resulted in an unprecedented increase in the spread of fake news, adding to an infodemic that has exacerbated the public health crisis's issues. Misinformation about the virus has spread quickly via many communication channels, including social media platforms having a negative impact on public health and societal stability. False claims about the virus's origin, weak preventative efforts, and unproven therapies have contributed to widespread confusion, fear, and poor decision-making. Several researches have been conducted to give information on the incidence and effect of false news during the epidemic. According to [4], the incidence of COVID-19 disinformation on social media platforms was found to be frighteningly high, with a significant part of the public exposed to erroneous information. Similarly, [5] found that exposure to viral disinformation was related with worse compliance with recommended public health interventions. During the epidemic, the widespread circulation of false news has spurred urgent requests for the development of reliable detection systems. Researchers have investigated a number of different strategies to recognize and counteract COVID-19 false news. For instance, [6] studied the application of machine learning methods, such as models based on deep learning, to automatically identify and categorize disinformation associated with COVID-19.

B. Transformer Models' Role in Natural Language Processing (NLP)

Transformer models have substantially advanced the capabilities of language interpretation and generating jobs, revolutionizing the area of Natural Language Processing (NLP). These models, like BERT as well as GPT-3, have shown outstanding performance in a variety of NLP applications, which include as translators of languages, sentiment analysis, along with text classification. The use of transformer models has resulted in considerable gains in NLP activities, notably machine translation and text production. BERT, for example, has shown cutting-edge performance in tasks such as named entity identification and text categorization. GPT-3 has exhibited the ability to generate human- like text in a variety of scenarios because to its huge size and outstanding language synthesis skills [9].

Furthermore, transformer models have been effective in Transfer learning entails fine-tuning models that have been trained on new data particular downstream tasks. This method makes use of huge pre-training datasets, allowing models to capture broad language knowledge before adapting to particular tasks using smaller task-specific datasets. Transformer models have had a significant influence on NLP research and applications.[10] Their capacity to grasp semantic linkages, manage long-term dependencies, and create coherent text has advanced the area. However, issues remain, such as the need for more efficient training techniques, resolving biases in pre-training data, and enhancing model decision interpretability.

C. The Difficulties of Using Transformer Models for COVID-19 Fake Information Detection

For effective and accurate results, the application of transformer models to COVID-19 false news detection presents a lot of difficulties that must be overcome. One of the most significant challenges is the restricted supply of labeled data particularly related to COVID-19 false news. The lack of annotated datasets hinders the development and assessment of transformer models, making optimal performance difficult to achieve [11]. Another difficulty involves the contextual comprehension of COVID-19 misinformation. Transformer models are necessary to comprehend the context and nuances of the shared information owing to the pandemic's ongoing dynamics and deceptive news reports. To ensure accurate detection, this necessitates robust training techniques and fine-tuning strategies [12]. Using transformer models for COVID-19 false news detection is also hindered by the need to manage multilingual and multimodal content. The dissemination of misinformation is not restricted by language, and the use of images, videos, as well as textual content in multiple languages makes it difficult to develop transformer models that can successfully process and evaluate such diverse sources of information. In addition, overcoming biases and taking ethical

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 9
Article Received: *25 July 2023* ***Revised:*** *12 September 2023* ***Accepted:*** *30 September 2023*

concerns into account is an essential part of the process of using transformer models to the identification of false news. Transformer models are trained on large- scale datasets, and if the datasets have biases, the models may inadvertently perpetuate such biases throughout the detection phase. If the datasets do not contain biases, the models should be OK. During the training and deployment of these models, ethical issues, such as guaranteeing justice and preventing discrimination, need to be carefully examined. In addition, the development

frameworks that promote openness, interpretability, and fairness in the use of transformer models may help to address the ethical problems that are connected with their usage [13].

D. Future Prospects: COVID-19 Fake News Detection Advancements and Innovations

Fake news identification is an ongoing task that requires continual developments and ideas in order to successfully counteract the spread of disinformation. Several future possibilities may contribute to the development of more robust and accurate detection technologies by building on previous research and resolving constraints [14]. The investigation of more complex forms of deep learning that go beyond transformer models is one possible path that might be taken in the future. Although transformer models have shown impressive success in natural language processing applications, such as the identification of false news, alternative architectural methods, such as graph neural networks and techniques based on reinforcement learning, might also be examined. These models shave the ability to capture more complex linkages and dependencies within the COVID-19 fake news data, which might contribute to an improvement in the accuracy of detection [15]. Integration of different types of information is yet another interesting and fruitful option for future study. The transmission of COVID-19 misinformation commonly uses textual, visual, and aural components. Increasing the detection accuracy and providing a more thorough comprehension of the false.

E. Problem Statement

Transformer models have made major contributions to natural language processing (NLP), but they are not without limitations. One important difficulty is that these models are difficult to interpret, making their decision-making process tough to understand and discover biases or inaccuracies. Furthermore, transformer models need significant computing resources, limiting their use in resource-constrained situations. Large pre-training datasets may create biases and disparities, demanding measures to address fairness and inclusion. Furthermore, these models continue to struggle with context comprehension and commonsense reasoning, limiting complex language processing. Resolving these issues is critical for the appropriate and successful use of transformer models in NLP, and it will need breakthroughs in interpretability, computational efficiency, bias reduction, and contextual awareness.

II. LITERATURE REVIEW

(Das et al., 2022) In this article, we expand upon our efforts English Fake News Detection within CONSTRAINT COVID-19 competition by describing a revolutionary A method for detecting false news that can automatically Identify "real" from "fake" news reports. Using a variety of characteristics that are visible intweets or news items as statistical features, including authors, URL domains, source, passwords and usernames, handles, and we have developed a team model consisting of models that have been trained a unique heuristic method and a mathematical feature combination network came next. Our suggested methodology additionally includes an accurate classes output confidence level and quantified trustworthy predicting uncertainty. We haver the suggested algorithm to show its effectiveness drawing from the COVID-19 fake news information and the FakeNewsNet dataset, which include examples of false news in both short news items and full pieces. Our F1-score on the COVID-19 dataset was 0.9892, while our F1-score for the FakeNewsNet dataset was 0.9156.

(Nakov et al., 2022)The lab assesses Arabic, Bulgarian, Dutch, English, German, Spanish, & Turkish are the seven languages in which the technology that supports different factuality activities. First, task 1 asks to forecast if a tweet merits fact-checking, contains a claim that can be Independently verified, harms society, or matters to decision-makers. It also asks to anticipate whether a tweet is linked to politics and propaganda surrounding the current COVID-19 infodemic. Retrieving statements that have already undergone fact-checking and that can be helpful in confirming a claim in a tweet is the ask of Task 2. Asserting a news article's credibility is task three. While Task 2 is a rating task, Tasks 1 and 3 are categorization tasks.

(Nakov et al., 2021) The lab covers the Arabic language, Bulgarian, English, Spanish, & Turkish while evaluating technology to assist factual work. In Task 1, candidates must identify which tweets (in each of the five languages) on politics and COVID-19 are worth fact-checking. Employing Using a list of previously verified claims (in Arabic & English), Task 2 asks you to decide if a claim in the tweet can be confirmed. Task 3 requires you to assess a news article's credibility and relevant area (in English). For ranking tasks, the assessment depends on average mean precision or accuracy at rank k; for classification tasks, it is based on macro-F 1. With 132 teams registered, this CLEF-2021 lab was the most well-liked one. Approximately one-third of them took part: For challenges 1, 2, and 3, teams submitted official runs in the amounts of 15, 5, and 25.

(Alouffi et al., 2021) Because false information from reputable and illegitimate sources is mixed together, it might be difficult to spot fake news. Social networks is especially important in light of the COVID-19 epidemic an unreliable source of information. A lot of During COVID-19, misleading information has been disseminated outbreak. Early detection is

the greatest strategy for handling this. In light of this, We have developed a deep learning framework in our study that has a hybrid approach that combines Learning using convolutional neural networks, or CNNs, as well as extended short-term memory to detect false COVID-19 information. The proposed model has the following layers: a layer for output, a layer based on LSTM, an embedded layer, a layer which pools data, a layer that uses convolution, a thick layer, plus a layer that flattens. Our proposed model, two deeper neural network models, & six ML theories are tested for experimental results using three datasets of false information from COVID-19. CNN and LSTM are examples of deep learning models; machine models for learning are LR, RF, SVM, DT, KNN, and NB. Furthermore, the degree of certainty, accuracy, recollection, and F1-measure matrix are used to verify the outcomes. The suggested model performs better than the two deeper learning methods and the six machine learning models, according to the performed trials. As a result, the suggested method can recognize COVID-19 fake news with a high degree of precision.

(Y. Li et al., 2020) The COVID-19 pandemic is regarded as the worst threat to humankind since World War II and the worldwide health emergency affecting the whole population. Unfortunately, the COVID-19 bogus news is spreading almost as quickly as the disease itself. Both the physical and emotional health of individuals worldwide will suffer as a result of inaccurate health assessments, worry, and hate speech. We suggest MM-COVID1, or the Multilingual & Multidimensional COVID-19 false News Data Repository, is a brand-new dataset for measuring false news in order to more effectively battle the COVID-19 false news. The relevant social context and multilingual fake news are offered by this dataset. We gather 7192 reliable pieces of information from six languages: Hindi, English, Spanish, Portuguese, French, and Italian; also, 3981 fake news items. We provide a thorough and preliminary examination of MM-COVID from several angles, and we show how useful MM-COVID is in a number of possible bogus news apps on social networking, such as COVID-19, and multilingual platforms.

(A. Wani et al., 2021) It has expanded the reach of knowledge and completely changed how quickly it is transmitted. But there's more to the tale than meets the eye. The production and because of these platforms, false information has been disseminated has proliferated. False information has not only led people astray, but it has also claimed lives. In these crucial In the COVID-19 epidemic, Giving false information to people is a simple way to deceive them. For this reason, it's critical to stop false news at its source and stop it from spreading distribution. We examine automated methods for identifying false news from an information mining standpoint. Using the Contraint@AAAI 2021 We examine many supervised techniques for classifying texts utilising the Covid-19 false information Detection dataset. Long short-term memories (LSTM), unidirectional encoder reconstructions from transducers (BERT), and convolutional neural network models (CNN), which are the foundation for the classification methods. Additionally, we Utilising an unlabeled COVID twitter dataset and distributed word representations from language model pre-training, assess the significance of unsupervised learning. Regarding Our highest accuracy of 98.41%, the Covid-19 fake news detection dataset makes this claim.

(Almatarneh et al., 2021) The primary purpose of this study is to investigate how well conventional Machine learning techniques are able to identify COVID-19 fake news. As things stand now, the models that were trained Using Naive Bayes and a Support Vector Machine methods fared much better than any of the other options.

(Vijjali et al., 2020) Particularly during the current COVID-19 pandemic, false information is rife, misleading people into believing tales and claims that might be hazardous. Quickly identifying bogus news helps stop fear, mayhem, and even health risks from spreading. We used cutting edge algorithms based on machine learning for the processing of natural language to create an automated two-stage process for identifying fake news related to COVID-19.The first model makes use of a cutting-edge fact-checking algorithm to extract the most relevant information on user assertions for specific COVID-19 claims. By calculating the relationship in text between the assertion and the actual facts that were obtained from a manually selected COVID-19 dataset, the The second model verifies the extent of "truth" within the assertion. A portion of the greater than about 5000 fraudulent COVID-19 assertions and objectively substantiated justifications that comprise the dataset were internally documented We used cross-validation to evaluate and train our models. The information is based on a publicly accessible knowledge source. We assess a number of methods that use transformer-based models with more contextual features than typical text-based ones, and discover that the best results are obtained from a model pipeline with two phases based on the ALBERT and BERT algorithms, respectively.

(Koloski et al., 2021) We provide our approach to solving the common COVID19 detection of fake news in English challenge in this study, which placed 50th out of 168 submissions. The solution performed within 1.5% of the highest-scoring answer. The suggested approach makes use of a heterogeneous representation ensemble that is modified for the classification challenge by adding a neural classification head with many hidden layers. The work includes thorough ablation experiments that illustrate the behaviour and potential consequences of the suggested approach. The answer is provided without charge.

(Patwa et al., 2021) This situation becomes much more precarious if there is a pandemic. In order to address this issue, we have curated and made publicly available on COVID-19 a collection of 10,700 articles and posts from social media that

includes either authentic or false news. We execute a binary classification job, identifying items as either genuine or false, and then Four distinct machine learning baselines—decision tree, logistic regression, a gradient boost, as well as support vector machine (SVM)—are used to benchmark the resultant dataset. In the test set, the SVM algorithm yields the best result we could get, achieving a F1-score of 93.32%.

(Qdroo & Baykara, 2022) The aim of this study is to develop a model that is capable of accurately categorising textual news articles into one of two categories—fake or real—using four datasets that are relevant to COVID-19. Two different kinds of hybrid deep neural network There were models created. The first model consists of two layers of the long-short term memory neural system (LSTM) and three layers on one-dimensional convolutional neural network (1D- CNN). The second variant consists of a two-layer bidirectional neural network based on LSTM (BiLSTM) and the one- dimensional convolutional neural network's three layers (1D-CNN). In the end, the outcomes of the hybrid models were compared to those of all three artificial intelligence classifiers that were applied to the same sets of data: Bayes naive, logistic reconstruction, & k-nearest neighbour. The results obtained using composite models were shown to be more accurate than the results obtained using the machine learning classifiers. This research produced encouraging findings, with 97.15%, 95.32%, 99.40%, & 99.82%) with the second model using the same four data sets, and (96.98%, 94.52%, 99.60%, & 99.90%) for the initial model using all of the data sets. Both models used the same data.

(Y. Li et al., 2020) Unfortunately, the false information regarding COVID-19 is spreading at the same alarming rate as the virus itself. People all around the globe will suffer adverse effects, not only to their mental but also to their physical health, as a direct result of inaccurate health measurements, worry, and hateful speech. The Multilingual & Multidimensional COVID-19 false News Data Repository, or MM-COVID1, is a novel dataset that the authors propose for the identification of false news in order to assist in the fight against the COVID-19 false news in a more effective manner. This dataset contains bogus news in many languages together with the applicable social context. We have collected a total of 3981 items of fake news and 7192 reliable items of information in the following languages: Hindi, French, Italian, Spanish, Portuguese, and English. An exhaustive and exploratory analysis of MM-COVID from a variety of angles is presented here.

(Whitehouse et al., 2022) In this work, we explore the influence that the integration of information into PLMs may have on the identifying fake news. We examine several cutting-edge ways for knowledge integration on two well-known fake news datasets: COVID-19, a collection of social media messages connected to the COVID-19 epidemic, and LIAR, a politics-based dataset. The majority of these studies make use of Wiki-data as the knowledge base. The results of our studies indicate that knowledge-enhanced models may greatly improve the accuracy of false news identification on LIAR as long as the knowledge base is up to date and relevant. The contradictory results from COVID-19 highlight the necessity of domain-specific and up-to-date knowledge bases, as well as the dependence on stylistic traits. The source code may be accessed at this location.

(Cui & Lee, 2020) In the midst of the With the COVID-19 pandemic, misleading information is spreading on social media platforms like wildfire. People have been thrown into a state of bewilderment as a result of these bogus news pieces, which has also caused major social disruptions. We propose a generalized classification model known as MCNNet, which has the capability of learning across multiple kernel-sized convolutional layers in different parallel channel networks. This will allow us to efficiently identify these types of news items. Any real-world dataset that contains bogus news may benefit immensely from MCNNet's capabilities. The performance of our Several real-world false news datasets was used to assess the model, including the results of the experiments have been displayed.

(Gundapu & Mamidi, 2021) Recent fast as a consequence, the dissemination of erroneous data and disinformation has dramatically grown. of technological advancements in social media platforms like Twitter. It is anticipated that this tendency will continue for some time to come. People are more likely to believe false claims and publications in the midst of the current COVID-19 epidemic due to the extensive distribution of incorrect information, which may potentially be harmful. It is possible that faster detection of false news might lead to less widespread fear and bewilderment among members of the public. We describe a technique to analyse the veracity of data on the COVID-19 epidemic shared on social media, and our findings can be seen in this publication. The most effective method that we have developed for detecting The ensemble consisting of the transformer models known as BERT, ALBERT, & XLNET serves as the foundation for misleading news. This type had knowledge and assessed within the shared task's structure English COVID19 fake news Identification that was part of the ConstraintAI 2021 competition [1]. On the testset, our system received a score of 0.9855, which placed it in fifth place out of 160 total teams.

(Koirala, 2020) The concept of "fake news" has lately piqued the attention of a significant number of individuals due to the expanding accessibility of technical media sources (such as the internet, television, blogs, and social media) among consumers and the significant influence that false tales like these have. It is a challenging undertaking to use human monitoring and identification of each fake news that is spread. As processing technology, As deep learning techniques and machine learning models advance, the need for human intervention in pattern detection tasks may be rendered obsolete and replaced with the ability to delegate such responsibilities to computers. However,

this needs a huge dataset consisting of both genuine and fabricated news stories. Some datasets pertaining to false news have been developed, but the amount and properties of the data they possess are insufficient for the construction of models that provide appropriate categorization. The third issue is that There has been relatively little study about the use of deep learning methods and language reliable categorization of false news. The study that has been carried out has yielded results with a degree of precision that is not very high. Deep learning is discussed as a method for classifying false news items in this research that are connected to COVID-19.

(Narra et al., 2022) To accomplish this goal, the study's objective is to look at the effects that how various subset feature selection methods affect the effectiveness of models for the identification of fraudulent news. In relation to Artificial intelligence, machine learning, & feature selection that have been educated beforehand are being examined for their use with Chi-square and principal component analysis. In addition, an investigation into the influence of various preprocessing procedures is carried out with relation to the identification of bogus news. After being trained using the combination of properties of the bag of terms and term rate-inverse frequency of documents was, the additional tree classifier performs better with 0.9474 accuracy, as shown by the results acquired from extensive tests. If there is no pretreatment or partial processing done, the results that models provide are often not very good. The neural networks' performance: InceptionV3, ResNet, Long-short-term memory, convolutional memory, and long-short-term memory are only a little bit lower than that of the additional tree classifier. According to the findings, adopting a subset of features is another factor that contributes to achieving resilience for machine learning models.

(Du et al., 2021) This project aims to be the first attempt at identifying deception about COVID-19 in a language with limited resources (Chinese) by relying only on verified news in a language with abundant resources (English). Initially, we assemble a collection of actual and false news from China based on the fact-checking information that is already available. Then, we provide a deep learning architecture that we call CrossFake with the goal of jointly encoding the cross-lingual news body texts and accurately capturing as much of the news information as feasible. Empirical findings on our dataset reveal that CrossFake is successful in the cross-lingual situation, and it also beats numerous other false news detectors, both monolingual and cross-lingual.

(M. Chen et al., 2021) In this work, we provide a unique multimodal labelled dataset on the COVID-19 vaccination that includes news stories and tweets. This dataset is comprised of pictures, text, and information about the passage of time. We compiled a total of 2,593 news pieces from 80 different sources over the course of one year, beginning on February 16, 2020 and ending on May 8, 2021. Additionally, we gathered a total of 24184 tweets between April 17, 2021 and May 8, 2021. We divide the news collection into two trustworthiness categories: trustworthy and untrustworthy by combining evaluations via Medias Bias Charts & News Bias/Fact Check (MBFC), two websites that evaluate news media. Employing two filters together enables a greater degree of accuracy in the labelling process. In addition to this, we suggest a stance detection system that would tag tweets with one of three degrees of credibility: dependable, unreliable, or inconclusive. We provide a variety of statistics in addition to other types of analytics, such as the distribution of publishers, the distribution of publishing dates, subject analysis, and more. We also present a unique design that creates a baseline performance of this dataset by categorizing news data as either false or accurate. Specifically, our architecture focuses on the classification of the data. According to our findings, the suggested architecture's accuracy is 0882 and its F-score is 0919in terms of identifying false information. Additionally, we provide a benchmarking performance for the identification of disinformation based on a dataset of tweets. This new multimodal dataset is useful for research on the COVID-19 vaccine, including spotting false information and researching the effect of fraudulent COVID-19 vaccine information, among other things.

(BOZUYLA & ÖZÇİFT, 2022) The World Health Organization specifically refers to false information about COVID- 19 as "infodemic." An infodemic is a spread of false information that may be harmful to people's health by causing confusion. Numerous falsehoods about COVID-19 are widely disseminated, leading to anxiety and tension. As a result, it is evident how crucial it is to construct a model for detecting fake news connected to COVID-19, with an emphasis on the Turkish language in particular. In order to determine if Turkish CVID-1919 news reports on social media are true, and we provide a sophisticated deep language transformer model in this work. In order to do this, we first made a benchmark collection of Turkish COVID-19 news from many sources. After completing a number of language preparation tasks, we used five standard machine learning methods, including Naive Bayes, Random Forest, K-Nearest Neighbour, Support Vector Machine, and Logistic Regression. We then used cutting-edge deep learning methods, including Long-term, short-term, bilateral memory Convolutional neural networks, gated recurrent neural networks, and long-short-term memory units all function as memory units. To improve the efficacy of the suggested method, we used Language transformers using deep learning, such as the Bi-directional Encoder Representations of Transformers, variants, for further assessment. Based on the data, we found that neural transformers—specifically, the Turkish-made BerTURK transformer—have a 98.5% accuracy rate in identifying COVID-19 bogus news.

(Lahby & Yassine, 2022) The purpose of this chapter is to carry out a comprehensive map ping analysis in order to

investigate and summarize research about the use of machine learning to identify fake news techniques. While a result, 76 relevant articles in all that were released on this subject between the 1st of January 2010 and the 30th of June 2021 were chosen after thorough consideration. The chosen articles were arranged according to eight criteria, which were then used to classify and analyse them: the publishing channel and year, the research kind, the the research area, the research platform, the research context, the research category, and a feature, as well as the machine learning methods that were used to deal with classification information. The findings indicated that the majority of the chosen publications create their models for machine learning utilizing a combination of linguistic and textual (or content-based) variables. Additionally, the binary classification techniques were the Using a deep neural network (DNN) and the Supported Vector Machine (SVM) technique methodology that were used to fight against false news the most.

(Karnyoto et al., 2022) During the epidemic, there was a significant circulation of false information about Covid-19. Due to the fact that individuals have difficulties recognising false news, identifying disinformation that is spread through Utilising the web is a significant and challenging task. In order to solve the issue of spotting fake news under the constraints of AAAI2021 - COVID19 BERT and GPT2 were the pre-trained models we utilised to determine whether English dataset contains bogus news were trained with the help of the enhancement of the BiGRU-CRF features and the BiGRU-Att-CapsuleNet example. The results of this study demonstrated that our hybrid model that included augmentation achieved a higher level of accuracy when in contrast to our reference model. Additionally, it was shown that BERT outperformed GPT2 in every model; the highest accuracy level for BERT that we were able to achieve was 0.9196, whereas the best accuracy for GPT2 is 0.8986.

(B. Chen et al., 2021a) Here, we propose a novel transformer-based model of language fine-tuning approach for the purpose of identifying fake news. This approach is based on language transformation. First, each individual model's token vocabulary is enlarged so that it better matches the real meanings of common professional terms. To distinguish the hard- mining samples, we secondly alter the heated-up softmax loss, which are often seen in false news due to the disambiguation of brief text. These samples are distinguishable by using the heated-up softmax loss. After that, we use something called adversarial training in order to make the model more resilient. In the end, one multiple layer perception is used to combine the anticipated characteristics that were recovered by the universal model of language RoBERTa and the model relevant to a domain BERT-CT. This allows for the combination of high-level and fine-grained specific representations. When in contrast to the most advanced methods in terms of many assessment criteria, quantitative experimental findings assessed using an existing dataset of false news called COVID-19 reveal that the proposed method performs superiorly. In addition to this, the highest weighted average score possible on the F1 exam is 99.02%.

(Pranto et al., 2022) On the other side, misinformation spreading connected Facebook users are facing a lot of challenges due to COVID-19. We have no knowledge of any previous research that examined the frequency false information connected to COVID-19 in Bengali on Facebook, despite the fact that Bengali ranks as the seventh most commonly spoken tongue worldwide. As this is despite the fact that Bengali is the world's fifth most spoken language. This article aims to build machine learning algorithms that are capable to automatically identify bogus news in Bengali. The BERT model, which has a score of 0.97 for its F1, is the one that performs the best. All Bengali-language postings on Facebook that are relevant to COVID-19 are subjected to BERT.

We discover ten different subjects in the COVID-19 Bengali false news that can be categorized into the following three groups: system (such as the medical system), belief (such as religious rites), and societal (such as scientific awareness). (Felber, 2021) This system article details our engagement with the 2021 COVID-19 fake News Detection Collaborative Tasks, which addresses the problem of classifying social media posts connected to COVID-19 as true or false. Specifically, the task asks participants to identify postings as authentic or phoney. Using a combination of conventional machine learning methods and many linguistic variables, including n-grams, accessibility, emotional tone, as well as punctuation, we tackle this challenge in our method. Together, these linguistic and machine learning features allows us to provide more accurate results. When it comes to the pre-processing stage, we try out a variety of different methods, such as removing stop words, stemming and lemmatization, breaking links, and a host of other things. Our best system, we find, is built upon the linear support vector machines (SVM), which on test data yields an average weighted F1 score of 95.19%. This places it in the centre of the leaderboard (position 80 of 167), which indicates that it is among the top performing systems.

(Alhakami et al., 2022) Amidst the ongoing the COVID-19 epidemic and the dissemination of false information via social media have both caused a drop in individuals' mental and physical health. As a result, in order to halt the dissemination of false information surrounding the novel coronavirus, Numerous studies have been conducted to automatically identify false information regarding COVID-19 by making use of a variety of intelligent approaches. Nevertheless, many research have produced contrasting findings with regard to the accuracy among the prediction examples. In order to automatically identify false information on COVID-19, we assessed a number of machine learning and deep learning algorithms in this work. These examples were developed is an effort to stop false information from spreading. Experiments were run on two datasets that were

freely accessible to the public, and many different metrics were used to evaluate the outcomes of those experiments. When it came to forecasting false news, the results provided by the more conventional machine learning models were superior as opposed to those generated by the algorithms used for deep learning.

(A. Wani et al., 2021) Not only has false information misled people, yet it has also been directly responsible for the loss of human existence. In these pivotal moments Because of the Covid19 epidemic, it's simple to deceive and convince individuals of information that might be harmful. As a result, stopping fake news from spreading where it comes from and preventing it from accessing a larger audience are crucial. We examine several automated techniques for the detection of fake news from the perspective of data mining. On the Contraint@AAAI 2021 We examine several trained text classification methods using the Covid-19 False News Detection dataset. The three main components of the system are Long Short Term Memory (LSTM), bidirectional encoder representations using Transformers (BERT), and Convolutional Neural Networks (CNN) classification methods. We look at the importance of distributed word representations by the use of labelled COVID tweets as a corpus and language model preliminary training. We were able to recognize fake news on the Covid-19 dataset with a degree of accuracy that was the highest ever reported: 98.41%.

(Abdelminaam et al., 2021) The article suggests an upgraded deep neural network for the detection of false news. In- depth education approaches include Modi ed-LSTM (1-3 layers) and Modi ed GRU (1-3 layers). In specifically, we analyse a huge collection of tweets sharing COVID-19 data. In our research, we categorize problematic assertions as genuine or untrue. We evaluate the accuracy of prediction for different methods. There are Six learning techniques: support vector machines, random forests, logistic regression, logistic regression with k-nearest neighbors, decision trees, and naïve Bayes. Keras-tuner optimizes deep learning settings. Four benchmark datasets were applied. Key characteristics were extracted from four test datasets using TF-ID and N-gram with the baseline artificial intelligence model & embedding words for the suggested deep neural network techniques. Outcomes using the The suggested framework shows high accuracy in differentiating between real and false tweets, especially those including COVID-19 data. These results demonstrate a significant improvement over baseline machine learning models. Our method divides data into phoney and nonfake. We evaluate the suggested methods against six machine learning algorithms. There are Six methods of machine learning are available: supported vector machine (SVM), Random Forest (RF), K-nearest-neighbor (KNN), Decision Tree (DT), Logical Regression (LR), and Naive Bayes (NB). Keras-tuner is used for deep learning parameter optimization. There were four reference datasets utilized. TF-ID with N-gram and word embedding feature extraction techniques were utilized to extract critical characteristics from four reference datasets for the machine learning model at baseline and suggested deep neural network approaches. Results show the proposed framework accurately identifies Twitter messages using COVID-19 information, both bogus and real. These results demonstrate a significant improvement over baseline machine learning models.

(Girgis et al., 2019) Although there are many other types of deceit on social media, fake news is particularly significant since it is produced with the malicious aim to trick others. Because of what we have seen to indicate that this event has lately produced people's opinions and society to change. For instance, during revolutions in some Arab countries, false information emerged and swayed public opinion, leading to the absence of the truth. Fake news has also been identified as a contributing factor to Trump's victory in the presidential election. As a result, we made the choice to acknowledge and lessen this phenomenon, which continues to influence the majority of our decisions. Methods for identifying bogus news are many, creative, and often fascinating. The goal the goal of this research is to develop a classifier that can ascertain the legitimacy of news articles based only on their content. To tackle this issue, we use LSTMs and RNN method models (vanilla, GRU) to approach deep learning from a purely machine learning viewpoint. By applying the findings to the LAIR dataset that we utilized, we will demonstrate the differences and analysis of the data. The findings are comparable, but the GRU, with 0.217, outperforms the others. It is LSTM (0.2166) & vanilla (0.215) come next. In light of these findings, we would want to use a hybrid model combining the best aspects of GRU and CNN approaches on the same dataset in an effort to improve accuracy.

(Alenezi & Alqenaei, 2021) It is tough to stop the massive quantity of disinformation that is being spread. Therefore, there might be serious difficulties for frontline workers in each nation due to the dissemination of false information on COVID-19 epidemic, how it is treated, and vaccine. Building a machine-learning (ML) misinformation-detection algorithm that is capable of accurately recognizing false information pertaining to Covid-19 is thus imperative. We provide three efficient models for misinformation detection in this study. Three models are suggested such as k-nearest neighbors (KNN), a multichannel convolutional neural networks (MC-CNN), and LSTM (long short-term memory) networks, a specific kind of RNN. To evaluate the suggested models' performance using a range of assessment indicators, simulations were run. The suggested models outperformed the literature in terms of outcomes.

(Smitha & Bharath, 2020) On purpose or accidentally, purposely produced fake information is spread online. A broader segment of society that is oblivious to technology is being impacted by this. This work presents a model and approach for using natural language processing and machine learning to identify bogus news in news articles. The feature vector in this

proposed work is generated using a variety of feature engineering techniques, including TF-IDF, word embedding, and count vector. In order to discern between authentic and fraudulent news, seven different machine learning classification methods are developed. Next, a comparison is made between them using recall, precision, accuracy, and F1 Score. And then the most effective way is selected to make a model that can distinguish among phony and authentic news.

(Alhakami et al., 2022) The COVID-19 epidemic has led to a decline in people's bodily and emotional well-being as a result of false data from social media. Thus, in an effort to curb the dissemination of misleading data on the new coronavirus, several research projects have been launched to automatically identify false information about COVID-19 via the use of clever methods. On the predictive models' performance, however, many investigations have produced disparate findings. A number of deep methods for machine learning and learning for the automated identification of deceptive SARS-19 information have been assessed in this work. Using a number of assessment indicators, the tests were conducted on two datasets that were made accessible to the public. When predicting bogus news, the Compared to standard Deep learning and machine learning models fared worse.

(Qureshi et al., 2021) The COVID-19 epidemic has contributed to an increase in social media dishonesty, including rumors, Clickbait, satire, conspiracy theories, fake news, and smear campaigns. It compromises democracy, justice, truth, freedom of expression, trust, reputation, and journalism, all of which are detrimental to society. It is essential to recognize and include inaccurate information. There are many methods to identify false news in tweets, including content analysis, user network propagation, and news generator behaviour. Human-like content permits content-based deception. Detecting false news using network-based algorithms is delayed due to the whole graph. User privilege-based methods effectively identify bots or false accounts. These tools cannot identify bogus news from original accounts. We present a source-based strategy that targets news propagators, such as posters and re-tweeters, to address limitations in current methods. The propagators are linked via follower-following relationships. Using a machine learning framework, a feature set containing news propagator connection patterns and pro le characteristics is employed for binary tweet classification. Complex network measurements and user profiles are analyzed independently. We compare the suggested technique in the actual Using models for machine learning and deep learning at the node and community levels on the COVID-19 dataset. Compared to user and network features, hybrid features perform better. After optimization, the Ensembles deep learning model RNN with boosting model CATBoost performed best, with an AUC score of 98%. Moreover, early findings demonstrate the suggested solution's ability to handle political and entertainment false news with a limited training set.

(Kaliyar et al., 2021) These acts have the potential to significantly compromise the credibility of news media outlets. Therefore, in order to maintain the legitimacy of these social media channels, such dishonest behaviour must be curbed. For to identify such deceptive content, an effective automated method is essential. We introduce a hybrid model in this work that combines LSTM (Long Short Term Memory) with several convolutional neural network, or CNN, branches layers that have varying kernel sizes and filters, taking into account the previously described difficulties. Three thick layers make up our deep model, which allows for the automated extraction of more potent characteristics. In this study, we generated FN-COV, a dataset of 69976 real and false news articles from the COVID-19 pandemic, tagged with terms like quarantine, social distance, and covid19. With the help of PHEME, another real-time dataset of bogus news, we have confirmed the efficacy of our suggested approach. Our C-LSTM network's combined kernel and layer capabilities are profitable for both datasets. We obtained a higher precision of 91.88% using PHEME compared with earlier models utilizing our proposed model, 98.62% while via using FN-COV dataset.

(Paka et al., 2021) Fake news about COVID-19 has been going viral much quicker than the truth at a period when precise information is necessary for maintaining the safety and health of the public. phony News has the power to put people's lives in risk because addition to confusing them intellectually during outbreaks like the COVID-19 pandemic. This means that stopping the spread of misleading information via social media must happen right now. We provide CTF, a massive COVID-19 Twitter dataset that has been categorized as real and bogus. Furthermore, we introduce Using the wealth of unlabeled data, Cross-SEAN is a semi-supervised from beginning to end neural attentiveness model based on cross-stitch. Because it absorbs pertinent external information, Cross-SEAN partly generalizes to newly developing bogus news. We contrast Cross-SEAN with seven cutting-edge techniques for identifying bogus news. We note that it outperforms the best baseline by 9%, achieving an F1 Score of 0.95 on CTF. Additionally, we create the Cross-SEAN based Chrome plugin Chrome-SEAN, which makes it possible to detect phony tweets in real time.

(Karnyoto et al., 2022) Fake news may be very hazardous and disseminated via internet media. It can cause turmoil in the state, as well as fatalities, psychological damage, character assassination, and elections for political parties. False information about COVID-19 extensively circulated throughout the epidemic. Finding false information on the Internet is a crucial but tough endeavor since people find it difficult to discern between fake and legitimate news. In order to pre-train BERT and GPT2 to handle the issue of false news recognition in the context of Constraint @ AAAI2021 - the COVID19 false News

detection in English Dataset, the BiGRU-Att-CapsuleNet model & BiGRU-CRF features enrichment were used. This investigation revealed that, in contrast to our basic model, the accuracy of our hybrid model with augmentation was higher. In all models, it also shown that BERT produced better results than GPT2; the greatest accuracy that BERT and GPT2 could obtain together was 0.9196 and 0.8986, respectively.

(Vijjali et al., 2020) We used cutting edge machine learning Models of COVID-19 false news have been used to create a two-stage automated workflow for natural language understanding. In order to get the the most relevant data on user claims for certain COVID-19 claims, the first model makes use of a unique fact-checking method. The second model calculates the degree for "truth" in a claim using a textual entailment method by comparing it to the real facts that were obtained via human curation of the COVID-19 dataset. The collection of false claims and proven explanations for COVID-19 is derived from a publicly accessible information source. A portion of this dataset was subjected to internal annotation and cross-validation in order to assess and develop our models. The best results are obtained by a model pipeline where the two stages are handled by BERT and ALBERT, respectively, after evaluating a number of models using additional contextual information instead of only text-based aspects Models built on transformers.

(Tashtoush et al., 2022) This research aims to investigate the ability of deep neural networks, namely long- and short- term memory (LSTM), Bi-directional LSTM, Convolutional neural network models (CNN), as well as a hybrid CNN and LSTM network, to categorizes and detect false information linked to the COVID-19 pandemic in social media sites independently. The "COVID-19Fake News" dataset, which has 21,379 examples of accurate and inaccurate information on the COVID-19 pandemic and related vaccines, has been utilized to instruct and evaluate these deep neural networks. Real news was gathered from independent, globally reputable websites, including the official Twitter accounts of the United Nations (UN), the World Health Organisation (WHO), the International Committee of the Red Cross (ICRC), and the United Nations Children's Fund (UNICEF). Fact-checking websites such as PolitiFact, FactCheck, and Snopes provided the erroneous news information. The CNN model outperforms all other neural network models having the maximum accuracy of 94.2%, according to the evaluation results.

(Glazkova et al., 2021) The COVID-19 epidemic has significantly impacted many facets of human existence. As a result, social media users are actively debating the coronavirus epidemic and its effects. But not every social media post is authentic. Many of them disseminate false information that misinforms individuals, incites terror in readers, and thus intensifies the pandemic's effects. We provide our findings from this publication's shared task, Constraint@AAAI2021: COVID-19 False News Detection is English. Our recommendation is to apply our strategy specifically to the transformer- based ensemble of the COVID-Twitter-BERT (CT-BERT) models. We expound on the frameworks used, the techniques employed for text creation, and the incorporation of fresh data. As so, our best model achieved an adjusted F1-score of 98.69 for the test set in this shared dataset, placing it at the top of the leaderboard work, which drew 166 teams in total.

(Fifita et al., 2023) Therefore, for the COVID-19 pandemic response to be managed effectively, identifying false news is essential. Studies have shown that based on the content of news stories, machine learning algorithms are capable of identifying COVID-19 false news. It hasn't been investigated, nevertheless, how these models may be developed using biological data, which is often discussed in COVID-19 news. Utilizing machine learning models in conjunction with biological information extraction (BioIE), we provide a unique method for predicting COVID-19 false news. By using sophisticated BioIE algorithms, we were able to extract 158 unique characteristics from a sample of 1164 COVID-19 news items. Next, in order to anticipate COVID-19 false news, these attributes were used for fifteen machine learning classifiers' training. Outperforming each of the other 15 classifiers, the random forest model achieved an AUC (area around the ROC curve) = 0.882, which is between 12.36% to 31.05% greater than that of models trained on traditional features. A cutting-edge multi-modality model is also performed better after adding BioIE-based.

III. RESEARCH GAP

A comprehensive literature review of COVID-19 fake news detection systems revealed several research gaps. Despite the global pandemic, cross-lingual fake news detection systems remained understudied. Second, transformer- based models and machine learning have been coupled, although the ideal synergy is unclear. Standard machine learning methods and advanced transformers may make fake news detection techniques more adaptable. Since length and format have not been fully studied in detection algorithms, various news items need proper preparation. Research lacks common assessment criteria; hence a unified COVID-19 fake news detection evaluation approach is required. These issues must be addressed to improve pandemic misinformation detection tools.

IV. CONCLUSION

In conclusion, numerous methods for spotting COVID-19 fake news have illuminated the developing misinformation detection environment. Classic machine learning techniques and complex deep learning models like transformer topologies show the industry's continual efforts to increase detection precision and effectiveness. Significant gaps exist, especially in cross-lingual detection approaches. Due of the pandemic's global reach, multilingual information delivery mustbe enhanced. Due to the absence of standard evaluation markers, benchmarking

and assessingvaried methodologies is challenging. Standard assessment frameworks are needed for accurate evaluations and career progress.

Content-specific preprocessing is crucial. Detection systems must adapt to extensive news bodiesand brief headlines to be flexible and resilient. Overcoming these gaps is essential for comprehensive and widely applicable information crisis remedies. As COVID-19 misinformation grows, researchers must focus on novel, adaptable, and globally relevant ways. These methods should work across languages and media and withstand new deceptions.

V. FUTURE WORK

Multilingual COVID-19 detection of fake news algorithms will be explored to fight global misinformation. Model assessment criteria standardization fosters research best practices, uniformity, and unification. Content-specific preprocessing for many news formats improves detection system robustness. Incorporating public health data may increase detection algorithms' accuracy and relevance. Crisis misinformation spreads quickly, necessitating real-time identification and correction. For fair and unbiased detection findings, ethical problems including algorithmic bias and fairness must be investigated. Misinformation remedies including educational campaigns and tool deployment need academic, legislative, and technical partnership.

REFERENCES

[1] R. Vijjali, P. Potluri, S. Kumar, and S. Teki, “Two Stage Transformer Model for COVID-19 Fake NewsDetection and Fact Checking”.

[2] M. Chen, “D ATA R EPOSITORY FOR F AKE N EWS D ETECTION AND A arXiv :2109 . 06416v2 [cs . IR] 23 Sep 2021,” pp. 1–12, 2021.

[3] S. Raza and C. Ding, “Fake news detection based on news content and social contexts : atransformer-based approach,” *Int. J. Data Sci. Anal.*, vol. 13, no. 4, pp. 335–362, 2022, doi: 10.1007/s41060-021-00302-z.

[4] G. Pennycook and D. G. Rand, “Fighting misinformation on social media using crowdsourced judgmentsof news source quality,” 2018, doi: 10.1073/pnas.1806781116.

[5] J. Roozenbeek and S. Linden, “against online misinformation,” *Palgrave Commun.*, pp. 1–10, 2019, doi: 10.1057/s41599-019-0279-9. R. P. Ojha and P. K. Srivastava, “Controlling of Fake Information Dissemination in Online Social Networks : An Epidemiological Approach,” IEEE Access, vol. 11, no.February, pp. 32229–32240, 2023, doi: 10.1109/ACCESS.2023.3262737.

[6] R. P. Ojha and P. K. Srivastava, “Controlling of Fake Information Dissemination in Online Social Networks : An Epidemiological Approach,” IEEE Access, vol. 11, no.February, pp. 32229–32240, 2023, doi: 10.1109/ACCESS.2023.3262737.

[7] K. Shu, D. Mahudeswaran, S. Wang, D. Lee, and H. Liu, “FakeNewsNet: A Data Repository with News Content, Social Context, and Spatiotemporal Information for Studying Fake News on Social Media,” Big Data, vol. 8, no. 3, pp. 171–188, 2020, doi:10.1089/big.2020.0062.

[8] J. Cook, “Lewandowsky , S ., Ecker , U . K . H ., & Cook , J . (2017). Beyond Misinformation : Understanding and Coping with the ‘ Post-Truth ’ Era . Journal of Applied Research in Memory and Cognition , 6 (4), 353-369 . University of Bristol - Explore Bristol Research,” vol. 6, pp. 353–369, 2017, doi: 10.1016/j.jarmac.2017.07.008.

[9] L. A. Kumar and D. K. Renuka, “State-of-the-Art Natural Language Processing,” DeepLearn. Approach Nat. Lang. Process. Speech, Comput. Vis., pp. 49–75, 2023, doi: 10.1201/9781003348689-3.

[10] M. van Nguyen, V. Lai, A. P. Ben Veyseh, and T. H. Nguyen, “Trankit: A light-weight transformer-based toolkit for multilingual natural language processing,” EACL 2021 - 16th Conf. Eur. Chapter Assoc. Comput. Linguist. Proc. Syst. Demonstr., pp. 80–90, 2021,doi: 10.18653/v1/2021.eacl-demos.10.

[11] T. Brown et al., “Language models are few-shot learners,” Adv. Neural Inf. Process. Syst.,vol. 33, pp. 1877– 1901, 2020.

[12] R. C. Thompson, S. Joseph, and T. T. Adeliyi, “A Systematic Literature Review and Meta-Analysis of Studies on Online Fake News Detection,” Inf., vol. 13, no. 11, 2022,doi: 10.3390/info13110527.

[13] M. Samadi, M. Mousavian, and S. Momtazi, “Deep contextualized text representation andlearning for fake news detection,” Inf. Process. Manag., vol. 58, no. 6, p. 102723, 2021, doi: 10.1016/j.ipm.2021.102723.

[14] J. O. Healthcare Engineering, “Retracted: IoT-Enabled Framework for Early Detection and Prediction of COVID-19 Suspects by Leveraging Machine Learning in Cloud,” J.Healthc. Eng., vol. 2023, p. 9768467, 2023, doi: 10.1155/2023/9768467.

[15] S. Raza, D. J. Reji, and C. Ding, “Dbias: detecting biases and ensuring fairness in newsarticles,” Int. J. Data Sci. Anal., 2022, doi: 10.1007/s41060-022-00359-4.

[16] D. R. Patil, “Fake News Detection Using Majority Voting Technique,” 2022, [Online].

[17] Available: http://arxiv.org/abs/2203.09936

[18]

[19] P. T. Endo et al., “Illusion of Truth: Analysing and Classifying COVID-19 Fake News inBrazilian Portuguese Language,” Big Data Cogn. Comput., vol. 6, no. 2, 2022, doi: 10.3390/bdcc6020036.

[20] B. Alouffi, A. Alharbi, R. Sahal, and H. Saleh, “An Optimized Hybrid Deep LearningModel to Detect COVID-19 Misleading Information,” Comput. Intell. Neurosci., vol. 2021, 2021, doi: 10.1155/2021/9615034.

[21] W. H. Bangyal et al., “Detection of Fake News Text Classification on COVID-19 UsingDeep Learning Approaches,” Comput. Math. Methods Med., vol. 2021, 2021, doi: 10.1155/2021/5514220.

[22] M. Schütz et al., “AIT_FHSTP at CheckThat! 2022: Cross-Lingual Fake News Detectionwith a Large Pre- Trained Transformer,” CEUR Workshop Proc., vol. 3180, pp. 660–670,2022.

[23] W. Shishah, "JointBert for Detecting Arabic Fake News," IEEE Access, vol. 10, no. May,pp. 71951–71960, 2022, doi: 10.1109/ACCESS.2022.3185083.

[24] M. H. Goldani, R. Safabakhsh, and S. Momtazi, "X-CapsNet For Fake News Detection,"pp. 1–12, 2023, [Online]. Available: http://arxiv.org/abs/2307.12332

[25] G. S. Cheema, S. Hakimov, and R. Ewerth, "TIB's visual analytics group at MediaEval'20: Detecting fake news on corona virus and 5G conspiracy," CEUR Workshop Proc.,vol. 2882, pp. 3–5, 2020.

[26] R. Bounaama and M. E. A. Abderrahim, "Classifying COVID-19 Related Tweets for FakeNews Detection and Sentiment Analysis with BERT-based Models," arXiv Prepr.

[27] M. Taha, H. H. Zayed, M. Azer, and M. Gadallah, "Automated COVID-19 misinformation checking system using encoder representation with deep learning models,"IAES Int. J. Artif. Intell., vol. 12, no. 1, pp. 488–495, 2023, doi: 10.11591/ijai.v12.i1.pp488-495.

[28] R. K. Kaliyar, A. Goswami, and P. Narang, "FakeBERT: Fake news detection in social media with a BERT-based deep learning approach," Multimed. Tools Appl., vol. 80, no. 8,pp. 11765–11788, 2021, doi: 10.1007/s11042-020- 10183-2.

[29] S. Almatarneh, P. Gamallo, B. ALshargabi, Y. AL-Khassawneh, and R. Alzubi, "Comparing traditional machine learning methods for covid-19 fake news," 2021 22nd Int. Arab Conf. Inf. Technol. ACIT 2021, 2021, doi: 10.1109/ACIT53391.2021.9677453.

[30] M. Umer, Z. Imtiaz, S. Ullah, A. Mehmood, G. S. Choi, and B. W. On, "Fake news stancedetection using deep learning architecture (CNN-LSTM)," IEEE Access, vol. 8, pp. 156695–156706, 2020, doi: 10.1109/ACCESS.2020.3019735.