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Fake News Detection Datasets: A Review and Research Opportunities

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Abstract: The impact of fake news is far-reaching, affecting journalism, the economy, and democracy. In response, there has been a surge in research focused on detecting and combating fake news, resulting in the development of datasets, techniques, and fact-verification methods. One crucial aspect of this effort is the creation of diverse and representative datasets for training and evaluating machine learning models for fake news detection. This review paper examines the available datasets relevant to detecting fake news, with a particular emphasis on those available in the Indian context, where few resources exist. By identifying research opportunities and highlighting existing corpora, this paper aims to assist researchers in improving their fake news detection studies and contributing to more comprehensive research on the topic. To the best of our knowledge, no survey has specifically focused on accessible corpora in the Indian context, making this review a valuable resource for researchers in the field.

Keywords: dataset, fake news, India, misinformation, satire, timeline, rumour

1. Introduction

The fabrication of information is not a recent phenomenon; it has existed since the beginning of humanity. In the past, false news was spread through verbal communication, as individuals would believe and transmit erroneous information they had heard from others [1]. While this approach still persists, it has gained momentum with technological advancements. The internet, introduced in the late 20th century, was expected to promote universal access to knowledge and create a more open and tolerant world. India is the world's largest democracy, and in recent years, the country has experienced a significant increase in internet usage and digital adoption, providing more online access to information than ever before[2]. However, the current reality of the internet is far from ideal, with misinformation, deception, and conspiracies prevailing on many social media platforms. India is now one of the largest markets for technology platforms such as Facebook and WhatsApp. Although this rise in online access has been facilitated by increased smartphone usage and lower data costs, it has also enabled fake news to spread rapidly across the country [3]. The proliferation of such misinformation has had significant real-world consequences, including election interference, public health risks[4], [5], and even genocide.

A. Fake News and Related Concepts

The term fake news refers to information that is false or misleading and presented in a way that gives the impression that it is genuine news [6]. The primary purpose of fake news is typically to deceive, either for financial or political gain, and to cause harm to an individual, organization, or entity. To attract more readers, fake news stories often employ misleading or sensational headlines that may be completely fabricated or contain partial truths. There are several types of fake news, including:

- **Fabricated stories:** These are completely made-up stories with no basis in reality. They are often created for the purpose of generating clicks and revenue or to spread propaganda or misinformation.
- **Misleading information:** This type of fake news involves the spreading of information that is technically true but is presented in a misleading or incomplete way, or is out of context, in order to create a false impression.
- **Manipulated images and videos:** Images or videos are altered or manipulated in this sort of fake news to convey a false or misleading message.

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- **Satire:** Satire is a type of humor in which irony, sarcasm, or ridicule is used to comment on society, politics, or other matters. It is not intended to be taken as literal truth, but rather as a form of humor. For example, "The Munshi Show" is a popular online cartoon in India that employs satire to comment on Indian society and politics.
- **Parody:** It imitates the style of a particular work, person, or genre for the purpose of making fun of it. Parodies often use exaggerated or distorted elements of the original work to create a humorous effect. The TVF channel in India is an example of a platform that produces parodies of well-known Indian TV shows and films, as well as original comedic content.
- **Hoaxes:** A hoax is a deliberate falsehood made to look like it's real. It is created with the intention of tricking or deceiving people. It can lead to public panic or fear[7].

The European Council research report introduced the term 'information disorder' [8]. Information disorder refers to the spread of false, misleading, or inaccurate information, often through digital and social media platforms. According to, it can take various forms, such as misinformation, disinformation, and malformation. It is important to distinguish among these terms, as depicted in Figure 1. All this information disorder comes under the umbrella of fake news.

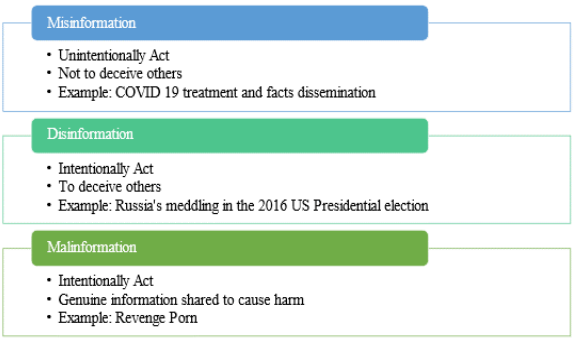

Figure 1. Various forms of Fake News

B. Channels for Fake News Disseminations

Fake news is not a new phenomenon; it is as old as mankind. Nowadays, it has become hyped due to technological advancement. It is not that it only circulated through the internet; words of mouth also played a part in it. In the digital age, it has gained prominence, especially on social media and websites. The Internet has revolutionized communication, commerce, and access to information. But it is the primary medium through which fake news is distributed, as it provides a platform for the creation, publication, and sharing of content with a worldwide audience. Social media plays a pivotal role in the spread of fake news due to its vast user base and the speed at which information can be disseminated. Now anyone can become an influencer and share what they want to share, whether it is genuine content or misleading content. Fake news can be spread through various channels, as mentioned below:

- Social media: Facebook, Twitter, and WhatsApp[9] no doubt played a vital role to propagate false information [10]. It spread swiftly and quickly reach a broad audience through shares, likes, and comments.
- News websites: False news websites can be made to look like authentic news sources in order to disseminate misleading information to a broad audience.
- Email: Fake news can be spread via email, either through mass mailings or by individuals forwarding fake news to their contacts.
- Word of mouth: Fake news can also spread through word of mouth, as people may believe and pass on false information they have heard from others[11].
- Bots and cyborgs: Automated accounts, also called bots and cyborgs, can amplify and disseminate fake news on social media platforms, making it more visible and credible.
- Paid promotion: Fake news creators and distributors can use paid promotions, such as social media ads, to target specific demographics and promote their fake news content. These ads can be designed to look like legitimate news stories or sources and can be difficult for viewers to distinguish from actual news[12].

However, False information has significantly accelerated due to the use of social media platforms and online channels that facilitate viral postings in audio, video, image, and text form (Figure 2.).

Figure 2. Fake News Dissemination Channels

- Textual Post: False news is primarily disseminated via text postings, which are frequently shared on numerous social media platforms.

- Image Post: Bogus news propagation organizations or individuals may choose to use images to help the content go viral. In this case, an image may be misrepresented by someone using deceptive text, or the image itself might be altered using various techniques[13].

- Video Post: Fake videos are one of the vectors used to convey false information. The majority of the video content in this place spreads fear by conveying incorrect information[14] such as hatred, racial violence, etc.

- Fake URLs: Through click-jacking, pharming, and other methods, fake URLs are created to propagate fake information as well as commit cyber fraud through fake coupons, discounts, and redemption schemes.

C. History of Fake News

The practice of fabricating information is nothing new. According to Guardian columnist Natalie Nougayrède: "The use of propaganda is ancient, but never before has there been the technology to so effectively disseminate it".

Human communication has been characterized by misinformation, disinformation, and propaganda since the time of Antony and Cleopatra in Roman times. In order to smear Antony's reputation, Octavian waged a propaganda campaign against him. These slogans, like archaic tweets, portrayed Antony as a womanizer and drunk after committing a sin against Cleopatra. Thus, fake news stories helped Octavian become Augustus, the first Roman Emperor[6].

Even the internet was not the first to lead to fake news; it was the printing press. Gutenberg's invention of the printing press in 1493, misinformation and disinformation were widely disseminated, culminating in "The Great Moon Hoax" of 1835 [15]. On the discovery of life on the moon, The New York Sun published six articles with illustrations of humanoid bat creatures and blue unicorns with bearded horns. The advent of radio and television in the 20th century gave rise to satirical news, sometimes mistaking it for actual news. The Internet has revolutionized communication, commerce, and access to information. Furthermore, misinformation, disinformation, propaganda, and hoaxes have also increased dramatically since the introduction of the internet and social media. But now, in the digital age, it has gained prominence, especially on social media and websites. People tend to comment on posts when there is content that they find emotionally engaging, and they tend to forward those posts as well. One of the key factors influencing susceptibility to fake news is confirmation bias, the cognitive tendency for individuals to remember, interpret, and seek information in a manner that confirms their pre-existing beliefs. Another term that relates to this fake news dissemination is an echo chamber; it is like a social media bubble where you mostly hear things you already agree with. This can make it easier for fake news to spread because you might not see different opinions.

D. The Scale of Fake News in India

The widespread availability of inexpensive smartphones and internet access has played a significant role in facilitating widespread mobile-based internet usage in India, both in urban and rural areas[16]. As of June 2022, there were over 339 million rural internet subscribers in India. The launch of Jio's fixed-line broadband service, called Gigafiber, is expected to further increase internet penetration, building on the upward trend seen in recent years. Furthermore, the BharatNet program plans to provide fiber connectivity to all Indian villages by 2025, which is expected to boost the use of internet-enabled devices in rural areas. As per the information available on Statista.com, the Digital India campaign implemented by the government has led to an increase in the number of active digital users in the country, which has reached 658 million as of February 2022. Deloitte's 2022 global TMT predictions estimate that the smartphone market in India will reach 1 billion users by 2026[17]. The internet, particularly social media and messaging platforms like Facebook, WhatsApp, and Twitter, has made it easier and more affordable for the average Indian to create, share, and access user-generated content. By 2027, India is projected to have 1.17 billion social media users, ranking second only to China, as per Statista.com[18](Figure 3.).

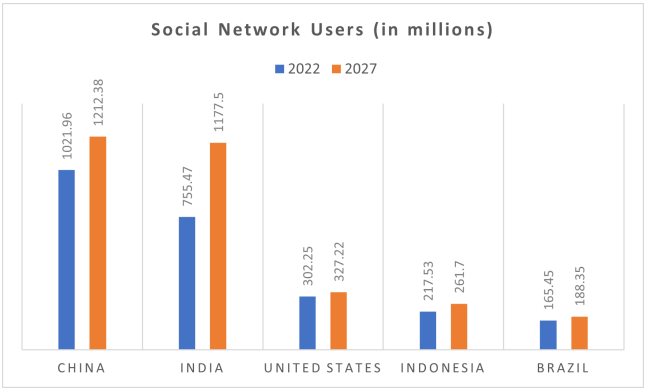

Figure 3. Projected growth of Indian social network users from 2022-2027

Platforms like WhatsApp enable users to share and interact with both text-based and multimedia postings[9]. Individuals, despite having different levels of literacy, can easily participate in the online ecosystem[19]. Yet, the growth of these online platforms has also made it possible for individuals with malicious or deceptive motives to disseminate bogus content widely. Again, it has made it possible for people with weak digital literacy to unintentionally share such content. In this regard, Indian journalist Ravish Kumar came up with the phrase "WhatsApp University," used to describe the propagation of false information and fake news through WhatsApp forwards in India[20].

E. Contribution and Organization

Fake news dissemination and its detection continue to be an ongoing process, attracting global focus in both academic and research communities. Before ML can be used to spot fake news, the first model has to be trained. In this case, using the dataset as fuel is important. Various datasets are undoubtedly accessible on a global scale; however, to the best of our knowledge, no research has been identified that specifically examines datasets within the Indian context. In light of this, the goal of this study is to enlighten researchers about the existing corpora so that they can be used to counteract bogus news propagation.
This survey research paper is a valuable contribution to the field of false news detection by offering novel insights and views. The identification of fraudulent news on digital platforms is of utmost importance, and this study aims to tackle this issue. The contributions of this paper encompass:

- Conceptual Clarity: This study presents concise and straightforward explanations of key points linked to fake news, laying the groundwork for future study and practice. This is useful for navigating the maze of false information.
- Dataset Exploration: The present study reviews and identifies various false news datasets from India. Multiple datasets covering various contexts and historical periods are provided.
- Research Facilitation: The purpose of this research is to help researchers and practitioners by examining the availability and usefulness of Indian fake news datasets. This direction can streamline the selection of research datasets, which will aid in the identification and prevention of fake news in India.
- Future Research: This study provides a comprehensive overview of the literature on DL and ML techniques for detecting fake news. This study provides scholars and practitioners with a greater understanding of the techniques and approaches that have been implemented in the global context by sharing key results and insights from this review.

The goal of this study is to get the answer to the research question:

What are the existing datasets containing fake news incidents in India, and what are their strengths, weaknesses, and limitations?

By doing so, this study aims to assist researchers and practitioners with a better understanding of the quality and potential uses of Indian datasets containing fake news incidents.

The paper is arranged as follows: Following the introduction of the term fake news and its related concepts, channels for spreading fake news, and history of fake news in India, Section 2 discusses some notable incidents involving fake news in India. Section 3 discusses fake news detection mechanisms, while section 4 discusses the role of datasets and the work of various researchers. Section 5 presents various globally available datasets in addition to Indian fake news detection datasets. Section 6 illustrates this study's limitations, and Section 7 concludes it.

2. Some Notable Incidents Related to Fake News in India

- The phrase "protection of cows" is often used rhetorically to appeal to people's emotions and values, particularly in India, where cows are considered sacred by many Hindus. In recent years, there have been several incidents of mob violence, lynching, and vigilantism related to cow protection, which has led to the loss of life and property damage[9]. Fake news stories related to cow protection in India often depict cows being mistreated or killed by individuals from certain communities, particularly Muslims, who are often falsely accused of cow slaughter. These stories can be used to incite religious and communal tensions, leading to violent attacks against innocent people. Many of these incidents have been sparked by fake news and rumors spread through social media platforms such as WhatsApp and Facebook. There have been 302 documented deaths from 127 incidents of this type of violence.
- In 2013, false video footage was used to stir up tensions and spark violent clashes between the Hindu and Muslim communities in the Muzaffarnagar district of Uttar Pradesh, India. These riots resulted in the deaths of 62 people, including 42 Muslims and 20 Hindus, as well as injuries to 93 others and the displacement of over 50,000 people [21].
- There was panic in some parts of the country in 2016 when WhatsApp messages claimed that sugar and salt were in short supply, which was completely untrue.
- In 2016, there were rumors circulating that 10 rupee coins were not genuine and that counterfeit coins were being circulated. This caused a commotion, as people began to claim that coins without the rupee symbol and those with 10 lines were fake. This led to widespread confusion and numerous issues.
- There was a rumor that the new 2000-rupee currency note contained a GPS chip that could track it 120 meters below ground[19].
- A fake news report from June 2016 stated that India's Narendra Modi has been named the world's best prime minister by UNESCO. This remark was spread widely on Twitter, notably by Indian snooker champion Pankaj Advani.
- A photograph of Prime Minister Narendra Modi and Sachin Tendulkar, with a picture of Mukesh Ambani

and his wife visible in the background, was widely shared on WhatsApp. However, it was evident that the image had been manipulated, as in the original photograph shared by the prime minister on Twitter, a different photograph was hanging on the wall in the background.

- An example of such a fake story is shown in Figure 4, when veteran Bollywood actress Farida Jalal has become a victim of a death hoax. When Twitter flooded with RIP messages then she tweeted back to confirm that she is very much alive[22].

Figure 4. Fake News (a) Farida Jalal's Death Hoax (b) Reply from Farida Jalal

- Zee News, ABP reported in 2017 that Dubai authorities seized Dawood properties worth Rs. 15000 crores, but this was false.

- Republic, Zee News, TOI, and other publications featured bogus news stating that President Kovind gained 3 million followers in his first hour on Twitter.

- In a 2019 Hindi tweet, JD(U) leader Alok announced that UNESCO had named "Jana Gana Mana" the best national anthem in the world. Further, he congratulated everyone and said he hoped some would not say it was Modi-Shah's doing. Once again, it was a bogus story.

- Fake news has led to the occurrence of several riots, including the Delhi riots of 2019 which were sparked by the Citizenship (Amendment) Act 2019.

- During the 2019 Lok Sabha Elections, the Election Commission of India (ECI) reported that there were 154 instances of fake news spread on social media. These fake news stories stated that someone had cast a ballot for one party when, in reality, another party's light was on in the electronic voting machine (EVM)[23].

- In 2017, the blog "Nostradamus and India" by French political writer François Gautier, it has caused controversy in India for its inaccuracies and misinformation. This blog reportedly makes false claims about Nostradamus predicting certain events in India, such as the rise of Narendra Modi and the success of the Indian space program. However, these claims have been debunked by experts, who point out that there is no evidence to support them. After TOI removed the blog, it was republished with a disclaimer.

- Due to fake videos and messages circulating via WhatsApp regarding child abduction, and trafficking, many people were beaten to death as well as injured by a mob.

- Despite efforts by some journalists to counter disinformation during the pandemic, India's prominent media organizations promoted misleading claims that were provocative in nature. One example of this is when Baba Ramdev launched Coronil as a COVID vaccine. When asked by the Indian Medical Association, he admitted that the drug might only be effective as a booster dose. However, news channels continued to feature Patanjali's advertisements while discussing the product.

- India's 2020 elections marked the debut of deepfake in a political campaign. Two videos of Delhi BJP head Manoj Tiwari were made public during legislative assembly elections in February 2020. Both of the videos have Tiwari criticizing the AAP-led Delhi administration; one video features Tiwari speaking in English, the other in Haryanvi. Eventually, according to the Vice investigation, it was discovered that both videos were elaborate forgeries made from a real clip of Tiwari discussing the CAA Bill in Hindi.

- The 2020-2021 Indian farmers' protest was marked by a lot of controversy and misinformation, including fake news. Several images were shared on social media that claimed to be from the farmers' protest but were actually old or unrelated images. There were several false claims made about foreign involvement in the farmers' protest. Some claimed that the protests were being funded by foreign NGOs. However, there is no evidence to support these claims.

- On Ram Navami (April 10, 2022), violence broke out throughout the country, causing the hashtag #IndianMuslimsUnderAttack to trend on social media. On April 12th, a fake story was spread on social media claiming that Muslims in India were in peril.

- Another example of fake news is a tweet from a bogus account claiming that Twitter would cease operations in India on May 26, 2021(Figure 5.). The fake account was suspended after the tweet briefly went viral. This information was spread by @AniNewsIndia, a fake news agency that used the name ANI. This explains the confusion.

The government of India has implemented various actions to stop the dissemination of false information. Some of the key actions are listed below:

Figure 5. Fake News dissemination from a bogus Twitter account

- The Press Information Bureau (PIB), the nodal organization for the Indian government, has set up a fact-checking division https://pib.gov.in/factcheck.aspx to verify the authenticity of news and information, particularly related to government policies and programs[24].
- In order to inform the public about the negative impacts of false news and how to spot and report it, the government has organized a number of awareness programs and seminars.
- Social media sites must remove content within 36 hours of receiving a court order or official command, according to the Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Regulations, 2021, which went into effect on February 25, 2021. In accordance with the regulations, social media sites must also designate compliance officers and nodal officers to work with law enforcement.
- The Indian Penal Code (IPC) is a body of criminal legislation that covers a variety of acts and establishes a framework for penalizing individuals who commit them. Many IPC sections can be used to combat the dissemination of false information, even if there isn't a specific regulation in the IPC that targets fake news.
- Eight YouTube news channels have been blocked by the government for providing false information about national security, international affairs, and public order[25].

In general, the Indian government has employed a multi-pronged strategy to counteract false information and disinformation, including legal action, media literacy campaigns, fact-checking portals, and cooperation with social media platforms. Fake news is still a problem, though, and more needs to be done to successfully fight it. Following, the mechanism to detect fake news is elaborated.

3. Fake News Detection Mechanism

Although there are various steps taken by authorities to counter this fake news spread issue, since phony news has become a global issue, many techniques and tools have been developed to combat it. It goes without saying that social media platforms play a significant part in spreading fake news. As social media platforms have become more widely used around the world, fake news has spread online at an unprecedented rate. Massive, varied, and heterogeneous information (both real and fake) floods social networks, posing a serious threat to society. To determine whether or not a piece of news is fake, a framework must first be trained. This requires data, and technological tools, including a web crawler that stores tweets, are available to assist in this process.

Type of Detection

Fake news can be examined from either a manual or an automatic approach.

Manual Fake News Detection: In the manual approach, human experts manually read and analyze the news articles to determine their authenticity. This involves fact-checking and verifying the information provided in the news using external sources, such as credible news sources or relevant research studies. This method is time-consuming and may be prone to errors, as it relies on the expertise and subjectivity of the human experts involved. It requires time and is not scalable to the vast amount of social media content available. However, it allows for a more nuanced understanding of the context of the news article and the ability to identify subtler forms of misinformation, such as satire or sarcasm.

Here are some examples of fact-checking websites as shown below in Figure 6:

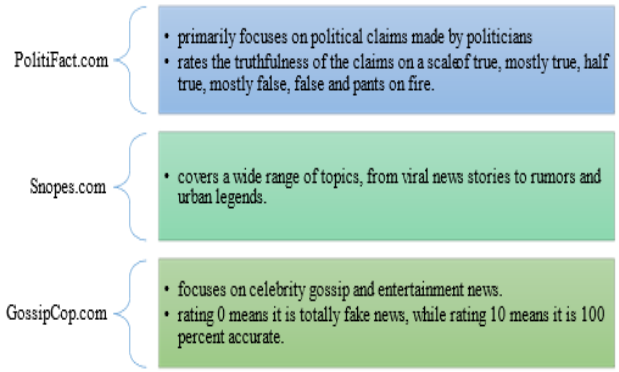

Figure 6. Fact-Checking Websites

Snopes, PolitiFact, and GossipCop all aim to provide accurate information and debunk misinformation, but they differ in their focus and the types of claims they investigate. Snopes covers a wide range of topics, while PolitiFact focuses on political claims, and GossipCop specializes in celebrity gossip and entertainment news.

Some instances of Indian fact-checking websites are shown in the Table I below.

Automated Fake News Detection: In the automatic approach, news stories are analyzed to find patterns of disinformation using ML algorithms and NLP techniques.

TABLE I. Indian Fact Checking Websites

Source	Language Support	Domain
Alt News	English, Hindi	Politics, Society Science
Boom Live	Hindi, English, Burmese, Bangla	General
DigitEye India	English	General
Fact Crescendo	Hindi, English, Punjabi, Urdu, Tamil, Telugu, Assamese, Marathi, Bengali, Kannada, Malayalam, Oriya	General, Coronavirus
FactChecker	English	General
Factly	English, Telugu	General, Coronavirus
India Today	English	General
NewsChecker	Hindi, English, Punjabi, Urdu, Marathi, Tamil, Bengala, Gujarati	General
The QuintWebqoof	Hindi, English	General, Health

These methods look for trends in the language and content of news stories using statistical and linguistic analysis. This methodology can analyze a lot of news stories quickly, making it faster and more scalable than manual approaches. This approach relies on the quality and quantity of the data used to train the ML, and DL models; this is where the dataset comes into play. These model learns from the data fed to it. The following section describes the role of datasets in fake news detection.

4. Role of Datasets

Datasets play a crucial role in the development and training of fake news detection systems. These datasets contain a collection of labeled examples of real and false news articles, which are used to train ML and DL models to recognize patterns and features that distinguish the two (Figure 7.). The performance of the false news detection system can be significantly impacted by the dataset's quality and diversity[26]. A good dataset should be representative of the type of content that the model will be applied to and contain a diverse range of examples of both real and fake news. A dataset can be of various categories: containing text data only, multimedia data only, or containing both. A dataset for detecting fake news can be viewed from two perspectives: as containing news articles from news channels or posts on social media. The news is categorized into two classes (real or fake) or into multiple classes.

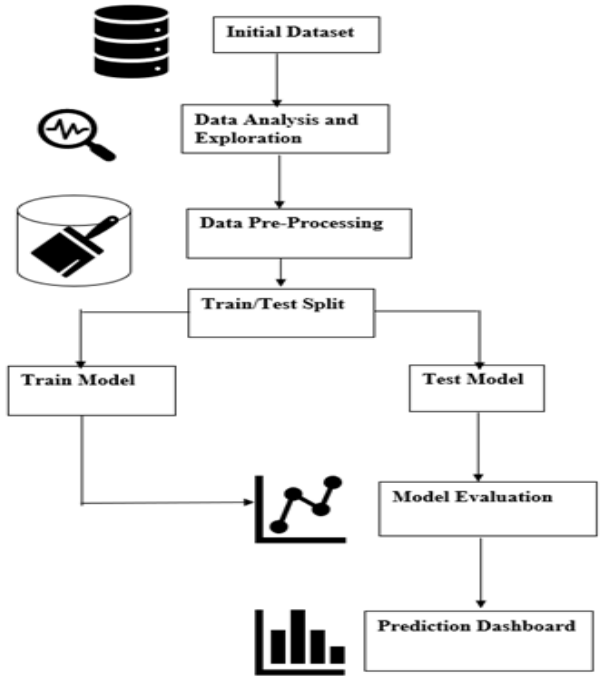

Figure 7. Role of datasets in Fake News Detection

It takes a series of steps to detect fake news using ML or DL techniques. Here are some of the key steps:

The very first and important step is to collect a large dataset of news articles from different sources that will act as fuel for further processing, including both real and fake news. The dataset should be diverse, covering different topics and domains, to help ensure the model is robust and can generalize to new data. The next step is to analyze the dataset with the aim of identifying patterns, relationships, and trends in the data. It is used to gain insight and identify important features, outliers, and potential errors or biases. Now the collected data needs to be pre-processed before it can be used for training the model. This includes data cleaning by removing irrelevant information and standardizing the format of the text. The pre-processed text is then used to extract features. In order for the ML model to make use of the data, feature extraction must first transform the text into a series of numerical features. Bag-of-words, TF-IDF, and word embeddings are some of the most frequently used feature extraction methods. It is up to the situation at hand and the sophistication of the dataset to determine which model to use now. Following model selection, the data that has already been cleaned and prepared will be used to "train" the model. In order to train the model, we separate the data into a training set and a testing set. Following model training, it is put to the test on testing data. Accuracy, precision, recall, and the F1 score are only few of the metrics used to assess the model's efficacy. These indicators can be used to assess the model's performance and determine where it needs

improvement. The third stage is model optimization, which takes into account the findings of the assessment. This could involve fine-tuning the model's hyperparameters, changing the feature extraction techniques, or collecting more data to improve the model's accuracy.

By following these steps, ML can be used to build a robust and accurate system for detecting fake news[27].

A. Literature review of ML in fake news detection

ML is the subset of AI that enables computers to analyze data and learn from it, and based on that learning, they perform specific tasks. ML may require some human intervention in initial training, and in the case of large datasets, the performance may degrade. Here, DL comes into play as it enables the use of large datasets and mimics human brain functioning. With the goal of reducing the propagation of fake news and protecting the credibility of the digital environment, researchers and professionals have developed a variety of methods for using ML and DL, either alone or in a hybrid setting, to detect and identify such content. The following Figure 8 shows various ML techniques used in this realm of fake news detection.

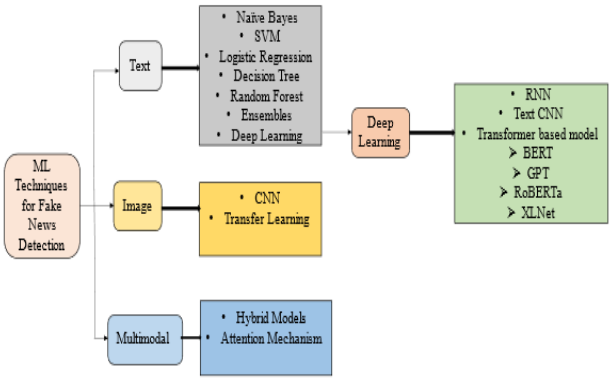

Figure 8. ML Tree

This section focuses on the research conducted to counteract the dissemination of fake news.

In study conducted by authors in [28] represented the conceptual characterization of fake news by classification of fake news. In order to highlight the most crucial considerations, the authors came up with essential concepts with the goal of identifying what is fake news. Here, the importance of developing a clear conceptual model of fake news and its connection to an XAI strategy is discussed. ML models are then generalized for numerous domains using the acquired information[29]. A false news detection model based on n-gram analysis and ML methods was proposed in the paper[30]. Two feature extraction methods and six supervised ML classification methods were also compared in this study. The combination of the TF-IDF feature extraction method and the Linear Support Vector Machine (LSVM) classifier achieves the highest accuracy of 92%.The authors of the study[31] identify bogus news using a Gaussian Naïve Bayes classifier. They collected data from Facebook and various other sources to implement their methodology and achieved 87% accuracy. A study conducted by authors [32] found that the bogus news identification can be achieved by predictive analysis techniques. The detection of counterfeit messages necessitates the implementation of three essential steps: pre-processing, feature engineering, and classification. The hybrid classification approach employed in this study is specifically designed to discern and classify instances of misinformation. A hybrid classification model, combining the K-Nearest Neighbors (KNN) and Random Forest algorithms, has been developed. The utilization of a hybrid false-message detection model resulted in an improvement of the final outcomes by a maximum of 8%.

To test the hypothesis that there is a link between rumor and sentiment, the authors[33] performed an experiment on the PHEME Twitter dataset. Different algorithms, including logistic regression, SVM, decision trees, random forest, XG-Boost, and LSTM recurrent neural networks with hierarchical attention networks, are implemented. Experimental results showed that HAN and SVM performed best with 86% accuracy for sentiment-aware rumor text recognition. To spot counterfeits in the news media authors [34] divided the characteristics they identified into three broad groups: complexity, psychology, and style. Next, an SVM classification model is constructed using these features for the dataset containing both true news from BuzzFeed and satirical news from Burfoot and Baldwin. Predictions of fake news against actual news were 71% accurate after the experiment. Another study [35] proposed a support vector machine (SVM) classification model that uses absurdity, grammar, and punctuation as features to determine satire and humor in news articles. The authors used 360 soft news articles and ended up with a 90% precision rate.

Deep learning [36], a powerful subset of ML, has garnered significant attention for its potential to learn features from data without feature engineering during training [37]. It shows remarkable performance in addressing complex problems, including fake news detection. By leveraging the capabilities of ANN to learn intricate patterns and representations, DL approaches hold promise in distinguishing between legitimate news and fabricated content. The authors in [38] developed an AI model utilizing NLP and conventional ML to capitalize on the use of DL in FND and categorize bogus news. The experiments were carried out using the Kaggle dataset and articles collected from the internet. Comparing the results to those of other ML and DL models revealed that Random Forest and CNN with GlobalMaxpool performed exceptionally well. It was shown that DL models exhibited an approximate 6% increase in accuracy compared to machine learning models. Fake news

affects politics, entertainment, health, and finance in the wide world of information. The stock market is negatively affected by fake news because it negatively affects investors and a nation's finances. The authors collected 8,000 news samples from news stories, comments, sources, and the stock market and labelled them. They modelled a financial fake news detection model based on CNN-LSTM and achieved 92.1% accuracy to identify and battle financial misinformation[39]. For multi-label classification of fake news authors [40] employed an ensemble-based approach using CNN[41] and Bi-LSTM. The classification was based on both textual content and variables associated with the behaviour of the news source. The classification system for evaluating the truthfulness of statements includes the following six categories: Pants-fire, False, Barely-true, Half-true, Mostly-true, and True. J. A. Nasir et al. developed a novel hybrid deep learning model [42] for spotting disingenuous articles. The researchers employed CNN for feature extraction and utilized LSTM for classification. The hybrid approach demonstrated superior performance compared to non-hybrid baseline approaches in the detection of fake news on two datasets, namely ISO and FA-KES. By inspiring this approach, authors [43] utilized a 1D CNN for the extraction of features and standard ML techniques for Bangla fake news classification. The proposed hybrid model obtained a 99.50% F1 score for overall data and 83.25% for fake labeled data for the random forest algorithm. Fake news concept is not limited up to text only, it can be in other visual forms as well including image, video, combination of these and only audio also. The first known use of deepfake in an election was in India's 2020 elections.

Content synthesis, or the production of deep fakes, is a common application of GAN. It uses two neural networks (a generator and a discriminator) that compete with one another across many iterations to generate more realistic content and tell it apart from real data. The authors [44] presented a thorough analysis and identification of current methods for creating and detecting deepfakes. Existing solutions utilizing ML and DL methods, as well as existing databases, are also highlighted. P. Deng et al.[45] used Google's Extreme Inception and MobileNet deep learning frameworks were used to detect deepfake videos on FaceForensics++. MobileNet has fewer features than Xception despite a comparable framework. The Fisherface Linear Binary Pattern Histogram with DBN classifier [46] detected deepfake images. The experiment included four datasets: DFFD, 100K-Faces, CASIA-WebFace, and FFHQ. The CASIA-WebFace picture dataset had 98.82% accuracy, while the DFFD dataset had 97.82%. A classical supervised-learning pipeline is used to distinguish spoof from bonafide speech [47]. The proposed approach is validated using public ASVspoof 2019 dataset. In the study [16], authors created a benchmark dataset to detect Indian fake news. The Random Forest algorithm achieved 94% text-only identification accuracy. In contrast, the Bi-LSTM architecture had 92.7% accuracy in deep learning models. Resnet-50 achieved 70.8% accuracy in 32*32 picture classification. In multi-modality research employing LSTM and VGG16, the maximum accuracy was 66% for 32*32 inputs and 74% for 224*224 inputs. The authors developed a method to assess the role of news text and visual elements in fake news prediction [48]. Textual representations are generated using a Text-CNN with a fully linked layer. Image data is analyzed using a pre-trained image2sentence model. The importance of textual and visual news is determined by cosine similarity. PolitiFact and GossipCop had 89.6% and 89.5% F1 Scores.

Researchers [49] conducted a detailed review of multimodel false news detection methods. ML and database-based multimodal fake news detection methods are also discussed. Many obstacles and potential in this subject are highlighted. SpotFake [50] uses language models and a VGG-19 model pre-trained on ImageNet to detect bogus news. Concatenating text and visual information creates a multimodal fusion module. This is fed into a fully linked neural network to detect bogus news. The study found 77.77% and 89.23% accuracy on Twitter and Weibo datasets, respectively. Based on [50], the authors used SpotFake + [51], an enhanced version. It extracts semantic and contextual information from full-length news articles and photographs using transfer learning. An Event Adversarial Neural Network (EANN) model [52] detects bogus news for new and time-critical occurrences. Three main components make up the suggested EANN model: Text and visual feature extractors make up the multi-modal feature extractor. b) The false news detector binary classifies posts using the features gathered in the previous phase. c) This latent representation helps the event discriminator label each post. The suggested model had 82.7% accuracy, 84.7% precision, 81.2% recall, and 82.9% F1 score on Weibo and 71.5% accuracy, 82.2% precision, 63.8% recall, and 71.9% F1 score on Twitter. By inspiring above mentioned EANN model, authors created the multimodal variational autoencoder (MVAE) [53] to find cross-modal connections. This model is trained simultaneously by learning the encoder, decoder, and fake news detector. The proposed architecture is being tested on Twitter and Weibo. Twitter accuracy rose from 71.5% to 74.5%, and the F1 score rose.

The analysis of various methods used for fake news detection is shown in Table II.

Depends on the specific goals, resources, and complexity of the problem some studies have utilized a single ML technique while others have employed a hybrid approach. The complexity of hybrid approaches increases accuracy and versatility but is not appropriate for all applications. Furthermore, if the dataset is skewed, the model is also biased and cannot objectively detect fake news. Using high-quality and diverse datasets is crucial for improving the accuracy of fake news identification[55].

There are various datasets available to train ML and DL models for fake news detection, some are publicly available

TABLE II. Fake news detection analysis based on several existing methods

Author's and Year	Technique	Deals with	Dataset	Results
H. Ahmed et al. 2017 [30]	LSVM	Text	25200 news articles	92% accuracy
S. B. S. Mugdha et al. 2020 [31]	Gaussian Naive Bayes	Text	538 Bangla news instances	87% accuracy
M. S. Looijenga 2018 [32]	Decision Tree	Text	613033 tweets	88% F1 Score
O. Ajao et al. 2019 [33]	SVM, HAN	Text	PHEME	86% accuracy
B. Horne et al. 2017 [34]	SVM	Text	BuzzFeed, Burfoot and Baldwin	71% accuracy
C. Lai et al. 2022 [38]	Random Forest, CNN	Text	Kaggle	Accuracy 93% on RF, 98% on CNN
D. K. Sharma et al. 2021 [16]	Random Forest, LSTM, Bi-LSTM, VGG16, Resnet-50	Text, Image	IFND	Accuracy Text (94% RF, 92.7% Bi-LSTM), Image (70.8% Resnet-50), Multi-modality (LSTM+VGG16 74%)
X. Zhou et al. 2020 [48]	CNN, image2sentence	Text, Image	PolitiFact and GossipCop	89.5% F1 score
X. Zhi et al. 2021 [39]	CNN-LSTM	Text	8000 samples	92.1% accuracy
K. M. Fouad et al. 2022 [40]	CNN, LSTM, BiLSTM	Text	9119 tweets	84.82% accuracy
ST. Suganthi et al. 2022 [46]	DBN, RBM	Images	CASIA-WebFace , FFHQ, DFFD, 100K-Faces	97.82% accuracy
C.Borrelli, et al. 2021 [47]	Random Forest, SVM	Audio	ASVspoof 2019	79% accuracy
S. Kumar et al. 2022 [54]	Naïve Bayes, logistic regression, LSTM	Text	Hindi Fake and True Dataset	92.36% accuracy
Y. Wang et al. 2018 [52]	CNN, VGG19	Text and Image	Twitter, Weibo	82.7% accuracy, 84.7 % precision, 81.2 % recall, and 82.9 % F1 score

and some are available on request. Most investigators can gather datasets from online repository sites like Kaggle [https://www.kaggle.com] for research work. Despite the fact that several datasets are available in resource-rich English and contain data from other countries, there are only a few datasets available in the Indian context[2], [16], and furthermore, there are a few datasets available for resource-poor languages or regional languages[56]. In the Indian context, we are able to find only a few datasets in English available for public use, and for Hindi (Devanagari)[57], a regional language, only a few are available. In this regard, the aim of this study is to enlighten researchers about the corpora available so that they can utilize them to address the threat of fake news. To the best of our knowledge, no survey of the datasets that are available has specifically focused on corpora that are accessible in the Indian context.

5. Existed Datasets to Detect Fake News in India

The accompanying Figure 9 depicts the research approach used in this study. A manual search technique is used, with precise keywords such as fake news, India, Indian, detection and dataset picked to correspond with the study question. Extensive literature research is carried out using a variety of resources, including IEEE Explore, Scopus, ScienceDirect, and SpringerLink. Following that, studies with relevant titles and abstracts are identified, and a thorough evaluation is conducted. This final assessment tries to discover the strengths, shortcomings, and potential future directions of the research, providing a valuable resource for researchers working in the field of fake news identification.

For a country with diverse languages and news sources like India, collecting an extensive and trustworthy dataset requires considerable time and effort. However, researchers and practitioners have begun developing datasets specific to Indian news that can assist in detecting fake news. These datasets are valuable resources and have been presented in this section. Furthermore, a comparison of these repositories based on various metrics has been drawn in Table III.

Misinformation on social media is increasingly becoming a cause for concern, especially during elections in many countries. To address this issue, J.C.S. Reis et al. (2020) compiled a dataset of verified images circulated on

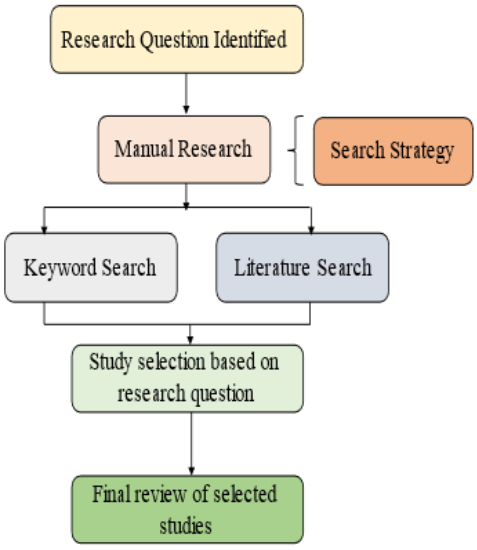

Figure 9. Methodology Overview

WhatsApp during the elections in Brazil and India[58]. The dataset was designed to help researchers better understand how misinformation spreads on social media, particularly in developing countries where WhatsApp is widely used. The dataset covers fake news shared during elections in two different countries, namely the Brazilian elections of 2018 and the Indian elections of 2019. It is comprised of 135 verified images for the Brazilian election and 897 for the Indian election along with annotations indicating their veracity. Fact-checking was performed by trained journalists and researchers, ensuring the accuracy and reliability of the annotations. By analyzing this dataset, researchers can gain insights into the types of misinformation that are commonly spread on WhatsApp[9], as well as the factors that contribute to the spread of false information. This information can then be used to develop strategies for combating misinformation on social media, such as educational campaigns or algorithmic approaches that can detect and remove false information.

The term Hostility refers to the presence of malicious intent or harmful motivations behind the spread of false information. Hostility can take many forms, such as political propaganda, disinformation campaigns, or personal attacks. False news is considered hostile when it is created and spread with the intention of harming or misleading people. The detection of hostility in false news is an important aspect of identifying and combating the propagation of false information. By understanding the motivations behind fake news, it is possible to develop strategies to counteract its effects and limit its reach. Hostility in fake news can be detected using various machine learning techniques, such as sentiment analysis, natural language processing. Even though Hindi is the third most commonly spoken language globally and has a substantial presence of Hindi material on social media networks, it is surprising that no significant dataset related to identifying fake news or hate speech in Hindi could be found. Therefore, a dataset has been created by M. Bhardwaj et al. (2020) "A Hostility Detection Dataset in Hindi [59]" which includes 8192 online posts in the Hindi language that have been labeled to indicate the presence or absence of hostile sentiment. The dataset covers four hostility dimensions, which are fake news, hate speech, offensive, and defamation posts, as well as a non-hostile label. This dataset has been used as part of the CONSTRAINT-2021 shared task on hostile post-detection. The authors of the dataset have benchmarked it using four traditional machine learning algorithms: Support Vector Machine (SVM), Decision Tree (DT), Random Forest (RF), and Logistic Regression (LR), with SVM reporting the highest weighted F1 score of 84.11%. By providing annotated text data, this dataset can help develop effective solutions for combating cyberbullying, moderating online content, and conducting sentiment analysis of social media posts in Hindi.

The issue of misinformation is not limited to resource-rich languages alone. To address this issue, the authors of the paper propose a novel approach for fact-checking in low-resource Indian languages based on factorization. As in India, where many people speak low-resource languages, the spread of misinformation can be especially problematic. There are challenges associated with developing a fact-checking system for low-resource Indian languages, such as the lack of annotated data and NLP resources. The authors then propose a factorization approach for fact-checking, which involves dividing the fact-checking task into two subtasks: claim verification and source verification. The claim verification subtask involves determining whether a claim is true or false, while the source verification subtask involves determining the reliability of the source of the claim. S. Singhal et al. (2021) created a dataset called FactDRIL[56], which contains 22,435 fact-checked news samples. Among these samples, 9,058 are in English, 5,155 are in Hindi, and the remaining 8,222 are in several regional languages, including Bangla, Telugu, Marathi, Malayalam, Tamil, Oriya, Sinhala, Assamese, Punjabi, Urdu, and Burmese. The dataset covers a wide range of domains, including health, society, religion, politics, world events, and elections.

The IFND dataset [16] by D.K. Sharma and S. Garg (2021) is composed of more than 10,000 articles that pertain only to India, with half of them being real news and the other half being fake news. The fake news articles are taken from various fake news websites, while the real news articles are sourced from credible news sources such as BBC and CNN. The articles are written in English and cover a diverse array of topics, such as politics, health, and entertainment. The authors of the study also conducted several experiments to assess the performance of existing fake news detection systems on the IFND dataset. They

discovered that these systems perform inadequately on the dataset, with the best system achieving a mere F1-score of 0.72. This emphasizes the need for additional research in the realm of fake news detection. To sum up, the IFND dataset is an essential asset for fake news detection researchers and experts. It provides a more realistic and demanding evaluation standard for fake news detection systems, which can contribute to the development of more efficient algorithms for identifying fake news.

A. Dhawan et al. (2022) acknowledged the importance of having a dataset of fabricated news events in India due to the increasing spread of misinformation and its potential impact on society. As a part of their investigation, they created a compilation of fabricated news incidents called "FakeNewsIndia[2]," which includes 4803 instances of fake news occurrences that took place in India. The dataset comprises 5031 Twitter links and 866 distinct YouTube video links, with the severity of impact categorized as low, medium, and high. The authors obtained the data by exploring various sources like news agencies, fact-checking websites, and social media platforms to discover and compile instances of fake news. The authors gauged the impact of the fabricated news by analyzing the engagement rate and like ratio.

B.S. Ahash et al. (2021) aimed to tackle the difficulty of identifying fake news in the Hindi language, which has received limited attention from researchers despite being widely spoken in India. To do this, they gathered a Hindi news dataset[57] from various sources containing 1022 genuine and 1156 fake news articles, including those from online news websites and social media platforms, and annotated the data to identify whether the news was genuine or fake. The authors utilized the labeled dataset to train and assess various machine and deep learning models, ultimately resulting in remarkable accuracy rates for detecting fake news. Specifically, the Naive Bayes classifier achieved 88.23%, Logistic Regression achieved 89.15%, and LSTM achieved 92.36%. They also analyzed the features that were most significant in detecting fake news in Hindi, identifying features such as word frequency and sentiment analysis as particularly important.

The research underscores the importance of developing models that are specifically designed for the Hindi language, given its unique linguistic and cultural characteristics. In the Indian context, various datasets have been developed and utilized for the detection of fake news, each with its own unique set of features and characteristics. These datasets play a crucial role in training and evaluating ML models designed to identify and combat fake news in India's diverse and complex media landscape. Figure 10. below shows the evolution of datasets over time.

The proliferation of fake news can be done in various ways, whether it's through text, images, audio, or a combination of these forms. This mode of communication is

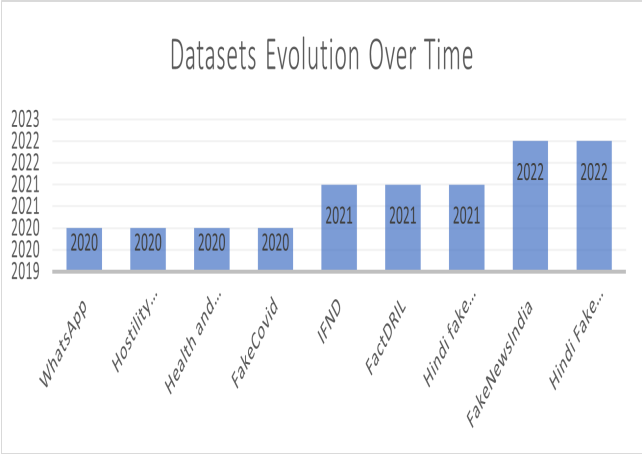

Figure 10. Indian Context Datasets evolution overtime

known as a modality. Some datasets may only contain one type of modality, known as "unimodality", which can either be text-only or image-only. Other datasets may include multiple modalities, referred to as "multimodality". Using a combination of text and multimedia content can make news more appealing and attention-grabbing for readers. It is also true in cases of fake news; as it can be more convincing if the text and multimedia content are coordinated to support each other. Researchers are actively working to address this problem. Following Figure 11. is the analysis of the Indian context datasets in terms of modality exploration:

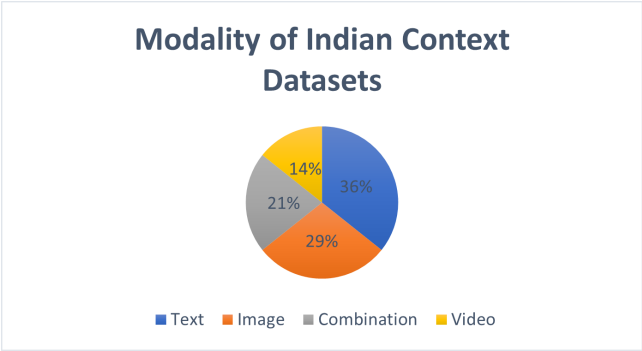

Figure 11. Modality of Indian Context Datasets

6. Discussion

The study reveals that fake news is a significant problem for society, and it is crucial to take steps to mitigate its adverse impact. By conducting a comprehensive survey, the study offers valuable insights into comprehending and stopping the production and dissemination of fake news. Consequently, the study has both theoretical and practical significance.

Theoretical Implications The research has significant theoretical implications as it offers a comprehensive understanding of fake news, including its objectives, intentions,

TABLE III. Indian Datasets for Fake News Detection: A Comparison of Key Features and Characteristics

Dataset and Year	Modality	Language	Size	Domain	Label	Availability Link
WhatsApp, 2020[58]	Unimodality	English	135 images from Brazil and 897 from India	Election	Real, Fake	Blank
FakeCovid, 2020[60]	Unimodality	Hindi, English, German	English (2116), Hindi (141) and German (47)	COVID 19	Fake, others	https://gautamshahi.github.io/FakeCovid/
Hostility Detection Dataset in Hindi, 2020[59]	Unimodality	Hindi	8192 online posts	Covid, Politics	Hostile (Hateful, Fake, Defamation and Offensive) or NonHostile post	Blank
Health and Well Being (HWB), 2020[61]	Unimodality	English	Total 1000 news	Health	Real, Fake	https://dcs.uoc.ac.in/cida/resources/hwb.html
FactDRIL, 2021[56]	Multimodality	Regional Indian Languages	22435 news samples	Health, Society, Religion, Politics, World, Elections	Fact Checking	https://bit.ly/3btmcgN
IFND, 2021[16]	Multimodality	English	37809 True and 19059 Fake news	Election, Politics, COVId19, Violence and Miscellaneous	Real, Fake	https://www.kaggle.com/datasets/sonalgarg174/ifnd-dataset
Hindi Fake News Classification Dataset, 2021[57]	Unimodality	Hindi	6487 fake news articles and 6707 authentic news articles	Blank	Real, Fake	Blank
FakeNewsIndia, 2022[2]	Multimodality	English	4803 fake incidents with 5031 Twitter links and 866 YouTube links	Impact Assessment of fake news	Impact Level Low, Medium, and High	On request to author
Hindi Fake and True Dataset, 2022[54]	Unimodality	Hindi	1022 real, 1156 fake	Politics, Business, Sports etc	Real, Fake	On request to author

and the types of information it conveys. The study also investigates the psychological and societal factors that contribute to the spread of fake news, as well as the role of social media. Moreover, the research explores the history of fake news and its prevalence in India, while underscoring the importance of datasets in detecting and preventing its dissemination.

Practical Implications In terms of practical implications, the study underscores the significance of datasets for fake news detection, as they provide the data used to train and evaluate ML models. Without access to a vast, diverse, and representative dataset, it would be challenging to develop accurate and effective models for identifying fake news. Therefore, the datasets, discussed in the paper, may act as a foundation for readers interested in creating their own classifiers and advancing this research further.

Limitations While this study has valuable insights on fake news, there are some limitations that suggest the need for improvement. For instance, the survey only covered articles in English, which might introduce a selection bias. Furthermore, most annotated datasets currently available concentrate on text-based information, with limited consideration given to attributes such as visual information, network information, or spatiotemporal information. In the future, research efforts could focus on creating a more comprehensive dataset that includes all relevant attributes related to news content, social context, and spatiotemporal information. It would also be preferable to generate datasets in languages other than English, since fake news is not exclusive to the English language.

7. Conclusion

The rise of technology has brought about a global shift towards digitalization, which has its advantages but also presents certain challenges. One of these challenges is the issue of fake news, which can have serious effects on society by spreading false information and influencing people's beliefs and opinions. For instance, fake news related to politics can manipulate people's viewpoints on candidates and policies, potentially impacting election outcomes. Inaccurate information related to health and science can also harm public health, such as spreading false information about COVID-19 and its treatments. Fake news can result in confusion, distrust, and division among individuals and groups, and can even lead to real-world consequences, such as violence or discrimination against particular communities. Additionally, the internet and social media have made it easier to spread fake news, which can make it difficult for people to differentiate between accurate and inaccurate information. It is, therefore, crucial to fact-check information and be careful when consuming news from unverified sources. Therefore, the selection of the right target dataset is a critical aspect of validating analysis outcomes or assessing the efficiency of suggested models in fake news research. This study intends to aid fake news researchers by providing them with appropriate datasets and enhancing the quality of research on the topic.

TABLE IV. List of Acronyms

Acronym	Meaning
CNN	Convolutional Neural Network
DBN	Deep Brief Network
DL	Deep Learning
LSTM	Long Short-Term Memory
ML	Machine Learning
NLP	Natural Language Processing
RBM	Restricted Boltzmann Machines
SVM	Support Vector Machine
TF-IDF	Term Frequency- Inverse Document Frequency
VGG	Visual Geometry Group
XAI	Explainable Artificial Intelligence

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