A CONCEPTUAL MODEL FOR EARLY DETECTION OF FAKE NEWS

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ABSTRACT

In the era of technology and digital media, the stormy interaction and massive spread of information have increased the significance of the need for credible information. The concept of fake news or forged news in that regard is not new and its ultimate profound impact on the addressed audience. This malicious act causes discomfort, character assassination, privacy breach, and defamation of the targeted audience. Such news is endorsed to disrupt society's normal functioning. Fake news due to its persuading terminologies and factors tends to destroy the openness to truth seeing. It interrupts the normal thinking process of the targeted audience and they end up having a typical or tuned mindset which ignites violence in society. Reviewed research depicts that automated detection of fake news has always been the prime focus whose authenticity according to the researchers' community, however, is still questionable. It is important to understand that automation without unfolding the core constructs based on which news is labeled as fake can never be relied as the pattern of news dispersion and creation changes with time or invention in technology. Moreover, manual detection has correspondingly added value to the existing research in terms of the detection of fake news. However, it is considered a costly and tiresome task. It is also notable that the present research is ignoring the fact that what makes news a fake news.

The need of the hour is to make an effort to carry the focus to the constructs contributing or labeling to the detection of fake news at early stages based on the previous and recent state of knowledge. Furthermore, a conceptual model to standardize the detection process based on verified contributing core constructs needs to be developed. The objective of this research is to identify the constructs, classify and categorize news for the detection of fake news. Thus, this research contributes a conceptual model encompassing different core constructs contributing to the early detection of fake news from the point it originates and disperses. On that account, a systematic literature review methodology is conducted to extract constructs from existing literature along with implicit and explicit removal. Subsequently, the data coding technique of grounded theory is applied for encoding the extracted data. Lastly, expert reviews have been conducted for the validation of that proposed conceptual model encompassing core constructs contributing to the propagation and dispersion of fake news. Resultantly, a total of 74 constructs are identified which are further grouped into 15 categories. This research will eventually help data-scientist to label the news as fake or real based upon the recognized, verified constructs.

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LIST OF ABBREVIATIONS

ML	-	Machine Learning
NLP	-	Natural Language processing
NN	-	Neural Network
CNN	-	Convolutional Neural Network
SVM	-	Support Vector Machine
IoMFT	-	Internet of Fake Media Things

LIST OF APPENDICES

DEDICATION

Alhamdulillah… All praises to Allah Almighty for making me who I am today and letting me achieve my dream. I dedicate this thesis work to my professors and lovelies Arsam Bhai, Zami Bhai, Shaista Khala, and Hani.

A special thanks to my best friends, my Saifo (papa), and mamma who have always been a pillar of strength for me throughout my life. My papa, who loved me unconditionally and made me who I am today THE STRONGEST AND A PROUD DAUGHTER. I will always LOVE you and cherish your memories Saifo (In shaa Allah).

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CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter encapsulates the introduction of fake news, its dispersion platforms, and its brief impact on a considerable audience. The background of research in this chapter demonstrates that research work in said field is not mature enough to cater to the issue of fake news to the required extent. So, the research problem, aim of the research, and scope of research, along with research questions, are mentioned in the chapter. The research problem depicts the need of conducting this research concerning existing studies and the scope of the research includes the enlisting of opportunities that can be paved through this particular research conduction. The outline of the paper is also mentioned in the discussed chapter to state the flow of the thesis.

1.2 Background Research

Social media are the applications or web forums that are internet-based and they permit users to share information, set of ideas, real-life events, or any content in the form of images, text, video, audio (Chen et al. 2020)(Qawasmeh, Tawalbeh, and Abdullah 2019) Uniform resource locator (URL) (Kaur, Kumar, and Kumaraguru

2020)(Wynne and Wint 2019), posts, articles (Kaur, Kumar, and Kumaraguru 2020), junk emails and messages (Jain et al. 2019) that might fascinate public at large. The the inception of the concept of social media was introduced in the 20th century but it got hype in the early 2000s after the invention of the concept of blogging (Hendricks 2013). The world has turned into a global village and this has led to the consumption of the internet at an extensive level.

Access to social media platforms is just a sign-up away. It is claimed that 57% of the world's population which means more than half of the world is currently having the access to the internet and out of that 55% is using at least one social media forum (Alves and Fernandes 2013)(Alves, Fernandes, and Raposo 2016) (DataReportal, 2021). A wide range of social media platforms was introduced over the years to ease communication among communities without bothering physical distances. On social media forums, activities like instant messaging, online games, image, audio or video sharing, URL and posts sharing, electronic commerce, management of business, information sharing, ideas sharing forum and news dissemination are being observed.

Social media serves as a forum that is immensely interactive to its users. This exceptional interaction with social media brought many cons to its users along with the bombardment of information. Users can have massive information within no time but the authenticity of that information is never guaranteed. They can connect to people around the globe with no hindrance but keeping secure and authentic information at stake (Zhou and Zafarani 2020a). Worthy things come up with a price tag thus, social media as a consequence has largely influenced the lives of many individuals and organizations by carrying out misinformation. Such news is then labeled as fake news or forged news.

Fake news also named forged or junk news refers to false propaganda that is dispersed to defame the targeted audience that could be government and non-government institutions, public figures, or an individual. This term got into the spotlight in 2015, once media analysts observed the profound impact of fake news

(Gadek and Guélorget 2020). Its most common propagation forum is social media and this forum due to its free or less expensive sharing capabilities and no verification policy (Kandasamy and Murugasamy 2021) makes it difficult to identify the broker of news. Fake news detection has grasped the attention of academicians, researchers, and industrial representatives due to the deep rapid circulation of misinformation through social media forums.

It damages one's reputation and can create mistrust in society about a particular organization or an individual. The high usage of social media, cheap rates, and economic benefits, attainment of cheap publicity, character assassination, blame game, power, and political benefits lead the sender to spread fake news. Constructs including repeated exposure of fake news, controlled perception, peer pressure, biased entities, and political, economic, and national interest lead the involvement of entities to disperse or get affected by such news (Zhou and Zafarani 2020a)(Kandasamy and Murugasamy 2021). Ease of access to most of the audience has increased the fake news's wide dispersion. It creates distress in society as a whole. Also, such news is causing severe health issues that are depression, anxiety, inattentiveness, and addiction (Burdisso, Errecalde, and Montes-y-Gómez 2019).

Generally, there are three categories for understanding the structure of fake news: facts that are manipulated unknowingly due to misguidance, reaction to some event, or lack of information; facts that are sarcastically manipulated without malicious intentions; and facts that are manipulated to defame an individual or an organization (A. Pathak 2019)(Rubin, Chen, and Conroy 2020)(Wardle 2017).

Also, few researchers assert that it has no universal definition to cross-check the betrayal factors of news (Zhou and Zafarani 2020a). Since the news has a large number of subjects and a large amount of data that propagates from multiple users with different intentions around the globe which makes it is difficult to cater. Fake news detection as earliest as possible is the prime requirement but before that understanding, the problem deeply and thoroughly is even more important for its authenticity. Fake news can be in any shape but the intention of its dispersion remains the same which is misguiding the targeted audience or construction of an

opinion in society or informing the targeted audience without having any authentic information grounds. The problem lies with the proportion and type of data being trained for automated detection of fake news. Currently, available datasets are not adequate to detect fake news at earlier stages since many social media platforms assert that the privacy of users' is their priority thus collection of data for the concretion of datasets is debatable. It is unquestioned that fake news is all about complex enormous data that need to be taken into account or at least most of it (Torabi Asr and Taboada 2019).

Fake news gets forged differently so news dispersion on social media needs to be controlled as early as possible (Kandasamy and Murugasamy 2021). Hence, it is required to get a basic conceptual model (Mondal et al. 2018)(Qazi, Khan, and Ali 2020) covering core constructs to work on root causes of fake news' dispersal which in the long run will help data scientists to automate tools for the detection of fake news as earliest as possible.

1.2.1 Research Problem

Fake news dispersion on social media is one of the critical challenges in this era of technology. News on social media might have a short life cycle yet it has a profound impact on the addressed audience. The growing concern of spreading the fake news and its consequences deemed utmost urgency about how to discontinue this chain of misinformation. The intensity of the issue to differentiate between fake and real news is an obstacle faced in existing studies. Though existing studies have focused on developing different mechanism for detection of fake news including data science, natural language processing (NLP) (Zhou and Zafarani 2020a)(Jain et al. 2019)(Antonakaki, Fragopoulou, and Ioannidis 2021)(Agarwal et al. 2019) (Kim and Jeong 2019)(Shu et al. 2020)(Qawasmeh, Tawalbeh, and Abdullah 2019), supervised and unsupervised machine learning (Chen et al. 2020)(Qawasmeh, Tawalbeh, and Abdullah 2019)(Zhou and Zafarani 2020a)(Jain et al. 2019)(Agarwal et al. 2019)(Bondielli and Marcelloni 2019)(Zhou et al. 2019)(Habib et al. 2019), supervised and unsupervised deep learning (Chen et al. 2020)(A. R. Pathak et al.

2020)(Kim and Jeong 2019)(Shu et al. 2020)(Bondielli and Marcelloni 2019)(Habib et al. 2019)(Abedalla, Al-Sadi, and Abdullah 2019)(Islam et al. 2020)(Gereme and Zhu 2019), crowdsourcing approach (Mondal et al. 2018), data mining (Burdisso, Errecalde, and Montes-y-Gómez 2019) , conventional neural network (CNN) (A. R. Pathak et al. 2020)(Hassan and Meziane 2019)(Ruchansky, Seo, and Liu 2017)(Earlier detection of rumors in online social networks using certainty - factor - based convolutional neural networks n.d.), hybrid approach (A. R. Pathak et al. 2020), block chain (Chen et al. 2020) for early detection of fake news. Progressive research is observed where researchers have started exploring the fake news detection both manually and automatically under the data-science field considering the datasets, which limits the research authenticity. Available datasets offer limited data as it is collected from multiple sources and a big chunk of data cannot be collected due to the restrictions applied due to the data security perspective (Jain et al. 2019). However, little research has focused on exploring the core constructs required for the early detection of fake news. Without considering the fact of what core constructs and other adaptable methods are required for early detection of fake news, the development of automatic tools and implications of data science for detection is invaluable (Zhou and Zafarani 2020a)(Qazi, Khan, and Ali 2020). This research aims to explore a conceptual model that would help in labeling a news as fake news by distinguishing fake news from real news.

Therefore, this research proposes to address this disparity by identifying, classifying, and categorizing detailed core constructs that are mandatory for detecting fake news at early stages. Furthermore, there is a dire requirement to develop an authenticated, effective and efficient conceptual model for early fake news detection including all the core constructs contributing to the dispersion of fake news (A. R. Pathak et al. 2020)(Qazi, Khan, and Ali 2020).

1.3 Research Question

Research questions aids in pinpointing the area of research being focused on, to keep the research relevant. The addressed research questions in the present research are mentioned below.

i. What are the constructs considered for the early detection of fake news?
ii. How the identified constructs can be grouped meaningfully for the early detection of fake news?

1.4 Research Objective

The objectives of this research are given as follows.

i. To identify the constructs considered for early detection of fake news.
ii. To classify and categorize the extracted core constructs for early detection of fake news.

1.5 Aim of Research

This research aims to extract and list down all core constructs required for early detection of fake news through exiting literature. Moreover, it aims to develop a conceptual model based on those core constructs of fake news by meaningful classification and categorization of identified constructs.

1.6 Scope of Research

To the best of the author's understanding, the current research arena emphasizes more on automation of tools that can detect fake news rather than the

explanation of constructs which constructs should be considered, what are the relevant aspects required during the automation procedure (Castelo et al. 2019)(Aloshban 2020). So, the scope of this research is to identify the constructs and develop a conceptual model that will eventually help to categorize that news can be labeled fake or real. This research work is unique in nature by providing ease to future researchers aiming to contribute to the field of investigating fake news.

1.7 Contribution of Research

The present research considerably contributes to the detection of fake news at the earliest. It contributes by proposing a conceptual model extracted from existing literature by following systematic literature review, data coding technique of grounded theory, and expert review. It enlists the detailed core constructs that are mandatory for the early detection of fake news. These identified core constructs include the constructs contributing to the propagation and dispersion of fake news. These constructs are passed through implicit removal and explicit removal to remove redundant information. It is important to understand that the extracted constructs if controlled at early stages can help in the halt of the cycle of misinformation or fake news. Research papers selection is done through quality assessment procedure of systematic literature review to authenticate research by adding valuable and accepted research papers. The gained core constructs extracted from systematic literature review and after implicit and explicit removal are 74.

These core constructs are meaningfully classified and categorized using the data coding technique of grounded theory. These constructs are further grouped into 15 categories which include those extracted constructs. To conclude an authentic and effective conceptual model for the detection of fake news at early stages, an expert review has been done. Through the expert review, the suggested model along with its group names and constructs are verified.

1.8 Thesis Outline

This paper is structured in five sections. The first section describes the brief introduction of the paper which comprises of overview of chapter one, the background of research, research problem, research question, and objective of the research, aim of the research, research's scope, and research's contribution along with an outline of the thesis. The second chapter illustrates a literature review that includes a brief presentation of all the existing literature being reviewed during the present study, the definition of fake news, and early detection of fake news.

The third chapter discusses the methodology of the proposed architectural model comprehensively. The fourth chapter portrays the results of the study with a discussion to define the work done. The fifth chapter contains future work and limitations of the proposed study. It details the conclusion by presenting a brief review of the paper in a paragraph.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

The definition of fake news, terms related to fake news, and detection of fake news at early stages in existing literature are considered in the preceding chapter. The existing literature is presented in this chapter to explain the need for the said research. Existing literature along with its contribution to present research and the research gaps are discussed in this chapter.

2.2 Definition

News refers to a piece of information spread through any means to educate, entertain or ridicule the targeted audience. Fake news is a term that has different shapes along with different terminologies. The term ‘Fake News’ is defined or perceived differently by different researchers. The researcher community has named it differently depending upon the intent of dispersion of news on social media forums.

A few of the terminologies referred in existing studies by the researcher community are post-truth (Gadek and Guélorget 2020)(Al Asaad and Erascu 2018)(Emotion cognizance improves health fake news identification n.d.)(Zhou and Zafarani 2019), false information (Islam et al. 2020), disinformation (A. Pathak 2019)(Wardle 2017)(Bondielli and Marcelloni 2019) (Al Asaad and Erascu 2018)

(A. R. Pathak et al. 2020)(Jain et al. 2019)(Yaqub et al. 2020), rumor (A. R. Pathak et al. 2020)(Jain et al. 2019)(Bondielli and Marcelloni 2019)(Islam et al. 2020)(Mondal et al. 2018)(Ma et al. 2020), misinformation (A. Pathak 2019)(A. R. Pathak et al. 2020)(Qawasmeh, Tawalbeh, and Abdullah 2019)(Shu et al. 2020)(Castelo et al. 2019)(Yaqub et al. 2020)(You et al. 2020)(Almaliki 2019), mal-information (A. Pathak 2019)(Wardle 2017), internet of fake media things (Chen et al. 2020), hoaxes, half-truth (Kapusta et al. 2020), false information (Islam et al. 2020), fabricated news, manipulated news (Fake News Detection using Deep Learning n.d.), unverified news (Huang et al. 2020), false news (Guo et al. 2020), and infodemic (Emotion cognizance improves health fake news identification n.d.)(Espiritusanto and Dinant 2021).

Few researchers assert that there is no unanimously accepted definition with which the multi-dimensional domain of fake news can be covered (Zhou and Zafarani 2018) (Zhou and Zafarani 2020b) however, several researchers declared few definitions of fake news or the terminologies associated with the term fake news.

Fake news is the kind of news that contains misinformation, manipulative and biased statements, targeting a group or an individual having malicious intentions. Such news helps in opinion-shaping of the public at large or strengthens pre-notions or existing views associated with an incident (Abedalla, Al-Sadi, and Abdullah 2019)(Nyow and Chua 2019). In this era, due to advancement and lack of time, one does not have time to get news from traditional ways so it gave free hand to extensive social media usage that follows no standards. This era is considered to be the golden age of fake news. This liberty led social media user's face the challenge of identifying fake news and the credibility of news is always at stake (Bondielli and Marcelloni 2019).

It has distracted and desensitized individuals or societies over crucial incidents. This is why incidents remained unsettled and cause distress. That's why there is a need to detect fake news at the early stages to avoid all these issues. Early fake news detection refers to the detection of fake or forged news at the initial stages when it's not dispersed to the mass audience yet (Zhou et al. 2019). It will eventually

help in settling down the receivers mistrust in news brokers, unwanted violent behaviors, extremism, and discourteous behavior in societies (Agarwal et al. 2019).

2.2.1 Fake Definition: Author's Perspective

Based on existing knowledge and in the author's perspective fake news or forged news carries content that intends to control the way people think, spreads violence in terms of culture and religion, exploits information, character assassination, business rivalry, spread vulgarity, to harm one mentally and emotionally. As a consequence, it destabilizes the normal functioning of a society.

2.3 Early Detection of Fake News

Detection of fake news at early stages is crucial as if not detected earlier can cause severe damage to society as a whole. Though, many researchers have discussed this topic of concern early detection of fake news, however, an explicit gap can be seen in the literature. Literature shows that there is a demand for early fake news detection before its widespread, (Kandasamy and Murugasamy 2021) automated tools, and the core constructs on which news can be labeled as fake news.

Few researchers have discussed early detection of fake news however, most of them have provided theoretical importance, data science projects where datasets have been considered to predict the fake news, and few studies have focused to develop tools using crowdsourcing, natural language processing (NLP), and machine learning. However, it is being noticed that there is a limited number of gold standard datasets available for labeling news as fake which is a challenging and delayed task (Guo et al. 2020).

Few authors propose merging different techniques and methods to develop a detection tool for early detection of fake news for the future. The authors proposed to

adopt more relevant datasets with the incorporation of auxiliary information in the future (Wang et al. 2021).

Limited researchers have discussed few core constructs such as unintentionally manipulated facts, sarcastically manipulated facts, and intentionally manipulated facts. Fantahun Bogale, William Zhu and Bashar Al Asaad, Madalina Erascu notably in their corresponding researches has proposed the idea of detection of fake news at early stages to halt its wide dissemination (Deepak and Chitturi 2020). However, their literature has prioritized automatic detection techniques with no reference point to convert plugins. Literature scarce core constructs required for early detection.

Such constructs are valuable for the development of a mechanism for fake news detection, but also mandatory for the development of future software automated detection tools. Ignoring such crucial aspects can lead to a theoretical discussion in research; undermine the real detection of fake news on social media. Therefore, this research is addressing this gap by identifying the core constructs considered for the early detection of fake news. This will further be meaningfully grouped based on identified constructs and the development of a conceptual model for early detection of fake news fake after careful review.

2.4 Existing Studies

News refers to stating facts and figures of an event happening or happened through some channel targeting a set number of audiences. It is the information received first handedly through some source of information. The main purpose of news is to inform, guide, educate and entertain but now malicious intents have also been added to the list. Stereotypically, there are three categories for news propagation that are print media, electronic media, and social media. Amongst all, social media platforms have grasped the attention due to their rapid and easy access to a large audience for propagating news (Nyow and Chua 2019). The history of mankind is filled with fake news and its consequences on a group of people or

individuals. It all started in the early 19th century, a newspaper named Sun claimed that the moon is having an alien development that is when fake stories were introduced (CITS 2019). Such news was spread on purpose to increase the circulation of newspapers and make them popular amongst people.

Exaggeration of events has constantly been a trend of the news market grabbing the attention of the targeted audience. It has become a major concern for researchers recently. Its wide and easy spread has allowed senders to be a part of this malicious act and also receivers can be a part of this vicious cycle (Burbach et al. 2019). Without authenticity, news disperses within no time among most of the receivers (Nyow and Chua 2019). Brokers of fake news do this as a publicity stunt, to influence people's minds, out of professional jealousy, or for fun, imparting a negative impact on the receiver. Due to the excessive use of the internet and social media, fake news brokers have targeted these platforms for spreading the news with malicious intent.

This world is a center of happenings and in these scenarios, fake news explodes as if it's all truth being told. Fake news turned into a global concern when society urged to take it as a serious concern. Researchers around the globe have done work in this particular area of concern. Also, few researchers have emphasized the need for early fake news detection which is a novel area of research up till now. Distinguishing fake news and genuine news requires a secure, well-established mechanism to detect fake news at early stages.

Untruthful information is categorized into four different types that are named as a rumor, fake news, misinformation, and hoax by the researchers. The discussed research paper provides a survey on existing studies encompassing categorization of untruthful information, approaches for detection of fake news, and how these factors affect the decision-making process. However, future research needs to be done in account to address healthcare, education, and politics. Also, a hoax in the domain of untruthful information is the least considered area that needs to be focused on. Francesco Pierri and Stefano Ceri have also categorized untruthful information as disinformation, junk news misinformation, satire, rumor, propaganda, hoaxes, and

clickbait depending upon the intentions of the news creator. Researchers (Habib et al. 2019)(Pierri and Ceri 2019), second the idea of different kinds of untruthful information as satire, hoax, and misleading information, clickbait, out of context information, conspiracy, and propaganda. Information is categorized into three categories such as misinformation, disinformation, and misinformation depending upon the intentions of the news creator (Wardle 2017).

Information verification through fact validation or checker is available online but those are not considered as effective as it demands manual validation of an expert of that particular area which ultimately slows down the process of the information cycle (Mishra and Setty 2019).

Xinyi Zhou and Reza Zafarani (Zhou and Zafarani 2018)(Zhou and Zafarani 2020a) discussed the issue of fake news detection by presenting a survey-based analysis using qualitative, quantitative, and intervention techniques. This research paper reviewed and summarized the existing theories, models, and empirical approaches to detect fake news. It presented four parameters for detection as false knowledge, writing style, propagation style, the credibility of creators' and spreaders.

K. Shu, A, Sliva (Rubin, Chen, and Conroy 2020)(Granskogen and Gulla 2017) presented a thorough review of detection and characterization of fake news on social media through data mining perspective and datasets available. It presents the idea of fake news detection by knowledge-based, style-based, stance based and propagation-based. Fake news can be characterized based on psychology foundation, malicious foundation, echo chamber, and social foundation. It is significant to understand that available datasets cannot be considered as a benchmark as it does not cover all the aspects helpful for fake news detection.

Victoria L. Rubin, Yimin Chen, and Niall J. Conroy have classified three types of fake news: forgery news, comic news, and hoaxes or intentionally fabricated news. The main purpose to create forgery news is to melodramatize or misrepresent a certain event with little or no knowledge with the help of striking captions. The sole motive to create comic news is fun and entertainment and usually, no harmful

intentions are meant by the publisher of news. Intentionally fabricated news as the name states have the motive to harm and they invoke negative emotions of a certain group to harm the targeted audience (Rubin, Chen, and Conroy 2020).

Fake news detection is a difficult procedure as it encompasses many factors. The world is having multiple languages and each language consists of various patterns of writing, various expressions of humor, and its fundamentals which makes detection a difficult procedure. However, its adverse effects can be controlled by using artificial intelligence. Yet, research scarce the basic core constructs that can be helpful in the labeling of news as fake through their automated tools (Agarwal et al. 2019). An analysis for the detection of rumor, available datasets for rumor detection, areas where it's applicable along with analysis of existing detection approaches has been done in this existing research paper. This revealed that existing studies puts more focus on detecting fake elements from long texts. It stresses the need of finding shreds of evidence before automated tool labels news as fake instead of just labeling news as fake without any provision of evidence (A. R. Pathak et al. 2020). Another study also seconds the dire need for assessment and authentication of existing automated tools to avoid the misinformation cycle (Almaliki 2019).

The information cycle on social media has always been a vicious cycle. Automatic detection replaced manual detection done by experts (Mustafaraj and Metaxas 2017). Manual checking websites are unable to cater to the large volume of data available on social media and automatic detection techniques lack gold standard datasets that can be considered viable in the detection of fake news (Nyow and Chua 2019).

Decisions based solely on the piece of information being displayed on social media without knowing its intent or furthermore constructs need to be improved this issue remains with the invention of automatic detection (Figueira and Oliveira 2017).

Alteration of news propagated on social media affects a wide range of the public by shaping their opinions and lives. Verification standards are useful but they do have certain hindrances for authentic detection of fake news that are discussed in

the discussed research paper. Detection of fake news gets more difficult once a user gets exposed to social media more than usual as one starts believing the repetitive news circulated on social media. Interestingly, based on headline-only news gets viral without further verification and going through the news's content (Yaqub et al. 2020).

In (Burdisso, Errecalde, and Montes-y-Gómez 2019), a detailed framework is given to detect fake news by qualitative, quantitative, and intervention news. It also presents four parameters that are false knowledge, writing style, propagation style, and credibility of creators and spreaders. Data is reviewed and summarized using existing resources.

To confine the widespread of fake news dissemination it's necessary to understand its creation patterns, identification, its impact, and ways to cater to those drastic impacts on individuals and society. This research paper suggests the idea of first identifying these factors to narrow down the research area for the accurate detection of fake news. Any information available on the internet can eventually turn out to be fake which makes detection a difficult task. The topic agnostic approach is used for checking the truthfulness factor on web resources (Castelo et al. 2019). Fake news encompasses news itself, reporter of news, and addressed the audience. In (Shu, Wang, and Liu 2017), the researcher gives an insight for future directions and mentions the drastic need of analyzing features for early detection and for modeling these features into analyzing fake news motives through the psychological point of view. Researchers agreed upon the three aspects of fake news detection that are news content, reporter of news, and feedback of addressed audience of shared information (Ruchansky, Seo, and Liu 2017).

In (Al Asaad and Erascu 2018), researchers discuss the format of satire news differentiating from traditional fake news by its format and style of delivering news. It also presents five predictive features in SVM based algorithm.

One of the biggest contributors to fake news' dissemination widely is the fact that people anticipate and believe upon news spread from social media platforms.

The research paper (Abedalla, Al-Sadi, and Abdullah 2019), reviews the background of fake news detection methods in deep learning and machine learning and its problems.

It is alarming to see how Facebook and WhatsApp have largely contributed to the dissemination of fake news through their platform and are unable to be detected. In (Jain et al. 2019), a researcher based upon the NLP, machine learning, and SVM proposes a model for fake news detection encompassing components like an aggregator, authenticator, and recommendation system.

The researcher scrutinizes the existing approaches of fake news detection methods. It has grouped multiple existing approaches of detection methods that are: machine learning method, knowledge-based, neural network, and conventional method (Hassan and Meziane 2019). In the submission (Bondielli and Marcelloni 2019), different kinds of division of fake information its features, and extant methods are discussed by reviewing existing literature.

With leading advancements in automated gadgets and extensive usage of social media platforms information reaches a wide range of audiences without any authentication. Taking this aspect into an account, Bashar Al Asaad and Madalina Erascu give an insight to future aiming to the labeling of data to achieve high verifiability of labeling news as fake. A model manipulating text model to authenticate news is also proposed (FakeNewsTracker: a tool for fake news collection, detection, and visualization n.d.). Most of the news propagated on social media threatens the integrity of news disseminated on social media. In this paper, a new term “Internet of Fake Media Things (IoFMT)” has been proposed. In 2017, this issue got public recognition as it is designed to divert the public’s attention from an important matter to another matter within no time. Author’s road map to future claims for adding the factor of reputation of the one broadcasting fabricated news on social media platform along with involving addressed audience on social media in their PoA protocol (Chen et al. 2020).

The deep learning approach is one of the techniques through which detection of fake news is tried to cater. In this light, the researcher based on textual features has taken into account supplementary features such as title, the content of news, labeling of news to characterize it as authentic or baseless news. With the concept of the online data mining approach, yet another author seconds the process of adding supplementary features to detect fake news (Deepak and Chitturi 2020). Using CNN (Convolutional Neural Network) with validity element, the researcher (Earlier detection of rumors in online social networks using certainty - factor-based convolutional neural networks n.d.), emphasizes on implementing three features content of news, targeted audience, and frequency of usage. The author of the research paper (Gereme and Zhu 2019), emphasizes the need of adding more supplementary information in the process for early detection of fake news to make it more effective.

Researchers agree that a combination of social circumstances and content-based along with supplementary information need to be implemented to develop a fake news detection tool. Also, it emphasizes the need for early detection of fake news (Mahid, Manickam, and Karuppayah 2018).

Detection of fake news has been thought to be the most crucial matter of the digital world. It affects people widely and due to its accelerated circulation on the digital world author thinks this circle of fake news circulation needs to cease in time. In this regard, an apparatus named Fake News Tracker has been introduced to help future research. Online fact-finding websites have been introduced to keep a check on fake news. However, it is humanly impossible to label news as fake online because of its heterogeneous nature and the bulk of information produced on daily basis. Also, a standard apparatus or constructs are missing in the current research which makes labeling difficult because the nature of fake news changes with the advancement in technology. Its future work includes real-time detection of fake news (FakeNewsTracker: a tool for fake news collection, detection, and visualization n.d.). Table 2.1 shows the detailed analysis of few existing studies.

Table 2.1: Detailed Analysis of Existing Studies.

Author and Year	Issue Discussed	Detection Technique	Parameter	Method-ology	Limitation	Future Work
Ajeet Ram Pathaka, Aditee Mahajana , Keshav Singha , Aishwarya Patila , Anusha Nair 2019(Bondielli and Marcelloni 2019)	Discusses dataset approaches used for detection of rumors	Machine learning Deep learning Hybrid approach	----	Comparative analysis	Theoretical discussion	----
Malik Almaliki 2019 (Yaqub et al. 2020)	No evaluation and validation are given of solutions provided for the detection of fake news. Considers gaps in existing literature and insight into future dimensions .	Overview	----	Systematic literature review	Theoretical discussion	----
Momina Qazi, M. U.S Khan,	Detection of fake news to	Transforme r model	----	Attention mechanism	No evaluation and	Adding more features to

Mazhar Ali 2020 (A. R. Pathak et al. 2020)	filtrate untrue news.				validation are given of solutions provided for the detection of fake news.	improve the model
K. Shu, A. Sliva, 2017 (FakeNews Tracker: a tool for fake news collection, detection, and visualization n.d.)	Review of detection of fake news on social media. Fake news characterization on psychology and social theories.	Data mining perspective	Knowledge-based, Style based, Stance based, Propagation based.	Reviewed fake news detection approaches from a data mining perspective, including feature extraction and model construction Datasets	Data-oriented Feature-Oriented Model-Oriented Application-oriented	Data-oriented Feature-Oriented Model-Oriented Application-oriented
X. Zhou, R. Zafarani 2 December, 2018 (Almaliki 2019)	This survey aims to presents a comprehensive framework to study fake news by qualitative, quantitative, and intervention techniques	Qualitative Quantitative Intervention	False knowledge Writing style Propagation style The credibility of creators' and spreader	Reviewed and summarize the existing resources Survey	Theoretical framework that highlights the importance of fake news especially highlights few constructs	Early fake news detection Cross Domain Fake news intervention Identification of check worthy content

2.4.1 Limitations in Existing Studies

The careful review of existing literature shows that present studies offer two techniques to detect fake news i.e., Manual detection of fake news and automatic detection of fake news. Manual detection of fake news is being done by human engagement in which a piece of information is reviewed by the expert or fact-checker websites. Automatic detection of fake news is being done with the help of different available techniques or datasets that are being labeled manually by experts (Figueira and Oliveira 2017).

Manual detection through fact-checker websites or experts is a delaying process and prone to error due to the unavailability of the bulk of data daily being processed in social media. It is, however, of great importance to understand that it is difficult to manually track down the dispersion technique or emergence. Automatic detection is also proposed as a solution but datasets based on which news is being labeled as fake are still not widely encompassing all the constructs contributing to fake news' generation and spread. Also, automatic solutions may find hindrance in data access through certain encrypted social media applications, and missing out on such information can lead to an abnormal circle of misinformation (Mustafaraj and Metaxas 2017).

An explicit gap in the literature regarding fake news can be seen as few researchers have discussed it thoroughly. Exiting literature depicts that there is a dire need to develop a conceptual model to validate the previously proposed automated detection tools and provision of a road map to futuristic research to detect fake news.

It can be seen fake news these days comes from people who are bounded closely to each other and that is how the impact of fake news increases massively. It could be coming from any social media platforms especially WhatsApp and Facebook whose sharing of information cannot be tracked down easily (Mike Wendling 2018). It is the need of the hour to detect fake news as early as possible before its widespread and consider the basic constructs on which news can be labeled as fake news. Several researchers have discussed the detection of fake news through

automated tools, however; most of them have discussed its theoretical importance and the factors due to which automated tools are not performing as per need.

From the authors' perspective, as shown in table 2.1, it is crucial to observe and identify the pattern of dissemination, life cycle, spreader of news (persuader/clarifier), its impact, targeted areas, etc. for the interference in the wide dissemination of fake news. X. Zhou and R. Zafarani state that it is important to understand the fake news dissemination pattern and how the change in aspects of fake news will change its detection process.

The aforementioned authors have particularly in their respective research papers have proposed general parameters for the detection of fake news manually but there is no definite view of a model on which fake news can be detected (Granskogen and Gulla 2017)(Zhou and Zafarani 2018).

It is seen that some of the information is deceiving or misleading without any relatedness to reality. Automated identification of misinformation or disinformation is challenging. It is very hard to give any verdict on the truthfulness of the information without any specific fake news constructs. The rest of the literature has prioritized automatic detection techniques with no reference point to convert plugins. In that regard, few authors state that no assessment criteria for the detection of fake news along with validation have been provided in automated detection tools. This means that automated detection tools scarce the basic description or idea based on which they are developed for the detection of fake news (A. R. Pathak et al. 2020)(Qazi, Khan, and Ali 2020). Below mentioned table 2.2 depicts the limitations in existing studies in a nutshell.

Table 2.2: Limitations in existing studies.

Sr. No	Detection Technique	Limitation	Reference
1.	Manual Detection	Expert evaluation is a delaying process and prone to error due to the unavailability of processed data.	(Mustafaraj and Metaxas 2017) (Granskogen and Gulla 2017) (Zhou and Zafarani 2018).
		Unavailability of a definite standardized model to validate the detection process.	
2.	Automatic Detection	Unavailability of basic description or assessment criteria of available automated tools. These solutions have no reference point to convert plugins.	(Mustafaraj and Metaxas 2017) (Mike Wendling 2018) (Jain et al. 2019) (A. R. Pathak et al. 2020)(Qazi, Khan, and Ali 2020) (Agarwal et al. 2019) (Albahar 2021)
		Hindrance in data access and collection due to encrypted social media applications such as WhatsApp, Facebook.	
		A variety of languages and domains of news patterns globally make the generalized detection questionable.	

So, in the light of the above-cited discussion it can be seen that the identification of core constructs is crucial valuable to detect fake news as earliest before its propagation to massive audience, and ignoring these constructs will question the detection criteria. Existing literature scarce a well-assessed and validated conceptual model with core constructs for the detection of fake news at early stages to declare fake news as fake after careful review.

CHAPTER 3

METHODOLOGY

3.1 Overview

The approach for conduction of research is discussed in this chapter which is a systematic literature review, data coding technique of grounded theory, and expert review. Here, a theoretical description of data collection methods is discussed to validate the research process. For systematic literature review (SLR), a guideline for performing systematic literature reviews in software engineering by Barbara Kitchenham is followed. In SLR, inclusion criteria, exclusion criteria, and quality assessment of the research papers are also done for accuracy and authenticity. For the conduction of expert review, a guideline by Ayub is followed which helps in validating the extracted conceptual model through field experts.

3.2 Research Practice

Research practice is an orderly process of conducting research in which data is gathered, organized, and assessed with the help of particular procedures. For the gathering of required data different techniques are used i.e., systematic literature review, data coding technique of grounded theory, focused group discussion, interview through questionnaire, etc.

3.3 Research Design

The research design of the present research comprises of three major steps that are systematic literature review, data coding technique of grounded theory, and expert review shown below in figure 3.3. The systematic literature review covers review planning, review conduction, review reporting. In review planning, research questions, keywords, strings, list of databases are included. Review conduction comprises the level of extraction and quality assessment. Lastly, review reporting is all about reporting achieved objectives. In the data coding technique of grounded theory, extracted data is encoded and through expert review, it is being verified. All the steps of research designs are shown in figure 3.1.

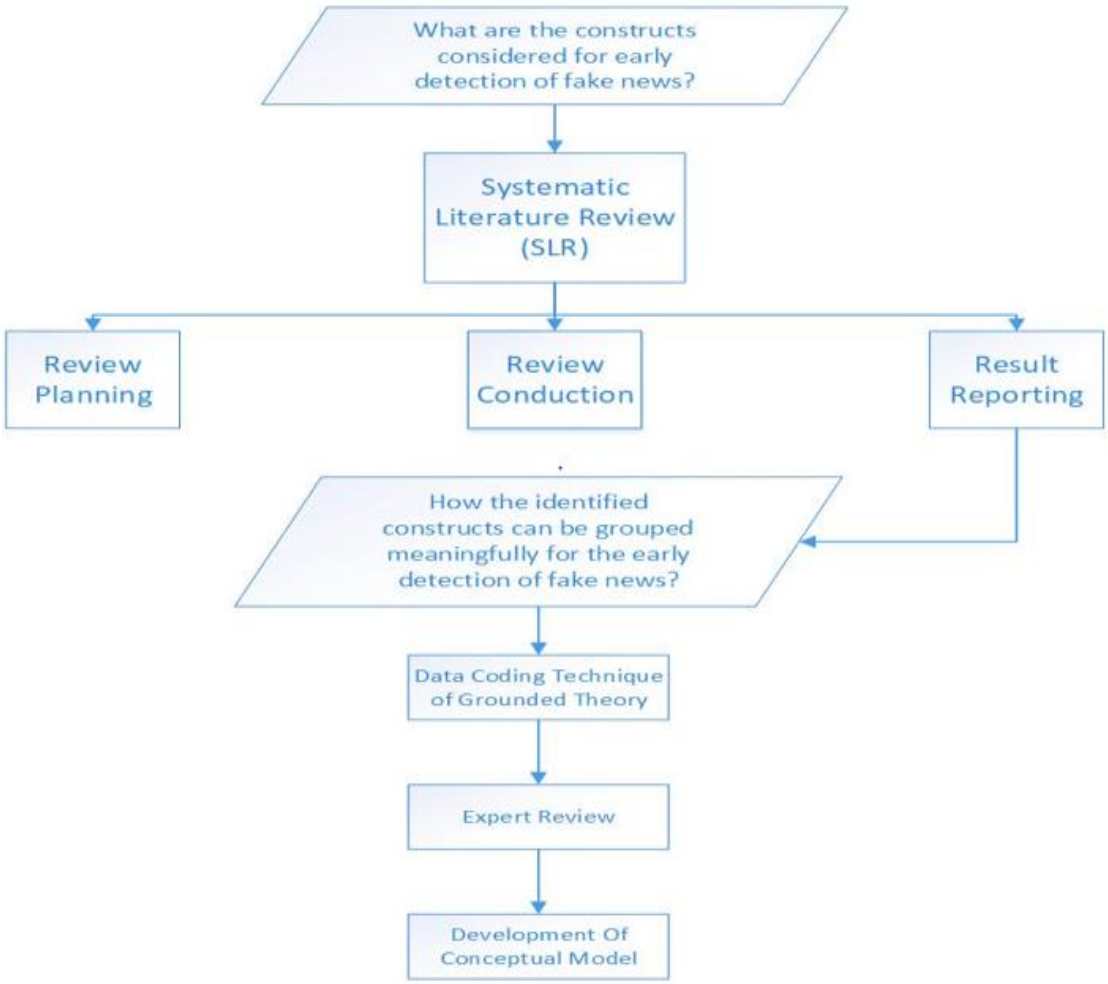


Figure 3.1: Research Stages

Research design as the name indicates refers to the systematic method of conducting research. It gives a future insight into the planning of research till its conduction (Mohajan 2019). It is defined to attain reliable and accurate results for which research is being conducted.

3.4 Systematic Literature Review (SLR)

A systematic literature review (SLR) is the comprehensive, thorough study of a particular topic to scrutinize the addressed research field. It gives a detailed understanding of existing knowledge and recent trends for research by identifying literature gaps. It helps in précising the area of research and helps in analyzing the motive of research. An authenticated, respective literature provides the supporting arguments for the proposal of new research for the validated research. SLR is done in a more systematic and standardized way than a literature review. The guideline followed for the conduction of systemic literature review is by Kitchenham (Kitchenham and Charters 2007).

A systematic literature review is a way of conducting research by assessing and reviewing available literature to answer a pre-defined specific research question. It is an impartial approach to literature review to validate the research. This approach is carried out in several pre-defined steps that are review planning, review conduction, and review reporting. The key objective of the conduction of systematic literature review is, to sum up, the currently available research to identify the limitations of literature gaps of current studies along with the contributions various researchers have done in that particular field (Ferreira Barcelos and Travassos 2006).

This systematic literature review has been done to find answers to discussed research questions. The key objective was to identify core constructs considered for early detection of fake news along with a meaningful grouping of extracted core constructs. It will help in the construction of a conceptual model for the early detection of fake news.

To get the authenticated constructs for the fulfillment of the requirement of a conceptual model for early detection of fake news a sequence of steps is followed to extract an answer from existing literature. The sequence of steps followed in SLR is planning of review, conduction of review, and reporting of review. Figure 3.2 gives an insight into the steps that a systematic literature review follows.

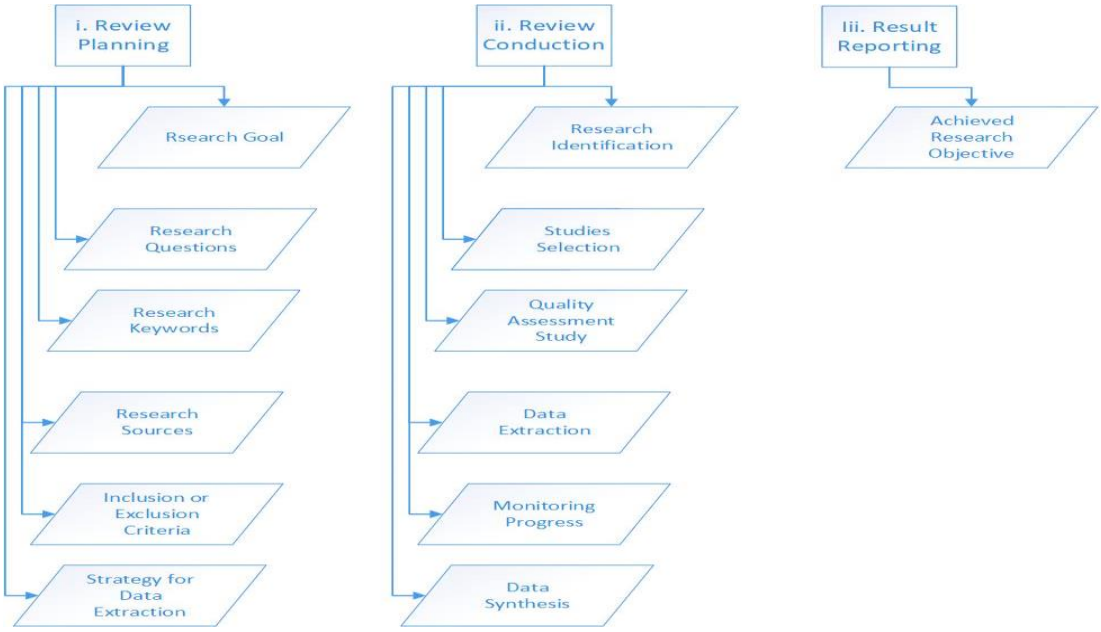


Figure 3.2: Systematic Literature Review Track (Ferreira Barcelos and Travassos 2006) (Kitchenham and Charters 2007)

Below mentioned is a brief overview of the systematic literature sequence followed for the systematic literature review.

3.4.1 Review Planning

This is the first step of a systematic literature review which identifies the need for conduction of research by designing questions and research protocol (Kitchenham and Charters 2007). This part of SLR also encompasses the scope of research (Ferreira Barcelos and Travassos 2006). It pinpoints the area of research, sources of information extraction (databases), keywords, strings for information

extraction from databases, inclusion and exclusion criteria to choose the related useful literature for the effective result extraction.

3.4.1.1 Research Questions

To carry out well-presented, coherent research it is crucial to understand clear objectives of the research area which is why outlining of research in question is important. Asking the right question will lead to the accurate answer for the question whereas an ambiguous question will lead to the ambiguous answer. Present research keeping in view the mentioned challenges in existing studies seeks out the answers to the following questions.

Research Question # 01: What are the constructs considered for early detection of fake news?

The aforementioned question explicitly answers the question of origination and dispersion of fake news and what constructs it encompasses. This will help in elimination of existing gap in literature by addressing core constructs required for the early detection of fake news.

Research Question # 02: How the identified constructs can be grouped meaningfully for the early detection of fake news?

The grouping or categorization of constructs required in the early detection of fake news will help in understanding the pattern of fake news' generation and its widespread. Above mentioned question's answer will further help in the easy labeling of data.

3.4.1.2 Research Keywords

A considerable number of keywords are considered to extract the authenticated and effective data from the digital databases. The choice of keywords is crucial as the roadmap to the research depends upon the appropriate collection of keywords. Given below table 3.1 shows the keywords applied for the extraction of relevant data from different search engines or digital databases.

Table 3.1: Research Keywords.

Sr. No	Applied Keywords
i.	Fake news OR Forged news
ii.	Manual detection OR automatic detection
iii.	Data labeling technique
iv.	Systematic literature review (SLR)
v.	Data coding technique. of grounded theory
vi.	A conceptual model for fake news detection

3.4.1.3 Strings

Following table 3.2 indicates the strings applied for the extraction of relevant data from different available search engines or digital databases.

Table 3.2: Search Strings with research keywords.

Sr. No	Keyword	Search Strings	String ID
1.	Fake news, Techniques, Constructs	“Fake news” detection” AND (“techniques” OR “constructs”)	String1
2.	Early rumor, Techniques, Constructs	“Early rumor detection” AND “constructs” OR techniques	String2

The creation of an effective combination of research string is always a concern for researchers. It is crucial to create well-defined, self-explanatory research strings to extract the right type of data from research databases. In this context, Boolean operators AND and OR are used to make the strings work properly. Boolean AND means both the statement before and after AND need to be there in a research paper. However, Boolean OR means any statement before and after OR operator can be in a research paper. The strings along with keywords are chosen wisely to make sure the right kind of string has been created for the right kind of data extraction.

3.4.1.4 List of Databases

The research databases are adapted to extract relevant data with the help of applicable strings. Following table 3.3 shows the list of databases used for extracting relevant data for early fake news detection.

Table 3.3: List of Databases.

Sr. No	Database	Uniform Resource Locator
1.	IEEE Xplore Digital Library	https://ieeexplore.ieee.org/Xplore/home.jsp
2.	ACM Digital Library	https://dl.acm.org/
3.	Springer	https://www.springer.com/in
4.	ScienceDirect	https://www.sciencedirect.com/
5.	Wiley	https://onlinelibrary.wiley.com/

3.4.1.5 Inclusion Criteria

Inclusion criteria are formulated to define what kind of research papers are included in current research depending upon the research requirement, questions, and type. Research papers are extracted and included in research after a thorough analysis of their contribution and work done in the particular field. In that context, title,

abstract, discussion, methodology, the discussion is scrutinized. Following are the set criteria for the inclusion of a research paper.

i. Consideration of research work from the past six years (2016-2021) to make the following research work more relatable and authentic.
ii. Research articles or journals or conferences from well-known databases to avoid any discrepancy in research work.
iii. Research work written in the English language will be considered only.
iv. Related to spread of fake news on social media and detection or early detection of fake news.

3.4.1.6 Exclusion Criteria

Exclusion criteria are formulated to define what kind of research papers are excluded in current research depending upon the research requirement, questions, and type. Research papers are excluded from the research process after a thorough analysis of their contribution and work done in the particular field. In that context, title, abstract, discussion, methodology, the discussion is scrutinized. If it does not fulfill the criteria of the paper is included, then it is excluded. Following are the set criteria for the exclusion of a research paper.

i. Outdated data and non-authentic data.
ii. Unpublished research work.
iii. Non-relevant data.
iv. Any other language except English.
v. Keywords that are not related to a particular research area will be excluded.
vi. Research work out of scope will be deducted.
vii. Research work that is more than six years old.

3.4.2 Review Conduction

The second step of systematic literature review to move closer to the validation of research validation is review conduction. In this part of the review, the accurate literature for the conduction of new research is being identified which further will be synthesized and monitored by data extraction (Ferreira Barcelos and Travassos 2006). The specific and relevant literature is extracted by following three levels of extraction approach. For the first level of abstraction after applying research strings in mentioned databases, obtained literature was reviewed by studying the title and abstract of the research paper. For the second level of abstraction, the conclusion is reviewed to check whether it fulfills the above-mentioned inclusion and exclusion criteria of research or not. For the final extraction level, discussion along with methodology is reviewed to make the relevant research paper part of the research process.

3.4.2.1 Level of Extraction

At the level of extraction, research strings were applied in the research databases from which a total of 256 research papers were collected in the initial stage. Snowball technique was also applied to bypass the chance of left-out research papers. In the first level of extraction, after reviewing the title and abstract 181 research papers were collected. After reviewing the abstract and conclusion of gathered research papers were 146. Abstract, discussion, methodology, and conclusion were reviewed in the third level of extraction and 137 research papers were finalized, however; the rest of the research papers due to non-fulfillment of said criteria were rejected. Following mentioned are the strings applied and table 3.4 shows the level of extraction with the number of research papers gathered from various databases and snowball techniques.

i. Applied String1: “Fake news” detection” AND (“techniques” OR “constructs”)
ii. Applied String2: “Early rumor detection” AND “constructs” OR techniques

Table 3.4: Level of Extraction.

Sr. No.	Research Databases	Total Result of Applied Strings	First Level Extraction (Title + Abstract)	Second Level extraction (Abstract + Conclusion)	Third Level Extraction (Abstract + Discussion + Conclusion + Methodology)
1.	IEEE Xplore	30	24	23	23
2.	ACM Digital Library	91	72	66	61
3.	Science Direct	76	33	33	32
4.	Springer	59	52	25	13
5.	Snowball Technique	8			
	Total	256	181	146	137

The above table shows that first column is of “databases” where all the research databases used during the research process are enlisted. Columns 4-6 shows that after applying three levels of extraction on total applied strings and what results in form of research papers are gained. The number of research papers gained after inclusion and exclusion criteria is 256 in total after the application of research strings.

3.4.2.2 Quality Assessment (QA)

Quality assessment refers to the systematic evaluation of chosen existing literature or data that need to be analyzed for research purposes. This is being done for the validation and preciseness of data to authenticate research in its later processes. Data in this part is critically analyzed to check whether it supports the presented idea of research and if it adds quality or value to the existing literature (Kitchenham and Charters 2007).

After review planning, several research papers were found relevant to the present research. To bypass biased results in review conduction research papers were analyzed through few researchers to validate the chosen research papers. After the analysis of research papers, seventy-four research papers were finalized by the researchers. Following were the questions being asked by each researcher while quality assessment process for the validation of those research papers and the score criteria of their judgment is also mentioned. Below mentioned table 3.5 shows the brief overview of quality assessment questions and assessment scores for the selection of a paper. The below table shows questions being asked from peer reviewers for the quality assessment of selected research papers and the last column shows the scoring criteria of quality assessment. Through scoring criteria, it can be seen that how beneficial a research paper is and how it can contribute to the research process.

Table 3.5: Quality Assessment (QA) (Kitchenham and Charters 2007).

Sr. No	Questions for Peer Reviewers	Quality Assessment Score Criteria
1.	Do the discussed research paper evidently, states the objective?	Poor Quality = 0 Fair Quality = 0.33 Good Quality = 0.66 Excellent Quality = 1
2.	In your opinion, does this research paper hold any worth to be a part of the present research?	
3.	Does this paper discuss the warnings to validity?	
4.	Does the discussed paper the limitations of the research paper?	

5.	Does this paper show result?	

Detailed scoring of research papers in the peer review phase is attached in appendix-A under the heading *Selected Research Papers by Peer Review and Author* which helped in validating chosen research papers. Peer reviewers have finalized 72 research papers by assigning them a score depending upon their degree of benefit to the present research. However, the author was not satisfied with the resultant research papers to the full extent so a thorough review was again done and in that review, two more papers were extracted and were included in the selected peer review research paper list. Those two papers were found helpful in context to aid present research. Papers collected after peer review are paper id 135 and paper id 136.

3.4.3 Review Reporting

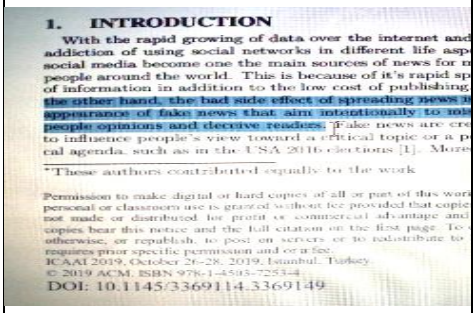
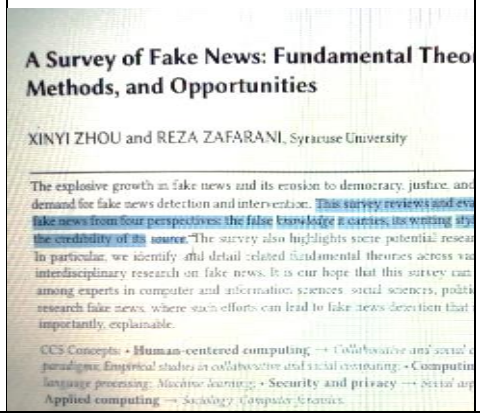
The concluding step of the systematic literature review is review reporting. In this part of the study the chosen literature is thoroughly scrutinized to uncover the answers to the research question and final results are reported (Ferreira Barcelos and Travassos 2006). It shows the achieved objectives of the present research.

Results gained from review planning and review conduction are mentioned above where the research paper selection process is briefly explained and through this process a list of constructs are extracted from literature.

3.5 Data Coding Technique of Grounded Theory

Grounded theory refers to the basic systematic methodology of collection of data for data synthesis and analysis to develop a theory based on the qualitative data assessment (Ayyub 2001). This is a repetitious process of data synthesis, analysis, and theory development up to theoretical saturation. This process helps in deep refine extraction of relevant data which is unbiased from selected literature. The output of the repetitious is referred to as grounded theory (Vollstedt and Rezat 2019). In this paper through the data coding technique of grounded theory, data collection and data encoding techniques are done to develop a valid model. Data collected from the data encoding technique is passed through rigorous data analysis to ensure no missed out data. The statements of the research papers are extracted which are then encoded to extract the core constructs. Table 3.6 depicts the examples of data coding techniques of grounded theory where data is extracted and encoded for the conceptual model.

Table 3.6: Example of Data Coding Technique of Grounded Theory (Ayyub 2001).

Paper ID	Papers' Statement	Attachment of Proof	Encoding of Data
PID_01	*"On the other hand, the bad side effect of spreading news is the appearance of fake news that aim intentionally to mislead people opinions and deceive readers."*	 1. INTRODUCTION With the rapid growing of data over the internet and addiction of using social networks in different life asp social media become one the main sources of news for m people around the world. This is because of it's rapid sp of information in addition to the low cost of publishing, the other hand, the bad side effect of spreading news i appearance of fake news that aim intentionally to mi people opinions and deceive readers. Fake news are cre to influence people's view toward a critical topic or a p cal agenda, such as in the USA 2016 elections [1]. More *These authors contributed equally to the work. Permission to make digital or hard copies of all or part of this wor personal or classroom use is granted without fee provided that copie not made or distributed for profit or commercial advantage and copies bear this notice and the full citation on the first page. To otherwise, or republish, to post on servers or to redistribute to requires prior specific permission and or a fee. ICAAI 2019, October 26–28, 2019, Istanbul, Turkey © 2019 ACM. ISBN 978-1-4503-7253-4 DOI: 10.1145/3369114.3369149	Deception driven content
PID_03	*"This survey reviews and evaluates methods that can detect fake news from four perspectives: the false knowledge it carries, its writing style, its propagation patterns, and the credibility of*	 A Survey of Fake News: Fundamental Theo Methods, and Opportunities XINYI ZHOU and REZA ZAFARANI, Syracuse University The explosive growth in fake news and its erosion to democracy, justice, and demand for fake news detection and intervention. This survey reviews and eva fake news from four perspectives: the false knowledge it carries, its writing sty the credibility of its source. The survey also highlights some potential resea In particular, we identify and detail related fundamental theories across va interdisciplinary research on fake news. It is our hope that this survey can among experts in computer and information sciences, social sciences, politi research fake news, where such efforts can lead to fake news detection that importantly, explainable. CCS Concepts: • Human-centered computing → Collaborative and social paradigms; Empirical studies in collaborative and social computing; • Computin language processing; Machine learning; • Security and privacy → Social an Applied computing → Sociology; Computer forensics.	Fake news feature styling

	its source."		

The above-cited examples depict extracted constructs from existing studies that were encoded and were named. In the first example with paper id 01 articulates, fake news cause change in attitude or it misinforms consumer of news and it was named as 'deception driven content' through data encoding technique.

The second example with paper id 03 articulates, how fake news can be identified by its way of written information, information, its dispersion methods, and reliability of news sender, and it was named as 'fake news feature styling' based on its nature and type of data through the encoding of data technique.

3.6 Expert Review

Expert is the one who has the relevant experience and interest in the addressed research problem to get validation for the research process. The expert review refers to the process of examining and collecting and verification of data to address a particular research problem. To address the answer to a discussed research problem, experts thoroughly examine the collected data, questions and test it for its validity. Experts questions the researcher to get the answer to technical questions. The proposed model based on the constructs obtained for early detection will be reviewed by field experts. This will not only help in authenticating the proposed model but will also be beneficial for pinpointing research gaps or useful suggestions. For expert evaluation conduction a guideline by Ayub, Expert Opinion Elicitation will be considered (Ayyub 2001). The guideline will help in selecting experts who are familiar with this field to gather their responses. Figure 3.3 shows the steps that will be followed for expert evaluation.

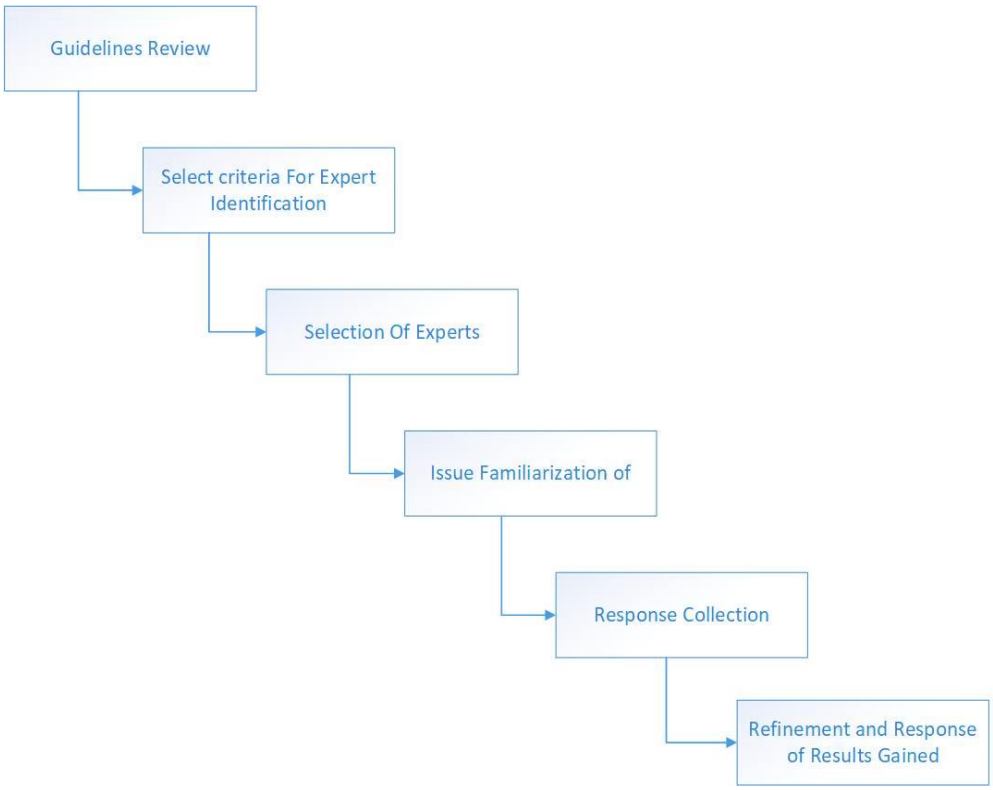


Figure 3.3: Expert Evaluation Steps

Experts' identification and their selection criteria are the initial steps, to begin with, expert review. Once experts' selection is done, it is crucial to get your experts familiarized with the discussed research problem, the need for the conduction of the research, and the collected data. To sum up, refine the responses collected from experts. After careful review by the experts, collect and cite the responses collected from experts in the light of that research problem. The selection criteria for experts are mentioned below.

i. Experience in academics or the tech industry.
ii. Expertise related to the discussed research problem.
iii. Availability for the research process.

Following table 3.7 shows personal details of experts' that conducted the expert review for the present research.

Table 3.7: Personal Details of Experts'.

Experts'	**Designation**	**Job Place**	**Email**
Expert 01	Professor	Bahria University, Islamabad	tamim@bahria.edu.pk
Expert 02	Assistant Professor	Narjan University, Saudi Arabia	maasghar@nu.edu.pk
Expert 03	Researcher	Brno University of Technology - VUT Brno	goni@vutbr.cz
Expert 04	Assistant Professor	NUML, Rawalpindi.	hnauman@numl.edu.pk

CHAPTER 4

IDENTIFICATION OF CONSTRUCTS FOR EARLY DETECTION OF FAKE NEWS

4.1 Overview

The chapter describes the results of the research questions addressed in this research. Initially result reporting of the SLR is presented that describes the constructs of fake news. Later, classification of constricts are explained briefly. Lastly, expert evaluation on the extracted constructs contributing to the fake news to validate the results for a conceptual model for the early detection of fake news.

4.2 Result Reporting

Fake news has grown into a major concern for researchers all around the world. The present research through systematic literature review has extracted constructs contributing to the propagation and its extensive dispersion to the massive audience. The protocol of systematic literature review (SLR) by Kitchenhams (Ferreira Barcelos and Travassos 2006) has been followed to identify the core constructs considered for early detection of fake news.

In SLR, planning of review, conduction of review, and its reporting are viewed along with quality assessment. This research methodology also encompasses inclusion

or exclusion criteria, level of extraction, and quality assessment of research papers done by the peer reviewers or peer researchers to validate the chosen research papers. Peer Reviewer have selected 72 papers out of 137 research papers. The author has reconsidered the research papers being rejected and after a thorough review, two more research papers are extracted that are helpful in the research conduction process. Below mentioned table 4.1 depicts the extracted research papers collected through different research databases and by applying different levels of extraction.

Table 4.1: Extracted Research Papers.

<table>
<tr><th>Sr. No</th><th>Research Databases</th><th>Initial Stage</th><th>First Level Extraction</th><th>Second Level Extraction</th><th>Third Level Extraction</th><th>Peer Review Selection</th></tr>
<tr><td>1.</td><td>IEEE Xplore</td><td rowspan="4">256</td><td rowspan="4">181</td><td rowspan="4">146</td><td rowspan="5">137</td><td rowspan="5">72</td></tr>
<tr><td>2.</td><td>ACM Digital Library</td></tr>
<tr><td>3.</td><td>Science Direct</td></tr>
<tr><td>4.</td><td>Springer</td></tr>
<tr><td>5.</td><td>Snowball Technique</td><td colspan="3">8</td></tr>
<tr><td>6.</td><td>Paper Selection by Author’s Review</td><td colspan="5">2</td></tr>
<tr><td>7.</td><td>Total Research Papers</td><td colspan="5">74</td></tr>
</table>

Inclusion criteria encompass the work done in the field of fake news detection in recent six years, research papers from well-known databases, research papers are written in English and relevant data on detection of fake news at early stages. However, exclusion criteria encompass outdated, irrelevant, non-authenticated, unpublished data, non-relevant keywords, out-of-scope research, research before the year 2016, and research papers except the English language. Through said criteria of inclusion and exclusion, 256 research papers were gathered from different research databases.

The initial search of applying string resulted in 256 total research papers from five research databases i.e., IEEE Xplore, ACM digital library, science direct, springer, Wiley Online Library. Beginning with the first level of extraction, resultant research papers were 181. The second level of extraction provided 146 and with the implementation of the third level of extraction along with the snowball technique 137 papers were gathered. In the said extraction levels, 137 out of 256 research papers were finalized. Research papers gathered from the third level of extraction and snowball technique were 137 which were selected as per said criteria and by the author's preference.

To bypass the chance of distorted results and the author's biases towards particular research, quality assessment has been done through peer researchers. The total number of research papers were assigned to a total of 14 researchers and titled as P1 till P14 in appendix A, table A1 under heading *Selected Research Papers by Peer Review and Author*. Moreover, five different questions regarding the research paper's content's quality were being asked to the researchers to scrutinize if it fulfills the answers of questions as per the present research's requirement. The comprehensive table of a selection of research papers through peer review is attached in appendix A. This scrutiny resulted in the selection of 72 research papers through peer-review.

The resultant research papers were gathered but to scrutinize those selected research papers by peer-reviewers were also reviewed by the author itself to ensure data reliability and completeness element. Thus, two more papers were also extracted

along with those scrutinized research papers that resulted in a total of 74 research papers out of 137 for the conduction of this research. A table depicting two scrutinized papers to assess quality done by the author is mentioned in appendix A, table A2 under the caption *Selected Research Papers by Peer Review and Author*.

All the research papers having a score greater or equal to 0.4, based on the criteria shaped by the author to select research papers are acceptable. However, research papers having less than a 0.4 average score in the quality assessment will be rejected.

Chosen research papers then were reviewed thoroughly to extract constructs required for the conduction of this research. Upon detailed and thorough review core constructs were extracted from research papers mentioned in appendix B, table B1, B2 under the caption *Extracted Constructs in Implicit Removal and Explicit Removal.* These constructs were later enlisted in the mentioned table and implicit and explicit removal was done on these constructs.

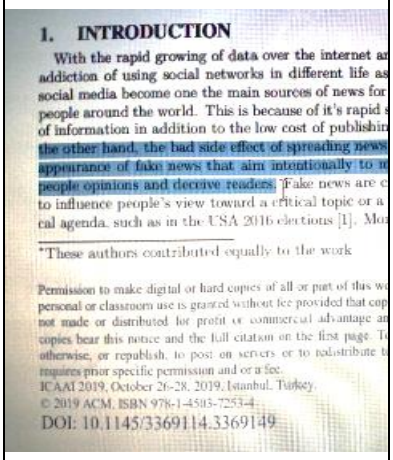
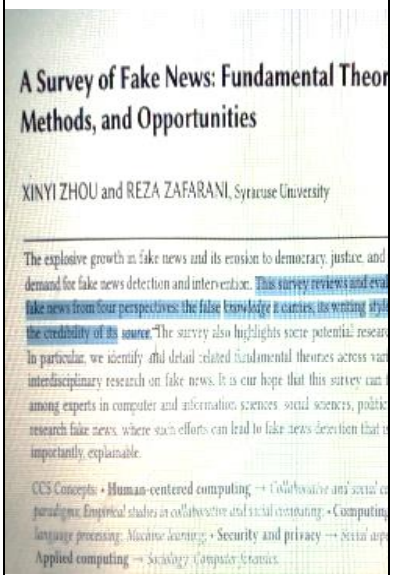
4.2.1 Identification of Constructs

Implicit refers to the altered names of the same constructs with the same meaning used by various researchers however, implicit removal indicates grouping same constructs with different names under one category. Explicit refers to the same names of constructs with the same meanings assigned by various researchers however, explicit removal indicates naming a construct. The conduction of implicit removal provides 73 constructs as a whole offered by multiple researchers however, explicit search contributed constructs contributing to the early detection of fake news. The tables of implicit removal and explicit removal enlisting paper ids, name of constructs, and assigned distinctive terms are attached in appendix B, table B1, B2 under the caption *Extracted Constructs in Implicit Removal and Explicit Removal.*

Data coding technique of grounded theory aids in encapsulating the enormous data into simple, understandable, and summarized form to get-to-the-point details.

Data is coded by summarizing the details into a small amount of data. In this part of the methodology, the data collected is given an appropriate name critically by removing the replicated data. Repetitive data or constructs in the constructs' extraction procedure were encoded by assigning a distinctive term. Table 4.2 shows few examples of the data coding technique of grounded theory and the way data is encoded.

Table 4.2: Sample of Data Coding Technique of Grounded Theory (Vollstedt and Rezat 2019).

Sr. No	Paper ID	Papers' Statement	Attachment of Proof	Encoding of Data
1.	PID_01	*"On the other hand, the bad side effect of spreading news is the appearance of fake news that aim intentionally to mislead people opinions and deceive readers."*	 1. INTRODUCTION With the rapid growing of data over the internet ar addiction of using social networks in different life as social media become one the main sources of news for people around the world. This is because of it's rapid of information in addition to the low cost of publishin the other hand, the bad side effect of spreading news appearance of fake news that aim intentionally to m people opinions and deceive readers. Fake news are c to influence people's view toward a critical topic or a cal agenda, such as in the USA 2016 elections [1]. Mo *These authors contributed equally to the work Permission to make digital or hard copies of all or part of this w personal or classroom use is granted without fee provided that cop not made or distributed for profit or commercial advantage an copies bear this notice and the full citation on the first page. T otherwise, or republish, to post on servers or to redistribute t requires prior specific permission and or a fee. ICAAI 2019, October 26-28, 2019, Istanbul, Turkey. © 2019 ACM. ISBN 978-1-4503-7253-4. DOI: 10.1145/3369114.3369149	Deception driven content
2.	PID_03	*"This survey reviews and evaluates methods that can detect fake news from four perspectives: the false knowledge it carries, its writing style, its propagation patterns, and the credibility of its source."*	 A Survey of Fake News: Fundamental Theor Methods, and Opportunities XINYI ZHOU and REZA ZAFARANI, Syracuse University The explosive growth in fake news and its erosion to democracy, justice, and demand for fake news detection and intervention. This survey reviews and eval fake news from four perspectives: the false knowledge it carries, its writing styl the credibility of its source. The survey also highlights some potential researc In particular, we identify and detail related fundamental theories across var interdisciplinary research on fake news. It is our hope that this survey can among experts in computer and information sciences, social sciences, politic research fake news, where such efforts can lead to fake news detection that importantly, explainable. CCS Concepts: • Human-centered computing → Collaborative and social c paradigms; Empirical studies in collaborative and social computing; • Computing language processing; Machine learning; • Security and privacy → Social aspe Applied computing → Sociology; Computer forensics.	Fake news feature styling

Paper id 01 shows that how the content related to misleading people through news is encoded into deception-driven content. In paper id 03, approaches proposed by the discussed paper's author are named as fake news feature styling on the basis that news can be styled differently. Given below table 4.3 is the representation of the procedure of implicit removal and explicit removal.

Table 4.3: Examples of implicit removal and explicit removal

Sr. No	Removal Type	Constructs Statement	Paper ID	Encoding of Data
1.	Implicit Removal	Low-quality news	PID_01	Quality of content
		Content quality	PID_84	
2.	Explicit Removal	Malicious users (intentionally create and/or propagate fake news motivated by some benefits)	PID_136	Mischievous users with hateful or mischievous intentions

Implicit removal simply means a different name for the same meaning construct. Example 01 shows implicit removal where the quality of content is discussed. In paper id 01, quality is named as low-quality news and in paper id 84 it is named as content quality. Through implicit removal, extra and non-required data will be removed and a new name has been assigned to it through a data encoding scheme.

Example 02 shows that paper id 136, for explicit removal, is named as malicious users (intentionally create and/or propagate fake news motivated by some benefits) and it is named as mischievous users with hateful or mischievous intentions. Data encoding has been done to name it according to its nature. Following

table 4.4 are the extracted constructs after implicit removal and explicit removal following the above-mentioned methodologies.

Table 4.4: Extracted constructs after implicit and explicit removal.

Sr. No	After Implicit Removal	After Explicit Removal
1.	Infodemic [Cited term presented by World Health Organization (WHO) in 2020]	Disrupts diplomatic process
2	Social media platform	Peer pressure to believe misinformed content
3	Quality of content	Repeated disclosure to misinformed content
4	Deception driven content	Standardized datasets
5	Dependence on social media content	Social media terminologies
6	Disrupts opinion	Misinformation
7	Active user involvement	Disinformation
8	Viral reviews	Mal-information
9	Violent behavior to the general public	Rumor
10	Automatic fact finding	
11	Manual fact-finding	
12	Content relevance w.r.t heading and body content	
13	Mischievous users with hateful or mischievous intentions	
14	Self or socially influenced immature users	
15	Threat to press	
16	Democracy instability	
17	Threaten country's security	
18	Threat to the educational structure	

Sr. No	After Implicit Removal	After Explicit Removal
19	Threat to judicial structure	
20	Threat to environment	
21	Threat to technology	
22	Threat to health care structure	
23	Threat to government	
24	Reputation tarnishing	
25	Threat to social stability	
26	Business rivalry	
27	Delayed response to calamities	
28	Political advantage	
29	Economic advantage	
30	Advertisement revenue	
31	Sociocultural differences	
32	Fake news feature styling	
33	Credibility of source	
34	Inexpensive	
35	Convenient to craft and disperse information	
36	Ease of access	
37	Timestamp	
38	Easily conveyable and socially relevant content	
39	Viral information	
40	Deeper impact of fabrications	
41	Distraction from discussed subject	
42	Desirability bias	
43	Massive content with a variety of subjects	

Sr. No	After Implicit Removal	After Explicit Removal
44	Deliberately and verifiably fabricated content	
45	Deceptive news	
46	Fabricated staged news	
47	Satire fabrication	
48	Propaganda	
49	Conspiracy theories	
50	Journalistic deception	
51	Serious fake fabrication	
52	Large scale hoaxes	
53	Inventive sentimental information	
54	Scandalous or exaggerated content	
55	Provision of the bulk of subjects for online discussion	
56	Long-standing news	
57	Click-bait	
58	False statement	
59	False stories	
60	Advertisement	
61	Articles	
62	Multimedia data	
63	Misrepresented messages and emails	
64	Misrepresented images	
64	Image tarnishing	
65	Distorted network of virtual news	
66	Cyber-security	
67	Nonexistence of restriction, reference, and facts	

Sr. No	After Implicit Removal	After Explicit Removal
68	Information distribution without verification	
69	Extensive users	
70	News consumers become news propagators	
71	Pre-processing of available content	
72	Individualized Characteristics	

Above mentioned constructs are the resultant of implicit removal and explicit removal. Constructs' extraction is a result of a systematic literature review, and then data encoded above is done through the data coding technique of grounded theory.

4.2.2 Classification and Categorization of Constructs

The classification is done by the data coding technique of grounded theory where extracted data is coded after implicit and explicit removal. The assigned distinctive constructs names are then categorized with a unique group name for further model development purposes. Distinctive group names with extracted core constructs are then further reviewed by experts. Experience in academia or tech industry, expertise related to the discussed research problem, and availability are the experts' criteria for the research process. Expert review is done for expert evaluation, assessment, and verification of grouping done by the author. Extracted constructs are shared with experts. Questions are being asked by them regarding the objective, expected outcome of the research, resources used to extract information, methodology, and base research paper. Extracted constructs with group names and requirements as per demand are provided through email. Research questions are shared with them to get the model verified along with below mentioned two key concerns.

i. Is the categorization of constructs mentioned accurately?
ii. Are the constructs having a suitable group name?

Given below are the constructs classified and categorized according to their features. These constructs along with their group names are further categorized into levels (level 01, level 02, level 03) depending upon their intensity and evilness.

Level 01 indicates the constructs that in today's era are known to the general audience which includes propagation platform, violence, and social stability. Level 02 shows that what constructs need to be considered for detailed detection of fake news which comprises content, beneficiary, and consequences. However, level 03 shows what core constructs need to be taken into account on an urgent basis for effective detection of fake news. This level consists of social media characteristics, accessibility, technique, data dispersion intention, diffusion pattern, types of fake news, content type, and individualized characteristics. Given below is table 4.5 which shows the list of constructs and names of their respective group concerning the detection of fake news at early stages.

Table 4.5: Classification and Categorization of Constructs.

L1G1	Infodemic	[Cited term presented by World Health Organization (WHO) in 2020]
Sr. No	**Group Name**	**Constructs**
L1G2	Propagation platform	Social media platform
Sr. No	**Group Name**	**Constructs**
L1G3	Violence	Violent behavior to the general public
		Deeper impact of fabrications
Sr. No	**Group Name**	**Constructs**
L1G4	Social Instability	Threat to press
		Democracy instability

		Threaten country's security
		Threat to the educational structure
		Threat to judicial structure
		Threat to environment
		Threat to technology
		Threat to health care structure
		Threat to government
		Reputation tarnishing
		Threat to social stability
		Business rivalry
Sr. No	**Group Name**	**Constructs**
L2G1	Content	Quality of content
		Deception driven content
		Content relevance w.r.t heading and body content
		Easily conveyable and socially relevant content
Sr. No	**Group Name**	**Constructs**
L2G2	Beneficiary	Political advantage
		Economic advantage
		Advertisement revenue
Sr. No	**Group Name**	**Constructs**
L2G3	Consequences	Image tarnishing
		Distorted network of virtual news
		Cyber-security
		Disrupts diplomatic process
		Peer pressure to believe misinformed content
		Repeated disclosure to misinformed content
Sr. No	**Group Name**	**Constructs**
L3G1	Social media characteristics	Active user involvement
		Viral review
		Number of followers
		User characteristics
Sr. No	**Group Name**	**Constructs**
L3G2	Convenience	Dependence on social media content
		Convenient to craft and disperse information
		Viral information
		Inexpensive
		Ease of access
		Nonexistence of restriction, reference, and facts
		Information distribution without verification

		Extensive users
		Timestamp
Sr. No	**Group Name**	**Constructs**
L3G3	Technique	Automatic fact finding
		Manual fact-finding
		Fake news feature styling
		Credibility of source
		Pre-processing of available content
		Standardized datasets
Sr. No	**Group Name**	**Constructs**
L3G4	Data dispersion intention	Mischievous users with hateful or mischievous intentions
		Self or socially influenced immature users
Sr. No	**Group Name**	**Constructs**
L3G5	Diffusion Pattern	Distraction from discussed subject
		Desirability bias
		Massive content with a variety of subjects
		Deliberately and verifiably fabricated content
		Inventive sentimental information
		Scandalous or exaggerated content
		Provision of the bulk of subjects for online discussion
Sr. No	**Group Name**	**Constructs**
L3G6	Types of fake news	Deceptive news
		Fabricated staged news
		Satire fabrication
		Propaganda
		Conspiracy theories
		Journalistic deception
		Serious fake fabrication
		Large scale hoaxes
		Inventive sentimental information
		Scandalous or exaggerated content
		Provision of the bulk of subjects for online discussion
		Long-standing news
		Click-bait
		Misinformation
		Disinformation

		Mal-information
		Rumor
Sr. No	**Group Name**	**Constructs**
L3G7	Content-Type	False statement
		False stories
		Advertisement
		Articles
		Multimedia data
		Misrepresented messages and emails
		Misrepresented images
Sr. No	**Group Name**	**Constructs**
L3G8	Individualized Characteristics	Political Association
		Age group
		Gender
		Social media usage frequency
		National and demographic factors

Given above are the constructs with a suitable group name which is assigned by the author which on later steps are verified through experts. For example, group name individualized characteristics are given to level 3, group 8 (L3G8) against constructs named as a political association, national and demographic factors, gender, age group, and social media usage frequency. Individualized characteristics refer to features possessed particularly and it varies from person to person. So, depending upon the constructs' nature this name is suggested as a group name.

Another example L2G3 displays the constructs as image tarnishing, the distorted network of virtual news, cyber-security, disrupts the diplomatic process, peer pressure to believe misinformed content, and these constructs are grouped with the name consequences. Consequences refer to the results of an activity that typically is unpleasant. By seeing the nature of the constructs', the name is being assigned as the above-mentioned constructs depicts that these are the consequences that a society or an individual has to bear due to the dispersion of fake news.

4.3 Experts' Suggestions for Improvement

Expert 01 has suggested adjusting level 1 first group name into some other category as it seems to be a subset and has asked to add more constructs in the third group. It has been suggested to rename the group's name in the level 2 second group and to justify the addition of ease of access into it. Also, the addition of 'credibility of source' did not seem to be right in level 2 and third groups.

Expert 02 has suggested to drop or change the position of credibility of a source in the L3G3 group under the group name technique and asked a question that why is infodemic a separate construct and not under some category.

Expert 03 has pointed out the missing constructs in level 1 group 1. In L1G3, an expert has inquired about the 'deeper impact of fabrication and in L1G4 names of constructs are suggested to replace. Expert 04 has pointed out the missing constructs in level 1 group 1.

Table 4.6 comprises a brief list of improvements suggested by experts. It depicts the group's original name, suggestion, or comment for suggested change by the expert. The detailed table with constructs and comments of experts alongside is mentioned in Appendix C, Table C1 under caption *Experts' Suggestions*.

Table 4.6: Improvement suggestions of Experts'.

Experts'	Group's Original Name	Suggestion/Comment
Expert 01	Infodemic	Seems a subset of some other group to me.
	Violence	More constructs addition proposed.
	Convenience	Seems correct to me, the group name could be revised. Why ease of access?
	Technique	I don't agree with placing of credibility of the source, the rest seems fine to me.

Expert 02	Infodemic	Is it a separate construct?
	Technique	The credibility of the source does not fit here.
Expert 03	Infodemic	The categorization is fine. What are the constructs?
	Violence	The categorization is fine. What does 'Deeper impact of fabrications' mean?
	Social Stability	The categorization is fine. I suggest adding the following group name: social, economic, and environmental instability. Then, re-categorize the constructs.
Expert 04	Infodemic	Constructs are missing.

Given below table discusses the changes asked by field experts to authenticate the conceptual model. Table 4.7 represents suggested modifications by experts.

Table 4.7: Suggestion Modifications.

Sr. No	Suggested Modifications
1.	Use *infodemic* as a sub-construct of the *timestamp*.
2.	More constructs are added to the group *violence* L1G3.
3.	The name of the group *convenience* L3G2 has been changed into *accessibility*.
4.	The construct named *credibility of the source* is removed from the constructed table.

Improved table with the help of experts' suggestions has been added to appendix C, table C2 under the caption *Classification and Categorization of Constructs*, to look into the verified core constructs contributing to the detection of fake news.

4.4 Conceptual Model Construction

For the development of a conceptual model comprising of core constructs systematic literature review, data coding technique of grounded theory and expert review have been conducted. In that context, eighty-two constructs have been extracted through a systematic literature review. These constructs were then encoded through the data coding technique of grounded theory. In the last step of validation and verification, the expert review has been done to detect fake news at early stages.

The constructs are assembled into groups depending upon their features and nature. The group names are uniquely identified by the author which was verified by experts.

Following is the model representation in pictorial form divided into three levels in Figures 4.1, 4.2, 4.3. Three levels are being created due to the intensity level with which the contribution process of fake news can get affected.

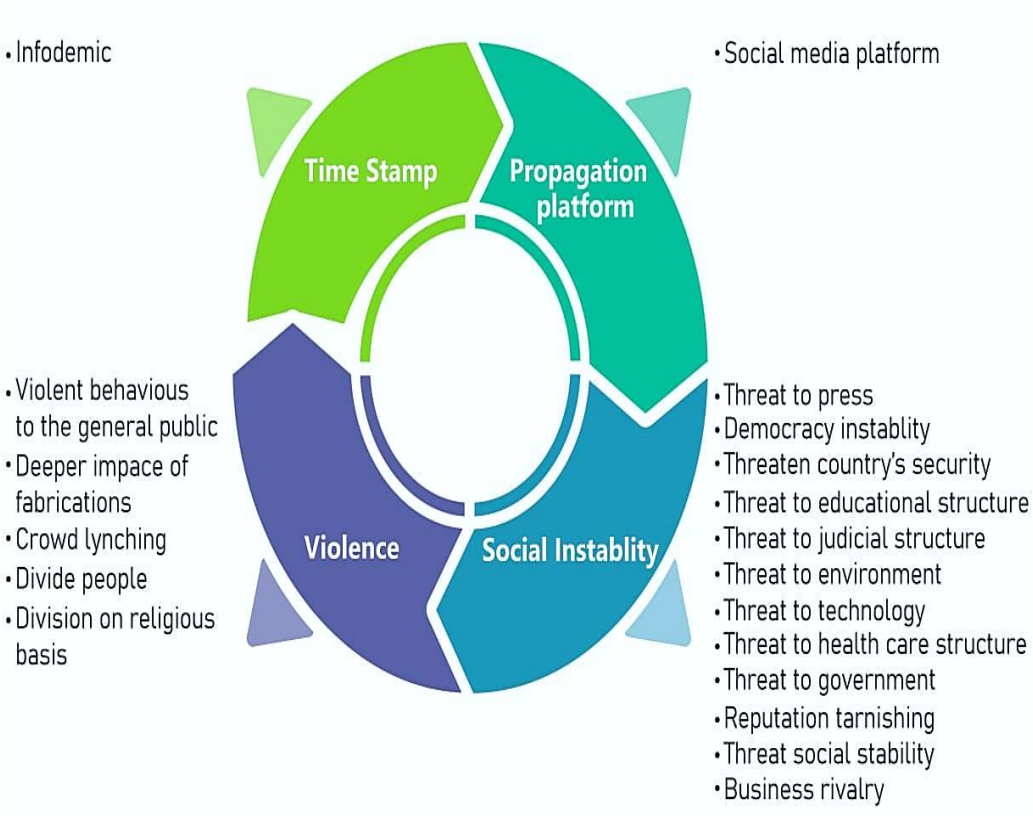


Figure 4.1: Level 01 Model of Constructs Contributing in Fake news

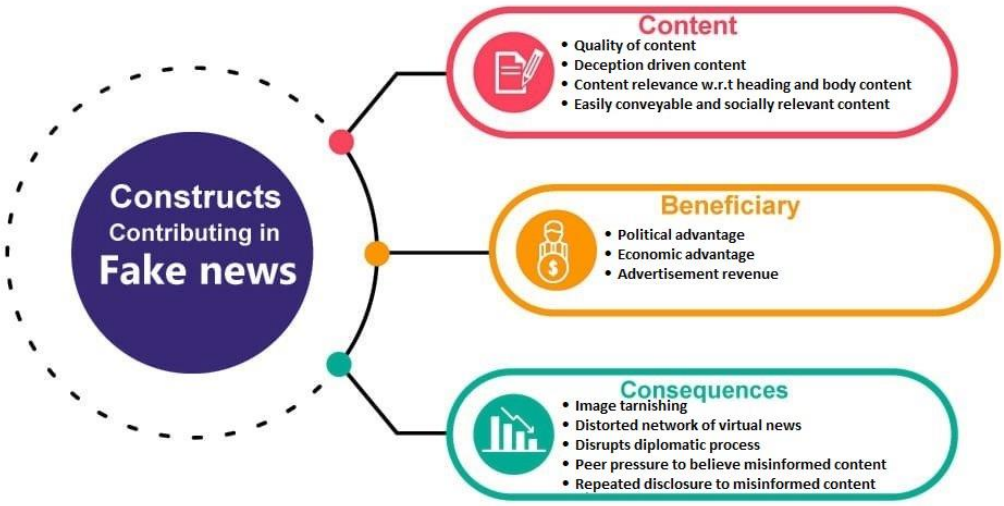


Figure 4.2: Level 02 Model of Constructs Contributing in Fake news

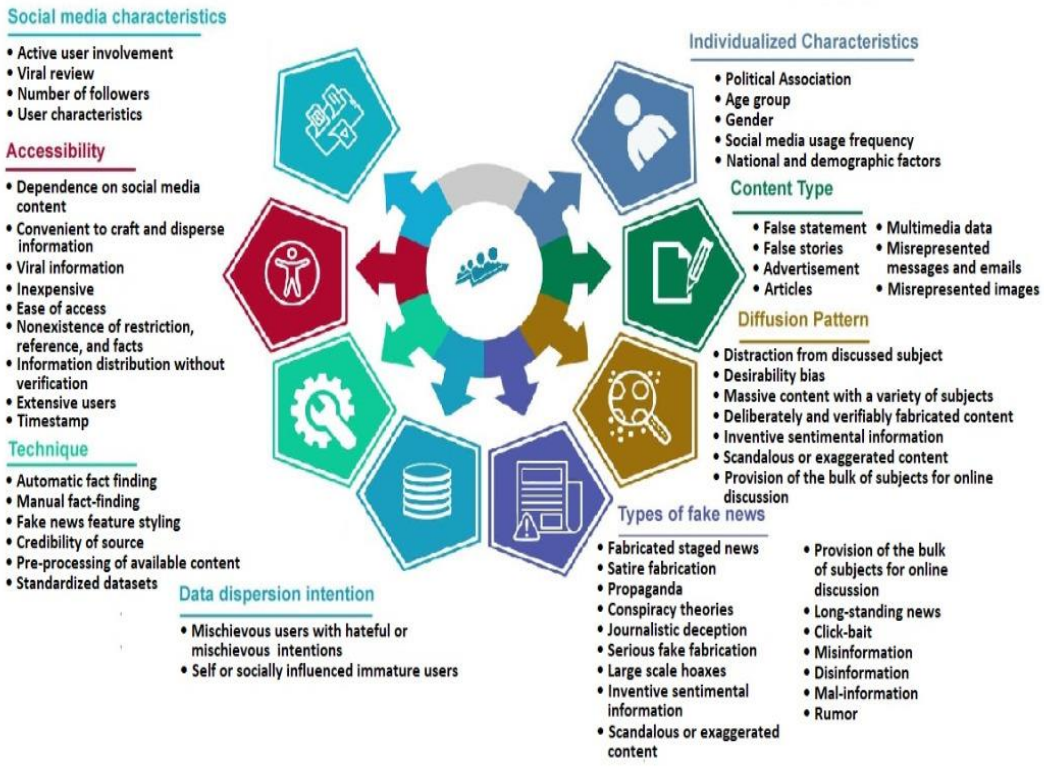


Figure 4.3: Level 03 Model of Constructs Contributing in Fake news

4.4.1 Results and Contribution

Existing literature has scarce unfolded constructs required for the detection of fake news at early stages. This research proposed the identification, classification, and categorization of constructs and based on which a conceptual model is proposed. Below mentioned are the phases of contribution done by the author.

4.4.1.1 Contribution Phase-I

This research will contribute to the labeling of existing data comprehensively and which will be then prepared for future predictions of fake news detection. In such a scenario, meaningful data and its labeling will contribute to the early detection of fake news.

4.4.1.2 Contribution Phase-II

The proposed model in this research encompassing constructs will be used for the industry to review and give weightage accordingly. Those weights will be later used for making predictions percentages. These constructs will be utilized for the automation of software tools, specifically for predictions.

4.1.1.3 Contribution Phase-III

The research will provide classical literature regarding the news constructs. What news is known as fake and what other essential constructs are necessary to recognize fake news so exploring various such constructs such as content, beneficiary, consequences, individualized characteristics, content type, diffusion pattern, types of fake news, data dispersion intention, techniques, accessibility, social media characteristics, timestamp, propagation platform, violence, social stability are

useful to recognize the news as fake news. Future studies can do more on exploring these constructs and re-verifying them in their studies.

4.5 Discussion

In this era, due to advancement and lack of time, one does not have time to get news from traditional ways so it gave free hand to extensive social media usage that follows no standards. This liberty led social media user's face the challenge of identifying fake news and the credibility of news is always at stake. This unhealthy act involves economic benefits to vendors, political benefits, etc. Fake news refers to the content that consciously betrays users to circulate misreport, distrust, and manipulation among users. Fake news also named junk news is propaganda that is propagated to defame the targeted audience. Its most common propagation platform is social media which due to its size (A. R. Pathak et al. 2020)(Agarwal et al. 2019)(Zhang and Ghorbani 2020)(Khandelwal and Kumar 2020) and the number of active users (Zhou and Zafarani 2020a)(Rubin, Chen, and Conroy 2020)(Antonakaki, Fragopoulou, and Ioannidis 2021)(Gereme and Zhu 2019)(Kapusta et al. 2020)(Wu and Liu 2018) makes it difficult to identify the broker of news. Social media along with its pros has brought many cons to society and fake news tops all.

Recent examples of universally viral videos are the accurate depiction of what kind of content is propagated and dispersed to a large number of audiences. It along with the ethical lacking of society shows that valuable content, unfortunately, is not entertained in the huge world of social media. Fake news is mentioned in the Pakistan's constitution as well and its implications in terms of punishment. The Citizens Protection (Against Online Harm) Rules, 2020 are based on the Pakistan Telecommunication (Reorganization) Act, 1996, and the Prevention of Electronic Crimes Act, 2016. These Acts appear to be aimed at "gaining more control" over digital data generated by Pakistanis, particularly on social media. The National Coordinator's Office is formed under Rule 3 of Chapter II of the Rules, and the Minister of Information Technology and Telecommunications appoints the National Coordinator. Companies can also provide data and information to the government.

Generally, such news is devised to persuade one's perspective about a certain issue. Lack of knowing internet's appropriate usage, biased behavior towards certain issue and bombardment of information also contributes in increasing wide fake news spread. Identifying fake news and its accuracy has always been a serious question to researchers.

Fake news has always been a concern in the field of journalism but recently it has invaded every single field which turned out to be a matter of ultimate intense concern for researchers around the globe. One of the biggest challenges is to analyze how such news propagates and reaches a massive audience within no time leaving a great negative impact on their minds. It is crucial to analyze that how an observer or a third person gets involved in the cycle of information manipulation.

Few researchers have proposed solutions for the detection of fake news by suggesting automated and manual detection tools. In view of automated detection tools, a question arises upon the validity of the tool with no prior information of constructs considered in the construction of the automated tool for detection of fake news (A. R. Pathak et al. 2020)(Qazi, Khan, and Ali 2020). Researchers have explained the need for manual detection however no focus on the core constructs required or considered for the detection of fake news at early stages has been proposed which questions the validity of proposed tools. Thus, present research addresses the literature gap by identifying the core constructs considered for early detection of fake news which further was meaningfully grouped to develop a model for early detection of fake news. Extracting truth is no more a difficult approach through the presented architectural model.

It can be seen in existing studies that researchers have not paid much attention to the development of a conceptual model which caused its irresistible growth and lack of authenticity of fake news. For the conduction of this research, the existing literature has been thoroughly reviewed by following the Kitchenhams. The systematic literature review contributes to identifying the core constructs considered for the early detection of fake news. The factors were extracted from existing studies based on their contribution to the propagation and dispersion of fake news. The

objective of conducting the methodology of data coding technique of grounded theory and expert review to classify and categorize the identified core constructs for early detection of fake news.

The data coding technique of grounded theory contributes to the collection of data and data encoding to develop a valid model. Data collected is encoded for the summarization of extensive data. Experts were identified based upon their expertise and the conceptual model is verified by the experts'. Field experts help in validating the conceptual model and it helps in locating research gaps.

CHAPTER 5

CONCLUSION

5.1 Overview

The conclusion, limitations, and future work of the present research are discussed in this chapter. It opens new research avenues for researchers working in the field of detection of fake news.

5.2 Conclusion

Fake news or forged news over the years has grasped the attention of its consumers due to its deep impact on the targeted audience (Rubin, Chen, and Conroy 2020). Also, it has gained the attention of researchers' community, industrialist stakeholders, government officials, security agencies, etc. to minimize the effect of slowly and deeply circulating fake news cycle. This disrupts the smooth functioning of any system which ultimately creates economic, health, trust issues in society.

However, it is a matter of utmost urgency to halt the circulation of such news at early stages to minimize its negative impact (Kandasamy and Murugasamy 2021). With a lot more advancement in the field of automated tools and manual detection techniques for the detection of fake news, no improvement in its dispersion cycle has been seen. Manual detection due to

the unavailability of a standardized model to label news as the fake is a challenging task and expert evaluation on the other hand is a delaying process due to the unavailability of processed data with lot more chances of human error.

Data security restrictions, missing out dimensions in automated tools, variety of languages and their literal meaning, limited user-centric approach, old-fashioned approaches to cater fake news formed on advanced patterns, unavailability of assessment criteria of automated detection solutions lead to inadequate or inefficiency of present solutions. Available datasets are inadequate to encompass all the domains of news which acts as the root cause for ineffective automated detection tools. So, there was a need to build a conceptual model to see how such news' dispersion cycle continues, the existing strategies to counter the impact of fake news, and what strategies are outdated in context to counter early detection of fake news.

The goal of the study was the analysis of the existing literature on the detection of fake news to construct a transparent way of identifying fake news at early stages by performing SLR, data coding technique of grounded theory, and expert review. Based on the existing review of fake news literature, constructs are identified. Then through the data coding technique of grounded theory and expert review, those constructs were classified and categorized. Addressed group of constructs in the detection of fake news are mentioned as 1) Time Stamp 2) Propagation Platform 3) Violence 4) Social Instability 5) Content 6) Beneficiary 7) Consequences 8) Social media characteristics 9) Accessibility 10) Technique 11) Data dispersion intention 12) Diffusion Pattern 13) Types of fake news 14) Content-Type 15) Individualized Characteristics. The groups are created with a classification of several extracted factors. The large circulation of fake news on social media and its detection has warranted the utmost attention of scholars, academicians, and industrial practitioners so open issues are also discussed in the paper that will aid in the advancement in the detection of fake news at the early stages.

5.3 Limitations

This article based on the existing literature has proposed a conceptual model to list down all the constructs from the origination of fake news to its dispersion. The core constructs have been extracted from the existing literature however, the author might have overlooked the interpretation of the existing studies that were considered for the conduction of this research. A limited sample size of extracted research papers, databases, and research keywords may act as a limitation in the present research. Also, industrial data has not been considered which in the future if considered can lead to a more structured validated model.

5.4 Future Work

This article has mainly given a conceptual model approach to detect fake news on social media by classifying it into constructs and grouping those constructs. As the amount of data on social media forums is huge and it is unpredictable due to the number of users it is providing access to so, it would be interesting to see how the implementation of this model will be helpful in the automatic detection of fake news.

Open issues for the detection of fake news can be involving users directly into the model, persuasive strategies for creating and believing in fake news, topic selection criteria, details that trigger audience attention, and effect of cultural/social background of the user along with the extracted constructs in the research.

Existing studies propose few datasets which are not adequate to label news as fake. It is crucial to standardize the available datasets for available automatic detection tools for fake news.

Another interesting avenue would be finding a common ground through which fake news can be detected as there are thousands of languages in which fake news is propagated and dispersed.

Assessment criteria have been mentioned through extracted core constructs in the present research so next, it would be an attention-grabbing topic to implement all three-level grouping of constructs into an automated detection tool.

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APPENDICES

APPENDIX A

Selected Research Papers by Peer Review and Author

Table A1: Selected Research Papers by Peer Review**.**

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
1.	PID_01	P1	1	1	0.33	0.33	0.33	0.598
2.	PID_02		1	1	1	0.33	1	0.866
3.	PID_03		1	1	0.66	1	0.66	0.864
4.	PID_04		1	1	1	0.66	1	0.932
5.	PID_05		1	1	0	0.33	0.33	0.532
6.	PID_06		1	1	0.66	0	0.33	0.598
7.	**PID_07**		**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
8.	PID_08		1	1	0.66	1	0.66	0.864
9.	PID_09		1	1	0.33	1	0.33	0.732
10.	PID_10		0.33	1	1	0.33	1	0.732
11.	PID_11	P2	0.33	1	1	0.33	0.33	0.598
12.	PID_12		1	1	1	1	0.33	0.866

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
13.	PID_13		0.66	1	1	0.66	1	0.864
14.	PID_14		1	1	1	1	0.66	0.932
15.	PID_15		0	1	1	0	0.33	0.466
16.	PID_16		0	1	1	0.33	0	0.466
17.	PID_17		0.66	1	1	0.66	1	0.864
18.	PID_18		0.33	1	1	0.33	1	0.732
19.	PID_19		0.33	1	1	0.33	1	0.732
20.	PID_20		0.33	1	1	0.33	0.33	0.598
21.	PID_21		1	1	1	1	0.33	0.866
22.	**PID_22**		**0**	**0.33**	**0.33**	**0**	**0**	**0.132**
23.	**PID_23**		**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
24.	PID_24		1	1	1	1	0.66	0.932
25.	PID_25	**P3**	0	1	1	0	0.33	0.466
26.	**PID_26**		**0.33**	**0**	**0**	**0.33**	**0**	**0.132**
27.	PID_27		0	1	1	0	0	0.4
28.	PID_28		0.66	1	1	0.66	1	0.864
29.	PID_29a		0.33	1	1	0.33	1	0.732
30.	PID_29b		0.33	1	1	0.33	1	0.732
31.	PID_30	**P4**	0.33	1	1	0.33	0.33	0.598
32.	PID_31		1	1	1	1	0.33	0.866

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
33.	**PID_32**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
34.	**PID_33**		**0.33**	**0**	**1**	**0.33**	**0.33**	**0.398**
35.	**PID_34**		**0**	**0**	**0.33**	**0**	**0.33**	**0.132**
36.	PID_35		0.66	1	1	0.66	1	0.864
37.	PID_36		1	1	1	1	0.66	0.932
38.	**PID_37**		**0**	**0**	**0.33**	**0**	**0.33**	**0.132**
39.	PID_38		0	1	1	0.33	0.33	0.532
40.	**PID_39**		**0.33**	**0**	**0.33**	**0**	**0**	**0.132**
41.	**PID_40**	**P5**	**0**	**0**	**0.33**	**0**	**0.33**	**0.132**
42.	PID_41		0	1	1	0.66	0	0.532
43.	PID_42		0.66	1	1	0.66	1	0.864
44.	PID_43		0.33	1	1	0.33	1	0.732
45.	PID_44		0.33	1	1	0.33	1	0.732
46.	PID_45		0.33	1	1	0.33	0.33	0.598
47.	**PID_46**		**0**	**0**	**0.33**	**0**	**0.33**	**0.132**
48.	PID_47		1	1	1	1	0.33	0.866
49.	PID_48		0.66	1	1	0.66	1	0.864
50.	**PID_49**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
51.	**PID_50**	**P6**	**0.33**	**0**	**1**	**0.33**	**0.33**	**0.398**
52.	PID_51		1	1	1	1	0.66	0.932

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
53.	PID_52		0.66	1	1	0	0.33	0.598
54.	PID_53		0.33	1	1	0.66	0	0.598
55.	PID_54		0.66	1	0	0.66	1	0.664
56.	**PID_55**		**0**	**0.33**	**0.33**	**0**	**0**	**0.132**
57.	PID_56		0.66	0.33	0	0.33	1	0.464
58.	**PID_57**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
59.	**PID_58**		**0**	**0.33**	**0.33**	**0**	**0**	**0.132**
60.	**PID_59**		**0.33**	**0**	**0**	**0**	**0.33**	**0.132**
61.	PID_60		0.33	1	1	0.33	1	0.732
62.	**PID_61**		**0.33**	**1**	**1**	**0.33**	**0.33**	**0.598**
63.	PID_62		1	1	1	1	0.33	0.866
64.	**PID_63**		**0.33**	**0**	**0**	**0**	**0.33**	**0.132**
65.	PID_64	**P7**	0.66	1	1	0.66	1	0.864
66.	**PID_65**		**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
67.	PID_66		0	1	1	0	0.33	0.466
68.	**PID_67**		**0**	**0**	**0**	**0.33**	**0.33**	**0.132**
69.	**PID_68**		**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
70.	PID_69		0.66	1	1	0.66	1	0.864
71.	PID_70	**P8**	0.33	1	1	0.33	1	0.732
72.	**PID_71**		**0**	**0.33**	**0**	**0**	**0.33**	**0.132**

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
73.	**PID_72**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
74.	**PID_73**		**0.33**	**0**	**1**	**0.33**	**0.33**	**0.398**
75.	PID_74		0.33	1	1	0.33	1	0.732
76.	**PID_75**		**0**	**0.33**	**0**	**0**	**0.33**	**0.132**
77.	**PID_76**		**0.33**	**0**	**0.33**	**0**	**0**	**0.132**
78.	PID_77		0.66	1	1	1	0.33	0.798
79.	PID_78		1	1	1	1	0.33	0.866
80.	PID_79		0.66	1	1	0.66	1	0.864
81.	PID_80	**P9**	1	1	1	1	0.66	0.932
82.	PID_81		0	1	1	0	0.33	0.466
83.	**PID_82**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
84.	**PID_83**		**0.33**	**0**	**0**	**0.33**	**0.33**	**0.198**
85.	PID_84		0	1	1	0.33	0.33	0.532
86.	PID_85		0.33	1	1	0.33	1	0.732
87.	PID_86		0.33	1	1	0.33	0.33	0.598
88.	**PID_87**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
89.	**PID_88**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
90.	**PID_89**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
91.	PID_90	**P10**	0.33	1	1	0.33	1	0.732
92.	PID_91		0.33	1	1	0.33	0.33	0.598

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
93.	PID_92		1	1	1	1	0.33	0.866
94.	PID_93		0.66	1	1	1	1	0.932
95.	PID_94		1	1	1	1	0.66	0.932
96.	**PID_95**		**0**	**0**	**0**	**0.33**	**0.33**	**0.132**
97.	**PID_96**		**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
98.	PID_97		0	1	1	0	0	0.4
99.	PID_98		0	0.33	0	0.33	0	0.132
100.	**PID_99**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
101.	**PID_100**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
102.	PID_101		0.66	1	1	0.66	1	0.864
103.	**PID_102**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
104.	**PID_103**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
105.	**PID_104**	**P11**	**0.33**	**0**	**1**	**0.33**	**0.33**	**0.398**
106.	**PID_105**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
107.	**PID_106**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
108.	PID_107		0.33	1	1	0.33	1	0.732
109.	**PID_108**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
110.	**PID_109**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
111.	**PID_110**	**P12**	**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
112.	**PID_111**		**0**	**0**	**0**	**0**	**0.33**	**0.066**

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
113.	**PID_112**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
114.	**PID_113**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
115.	**PID_114**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
116.	**PID_115**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
117.	**PID_116**		**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
118.	PID_117		0.33	1	1	0.33	0.33	0.598
119.	**PID_118**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
120.	**PID_119**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
121.	**PID_120**	**P13**	**0.33**	**0.33**	**0**	**0**	**0**	**0.132**
122.	PID_121		0.66	1	1	0.66	1	0.864
123.	**PID_122**		**0.33**	**1**	**0**	**0.33**	**0.33**	**0.398**
124.	**PID_123**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
125.	**PID_124**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
126.	**PID_125**		**0.33**	**0**	**1**	**0.33**	**0.33**	**0.398**
127.	**PID_126**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
128.	**PID_127**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
129.	PID_128		1	1	1	1	0.66	0.932
130.	PID_129		0	1	1	0	0.33	0.466
131.	PID_130	**P14**	0	1	1	0	0	0.4
132.	**PID_131**		**0.33**	**0**	**0**	**0**	**0.33**	**0.132**

Sr. No	Paper ID	Particpant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
133.	PID_132		0.66	1	1	0.66	1	0.864
134.	**PID_133**		**0.33**	**1**	**0**	**0.33**	**0.33**	**0.398**
135.	**PID_134**		**0**	**0.33**	**0**	**0.33**	**0**	**0.132**
136.	**PID_135**		**0**	**0**	**0**	**0**	**0.33**	**0.066**
137.	**PID_136**		**0.33**	**0**	**1**	**0.33**	**0**	**0.332**

Table A2: Selected Research Papers by Author

Sr. No	Paper ID	Participant	Question 01	Question 02	Question 03	Question 04	Question 05	Average Score
1.	PID_135	**Author**	0.33	1	1	0.33	1	0.73
2.	PID_136		0.33	1	1	0.33	0.33	0.59

APPENDIX B

Extracted Constructs in Implicit Removal and Explicit Removal

Table B1: Implicit Removal.

Sr. No	Constructs	Paper ID	After Implicit Removal
i.	Fake news detection, post-truth, rumor detection, internet of fake media things, misinformation detection, deception detection, deceptive online content, infodemic, weaponization of information, false information detection, information disorder	PID 01, 02, 03, 04, 05, 06, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 24, 25, 28, 29a, 29b, 30, 31, 36, 41, 42, 43, 44, 45, 47, 48, 51, 52, 53, 54, 56, 60, 62, 64, 66, 69, 70, 74, 77, 78, 79, 80, 81, 84, 85, 86, 90, 91, 92, 93, 94, 97, 101, 107, 117, 121, 128, 129, 130, 132	Infodemic [Cited term presented by World Health Organization (WHO) in 2020]
ii.	Social media, social networking sites (web-based networking media), online social network (OSN), online media, virtual world, digital media and social networks, microblogging platform, information-sharing platform, electronic media, fake media, social communication network	PID 01, 02, 04, 05, 06, 09, 12, 16, 17, 18, 21, 24, 25, 31, 35, 42, 43, 45, 47, 51, 54, 56, 60, 64, 69, 77, 78, 79, 81, 91, 94, 97, 107, 128	Social media platform
iii.	Low-quality news, content quality	PID 01, 84	Quality of content

Sr. No	Constructs	Paper ID	After Implicit Removal
iv.	Purposeful deception, mislead or deceive reader, forge fake information, news manipulation, fabricated news to deceive readers, mislead consumers, misleading information	PID 01, 02, 05, 12, 16, 38, 44, 45, 51, 52, 54, 69, 77, 79, 128	Deception driven content
v.	Reliance on social media, preference for social media news, lack of trust in a traditional news medium	PID 01, 02, 16, 24, 81	Dependence on social media content
vi.	Manipulation of public events, influence masses, a threat to society, influence public opinion and decisions, shape public opinion, confusing and persuading, distort awareness and decision making	PID 01, 02, 06, 08, 09, 13, 14, 41, 45, 47, 51, 52, 62, 69, 80, 81, 90, 94, 121, 128	Disrupts opinion
vii.	Sharing, forward, mentions (active user engagement), social tagging, popular trend	PID 03, 04, 35, 42, 60, 62, 121, 129	Active user involvement
viii.	Fake reports, fake product reviews, alternative facts replace facts, fake reviews	PID 03, 04, 14, 20, 42, 62, 94	Viral reviews
ix.	Mob lynching, murder, violence in society, discontent among people, inciting riots, rates of crime, religious clash, intention to harm an individual	PID 02, 03, 10, 11, 16, 29a, 31, 62, 69, 77, 80, 121, 128	Violent behavior to the general public
x.	Automatic fact-checking (fact extraction, knowledge extraction, source-based, style-based, propagation-based); data collection from crowdsourcing for dataset	PID 01, 03, 06, 09, 10, 20, 21, 29a, 31, 94, 135	Automatic fact finding
xi.	manual fact-checking (expert-based, domain experts, crowdsourced); computational fact-checking; human identification	PID 03, 04, 06, 29a, 42, 135, 136	Manual fact finding

Sr. No	Constructs	Paper ID	After Implicit Removal
xii.	Article's title, article's content, headline, the relationship between headline and body; text analysis; the relationship between topic and event	PID 01, 06, 08, 12, 17, 20, 21, 24, 28, 29a, 29b, 38, 41, 44, 52, 64, 78, 117	Content relevance w.r.t heading and body content
xiii.	Malicious users (intentionally create and/or propagate fake news motivated by some benefits)	PID 136	Mischievous users with hateful or mischievous intentions
xiv.	Naïve users (normal users, some of whom spread fake news along with malicious users, unintentional, self-influence, or social influence),	PID 136	Self or socially influenced immature users
xv.	Threat to journalism, shutting down and silencing dissent, a threat to freedom of expression	PID 03, 62, 84, 70, 136	Threat to press
xvi.	Democracy instable, influence political elections, threat to democracy	PID 03, 10, 14, 28, 44, 45, 47, 51, 62, 66, 84, 85, 136	Democracy instability
xvii.	Threaten public security, threaten country's security	PID 01, 03, 06, 31, 45, 62, 80,	Threaten country's security
xviii.	Threat to education	PID 03, 14, 20, 38	Threat to the educational structure
xix.	Legislation, policymakers, a threat to the justice system	PID 03, 29a, 51, 85, 121	Threat to judicial structure
xx.	Threat to environment	PID 29a	Threat to environment
xxi.	Threat to technology, science	PID 14, 20, 29a, 66, 129	Threat to technology
xxii.	Threat to health care, medical	PID 14, 29a, 66,	Threat to health care structure
xxiii.	Threat to government	PID 03, 121	Threat to government
xxiv.	Intention to damage an agency, institution, and organization, harm	PID 10, 16, 29a, 77,	Reputation tarnishing

Sr. No	Constructs	Paper ID	After Implicit Removal
	companies	121, 128	
xxv.	Threat to social stability, vulgarity, racism, defamation, a threat to society, spreads hatred, anger, and hate, creates real-life fears in society, social media fatigue, hate speech	PID 04, 11, 13, 14, 21, 30, 31, 45, 48, 52, 62, 66, 69, 117, 121, 128	Threat to social stability
xxvi.	Threat to online shopping, manipulate the stock market	PID 14, 20, 21, 29a, 45, 66, 121, 129	Business rivalry
xxvii.	Emergency response during natural disasters, crisis events; spread diseases even cause death	PID 45, 128	Delayed response to calamities
xxviii.	Political benefit, political unrest, political propaganda, fake news printing due to political pressure, change political scenario, effects political leaders	PID 03, 09, 12, 13, 16, 19, 20, 21, 29a, 38, 41, 45, 52, 62, 66, 69, 79, 80, 90, 128	Political advantage
xxix.	Economic benefit, economic sector, economic propaganda, economic disturbance, source of revenue, financial benefit	PID 03, 12, 16, 19, 21, 28, 45, 62, 69, 77, 80, 90, 94	Economic advantage
xxx.	A marketing campaign, increase advertisement revenue, seeking audience attention	PID 54, 56, 62, 90	Advertisement revenue
xxxi.	National and cultural differences, sociocultural	PID 12, 66	Sociocultural differences
xxxii.	Knowledge-based, writing style, propagation pattern; linguistic markup features (identification, propagation pattern, counter effect)	PID 03, 05, 09, 13, 38, 52, 84, 85, 135, 136	Fake news feature styling
xxxiii.	The credibility of a source, claim credibility and prediction, source reliability and trustworthiness checking methods, the credibility of	PID 03, 05, 10, 38, 62, 74, 85, 94, 136	Credibility of source

Sr. No	Constructs	Paper ID	After Implicit Removal
	its creators and spreaders		
xxxiv.	Low cost, social media is free of cost, less expensive in terms of both time and money, cheaper	PID 03, 11, 14, 27, 60, 62, 78, 91, 92, 97, 135, 136	Inexpensive
xxxv.	Convenient for evildoers to create and disseminate, blurred information creation and sharing online news, allows every user to rapidly publish their views, free content-generating applications, and software, easy to generate, fabrication of information is easy	PID 11, 12, 14, 42, 43, 48, 70, 86, 130, 135	Convenient to craft and disperse information
xxxvi.	Ease of use, easy access, simple access	PID 14, 27, 62, 70, 77, 78, 91, 92, 135	Ease of access
xxvii.	Timely nature, less time consuming, updates in every minute, rush to cover the latest news	PID 62, 77, 90	Time stamp
xxviii.	Rapid information sharing, a falsehood spread faster, easily conveyable and socially relevant news, rapid dissemination of information lead people to seek out consume news from social media, published online faster	PID 03, 06, 12, 27, 64, 77, 78, 97, 135, 136	Easily conveyable and socially relevant content
xxxix.	Spreads farther, falsehood diffused farther, wide propagation, false news spreads farther	PID 12, 18, 64, 91, 97, 136	Viral information
xl.	Increase readership, a falsehood spread deeper, feelings have more weight than evidence, spreads deeper and more broadly than true news	PID 12, 54, 64, 70, 94, 97	Deeper impact of fabrications
xli.	Distraction from the current issue, various perspectives of a single news	PID 24, 77, 94	Distraction from discussed subject

Sr. No	Constructs	Paper ID	After Implicit Removal
xlii.	Desirability bias, cherry-picking, believe fake news due to its features, confirmation bias or tunnel view, filter bubble, induces the biased or false beliefs into consumers, pre-existing beliefs or attitudes, author's judgment, echo-chamber effect	PID 03, 08, 13, 14, 16, 24, 35, 47, 48, 51, 52, 53, 62, 64, 69, 93, 94, 135, 136	Desirability bias
xliii.	Diverse information, a large number of subjects, a large amount of multimedia data, an enormous volume of data, increased data on social media	PID 14, 16, 17, 36, 79	Massive content with variety of subjects
xliv.	Intent to mock, intentionally and verifiably false, unconfirmed information,	PID 42, 51, 53, 70, 78, 107	Deliberately and verifiably fabricated content
xlv.	Deceptive news, half-truth, fabricated information, deceptive information, deception detection, maliciously false news	PID 03, 14, 35, 42, 45, 51, 62, 70, 79, 81, 92, 93, 94, 107, 136	Deceptive news
xlvi.	Social spam fabricated staged news, fraud	PID 04, 06, 16, 42, 45, 70, 79, 97	Fabricated staged news
xlvii.	Satire news, satire fabrication, humorous fakes (news parody, game shows), news satire, news parody	PID 03, 06, 13, 28, 42, 62, 70, 81, 90, 93, 107, 136	Satire fabrication
xlviii.	Propaganda	PID 70, 90, 93, 107	Propaganda
xlix.	Conspiracy theories, particular cause or agenda, controversy, out of context information	PID 28, 69, 90, 94, 107	Conspiracy theories
l.	Journalist deception, fraudulent journalist writing, opinion spam	PID 42, 90	Journalistic deception
li.	Fake serious fabrication, serious fabrication	PID 06, 13, 42	Serious fake fabrication

Sr. No	Constructs	Paper ID	After Implicit Removal
lii.	Large scale hoaxes, hoaxes/rumors, online hoaxes	PID 06, 13, 20, 35, 42, 90, 92, 93, 97, 107	Large scale hoaxes
liii.	Breaking news, innovative ways to create and spread news, emotional information, to attract eyeballs, appeals emotion	PID 06, 08, 12, 28, 42, 52, 66, 84, 94	Inventive sentimental information
liv.	Scandal-mongering or sensationalism to increase traffic or profits, sensational crime stories, sentiments	PID 42, 84	Scandalous or exaggerated content
lv.	Gossip columns about celebrities, online dissing and gossiping, uncontrolled use, uncontrolled growth, large scale application of social media, information overload	PID 17, 42, 48, 48, 79, 92, 121	Provision of the bulk of subjects for online discussion
lvi.	Long-standing, heterogeneous style, junk news	PID 06, 42, 51, 93	Long standing news
lvii.	Clickbait, eye-catching headlines, flashy headline and design, attractiveness, clickbait detection	PID 03, 06, 08, 42, 54, 62, 84, 90, 93, 94, 107, 135	Click-bait
lviii.	Blogs, posts, news editorial, false statement	PID 03, 04, 24, 30, 42, 52, 60	False statement
lix.	Claims, fake stories	PID 03, 24	False stories
lx.	TV ads, fake ads, presence of ads	PID 03, 14, 28	Advertisement
lxi.	News articles, articles, news report	PID 03, 24, 42	Articles
lxii.	Video and audio, multimedia data, verbal form,	PID 03, 12, 21, 45, 51, 52, 70, 91	Multimedia data
lxiii.	Email, messages, malicious messages, and emails	PID 03, 16, 45	Misrepresented messages and emails
lxiv.	Images, pictures, misleading images, visual form	PID 06, 12, 45, 51, 70	Misrepresented images

Sr. No	Constructs	Paper ID	After Implicit Removal
lxv.	The intent of defamation, image tarnishing, false impression, or conclusion	PID 62, 70, 128	Image tarnishing
lxvi.	Disrupts the authenticity of the news ecosystem, a threat to the public trust for news trustworthiness, threaten the internet credibility and trustworthiness	PID 16, 28, 62, 69, 81, 132	Distorted network of virtual news
lxvii.	Violated cyber and physical space, a threat to cyber security, cyber abuse, cyberbullying	PID 19, 30, 48, 52, 64	Cyber-security
lxviii.	Absence of control and fact-checking, no verification of online news, lack of reference and facts, non-verified users, unrestricted and open sharing of data, lacks censorship, no control gate	PID 06, 08, 13, 15, 17, 42, 53, 80, 97	Nonexistence of restriction, reference and facts
lxix.	Sharing information without verification, wrong information with lack of accuracy, widespread with people following it without any prior information of an event	PID 24, 74, 81	Information distribution without verification
lxx.	Extensive users, gain public trust, engage with a massive audience	PID 18, 84, 85, 86, 90	Extensive users
lxxi.	Misinformation disseminated by trusted news outlets or their friends and family, news consumers become news spreader	PID 78, 97	News consumers become news propagators
lxxii.	data processing (punctuation, removal, lowercasing, stop words removal, stemming, tokenization); pre-processing data (converting text to lowercase, removing numbers & punctuations from the data, removing white spaces from data, stop words	PID 38, 48	Pre-processing of available content

Sr. No	Constructs	Paper ID	After Implicit Removal
	removal using NLTK, stemming using NLTK, lemmatization using NLTK); pre-processing data (tokenization, word check, stemming, tagging, topic collection, verb collection, topic vectorization); pre-processing (regular expression, tokenization, lemmatization and stop words removal)		
lxxiii.	Credibility indicator (political affiliation, age, gender, social media usage frequency); the influence of demographic and cultural factors, age, gender, education; control variables (age, gender)	PID 64, 70, 121	Individualized Characteristics

Table B2: Explicit Removal.

Sr. No	Constructs	Paper ID	After Explicit Removal
i.	Diplomatic process	PID 12	Disrupts diplomatic process
ii.	Peer pressure	PID 03	Peer pressure to believe misinformed content
iii.	Repeated exposure	PID 03	Repeated disclosure to misinformed content
iv.	Lack of gold standard agreed on datasets	PID 06, 93	Standardized datasets
v.	Social media terminologies (user, follower, friend, post, retweet, user characteristics, status, source user, spreader),	PID 97	Social media terminologies
vi.	Misinformation	PID 03,	Misinformation

Sr. No	Constructs	Paper ID	After Explicit Removal
		17, 19, 29b, 45, 62, 66, 77, 81, 90, 92, 93, 101, 107, 128, 136	
vii.	Disinformation	PID 03, 06, 08, 29b, 45, 62, 81, 84, 90, 93, 101, 139	Disinformation
viii.	Mal-information	PID 29b, 101	Mal-information
ix.	Rumor	PID 02, 03, 06, 20, 28, 30, 31, 45, 62, 80, 81. 90, 92, 107, 136	Rumor

APPENDIX C

Classification and Categorization of Constructs

Table C1: Experts' Suggestions.

Sr. No	Group Name	Explanation	Comments
L1G1	Infodemic	[Cited term presented by World Health Organization (WHO) in 2020]	E1: Seems a subset of some other group to me E2: Is it a separate construct? E3: The categorization is fine. What are the constructs? E4: Constructs are missing.
Sr. No	**Group Name**	**Constructs**	**Comments**
L1G2	Propagation platform	Social media platform	E1: Agreed E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
Sr. No	**Group Name**	**Constructs**	**Comments**
L1G3	Violence	Violent behavior to the general public	E1: More constructs addition proposed E2: Appropriate E3: The categorization is fine. What does 'Deeper impact of fabrications' mean? E4: Appropriate
		Deeper impact of fabrications	
Sr. No	**Group Name**	**Constructs**	**Comments**
L1G4	Social Instability	Threat to press	E1: Correct E2: Appropriate E3: The categorization is fine. I suggest adding the following group name: social, economic, and environmental instability. Then, re-categorize the constructs. E4: Appropriate
		Democracy instability	
		Threaten country's security	
		Threat to educational structure	
		Threat to judicial structure	
		Threat to environment	
		Threat to technology	
		Threat to health care structure	
		Threat to government	
		Reputation tarnishing	

		Threat to social stability	
		Business rivalry	
Sr. No	**Group Name**	**Constructs**	**Comments**
L2G1	Content	Quality of content	E1: Agreed E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Deception driven content	
		Content relevance w.r.t heading and body content	
		Easily conveyable and socially relevant content	
Sr. No	**Group Name**	**Constructs**	**Comments**
L2G2	Beneficiary	Political advantage	E1: Agreed E2: Appropriate E3: The category and constructs are appropriate. Maybe you can consider social advantage. E4: Appropriate
		Economic advantage	
		Advertisement revenue	
Sr. No	**Group Name**	**Constructs**	**Comments**
L2G3	Consequences	Image tarnishing	E1: Good mapping E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Distorted network of virtual news	
		Cyber-security	
		Disrupts diplomatic process	
		Peer pressure to believe misinformed content	
		Repeated disclosure to misinformed content	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G1	Social media characteristics	Active user involvement	E1: Correct E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Viral review	
		Number of followers	
		User characteristics	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G2	Convenience	Dependence on social media content	E1: Seems correct to me, group name could be revised. Why ease of access? E2: Appropriate E3: The category and
		Convenient to craft and disperse information	
		Viral information	
		Inexpensive	
		Ease of access	
		Nonexistence of restriction, reference and facts	

		Information distribution without verification	constructs are appropriate. E4: Appropriate
		Extensive users	
		Time stamp	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G3	Technique	Automatic fact finding	E1: I don't agree with placing of credibility of source, rest seems fine to me E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Manual fact finding	
		Fake news feature styling	
		Credibility of source	
		Pre-processing of available content	
		Standardized datasets	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G4	Data dispersion intention	Mischievous users with hateful or mischievous intentions	E1: Good E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Self or socially influenced immature users	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G5	Diffusion Pattern	Distraction from discussed subject	E1: Agreed E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Desirability bias	
		Massive content with variety of subjects	
		Deliberately and verifiably fabricated content	
		Inventive sentimental information	
		Scandalous or exaggerated content	
		Provision of bulk of subjects for online discussion	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G6	Types of fake news	Deceptive news	E1: Very good work in this part of the section E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Fabricated staged news	
		Satire fabrication	
		Propaganda	
		Conspiracy theories	
		Journalistic deception	
		Serious fake fabrication	
		Large scale hoaxes	
		Inventive sentimental information	
		Scandalous or exaggerated content	
		Provision of bulk of subjects for online discussion	

		Long standing news	
		Click-bait	
		Misinformation	
		Disinformation	
		Mal-information	
		Rumor	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G7	Content Type	False statement	E1: Good findings E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		False stories	
		Advertisement	
		Articles	
		Multimedia data	
		Misrepresented messages and emails	
		Misrepresented images	
Sr. No	**Group Name**	**Constructs**	**Comments**
L3G8	Individualized Characteristics	Political Association	E1: Good mapping E2: Appropriate E3: The category and constructs are appropriate. E4: Appropriate
		Age group	
		Gender	
		Social media usage frequency	
		National and demographic factors	

Classification and Categorization of Constructs

Table C2: Levels of Constructs Contributing in Fake news.

Level 01 of Constructs Contributing in Fake news	
Group Name	**Construct**
Time Stamp	Infodemic

Group Name	**Constructs**
Propagation platform	Social media platform

Group Name	Constructs
Violence	Violent behavior to the general public
	Deeper impact of fabrications
	Crowd lynching
	Divide people
	Division on a religious basis

Group Name	Constructs
Social Instability	Threat to press
	Democracy instability
	Threaten country's security
	Threat to the educational structure
	Threat to judicial structure
	Threat to environment
	Threat to technology
	Threat to health care structure
	Threat to government
	Reputation tarnishing
	Threat to social stability
	Business rivalry

Level 02 of Constructs Contributing in Fake news	
Group Name	**Constructs**
Content	Quality of content
	Deception driven content
	Content relevance w.r.t heading and body content
	Easily conveyable and socially relevant content

Group Name	**Constructs**
Beneficiary	Political advantage
	Economic advantage
	Advertisement revenue

Group Name	**Constructs**
Consequences	Image tarnishing
	Distorted network of virtual news
	Cyber-security
	Disrupts diplomatic process
	Peer pressure to believe misinformed content
	Repeated disclosure to misinformed content

Level 03 of Constructs Contributing in Fake news

Group Name	Constructs
Social media characteristics	Active user involvement
	Viral review
	Number of followers
	User characteristics

Group Name	Constructs
Accessibility	Dependence on social media content
	Convenient to craft and disperse information
	Viral information
	Inexpensive
	Ease of access
	Nonexistence of restriction, reference, and facts
	Information distribution without verification
	Extensive users
	Timestamp

Group Name	Constructs
Technique	Automatic fact finding
	Manual fact-finding
	Fake news feature styling
	Credibility of source

	Pre-processing of available content
	Standardized datasets

Group Name	Constructs
Data dispersion intention	Mischievous users with hateful or mischievous intentions
	Self or socially influenced immature users

Group Name	Constructs
Diffusion Pattern	Distraction from discussed subject
	Desirability bias
	Massive content with a variety of subjects
	Deliberately and verifiably fabricated content
	Inventive sentimental information
	Scandalous or exaggerated content
	Provision of the bulk of subjects for online discussion

Group Name	Constructs
Types of fake news	Deceptive news
	Fabricated staged news
	Satire fabrication

	Propaganda
	Conspiracy theories
	Journalistic deception
	Serious fake fabrication
	Large scale hoaxes
	Inventive sentimental information
	Scandalous or exaggerated content
	Provision of the bulk of subjects for online discussion
	Long-standing news
	Click-bait
	Misinformation
	Disinformation
	Mal-information
	Rumor

Group Name	**Constructs**
Content Type	False statement
	False stories
	Advertisement
	Articles
	Multimedia data
	Misrepresented messages and emails
	Misrepresented images

Group Name	Constructs
Individualized Characteristics	Political Association
	Age group
	Gender
	Social media usage frequency
	National and demographic factors