Trends in combating fake news on social media – a survey
Botambu Collinsa, Dinh Tuyen Hoanga, Ngoc Thanh Nguyemb and Dosam Hwangd

aDepartment of Computer Engineering, Yeungnam University, Gyeongsan, South Korea; bdFaculty of Computer Science and Management, Wroclaw University of Science and Technology, Wroclaw, Poland

ABSTRACT
Social media following its introduction has witnessed a lot of scholarly attention in recent years due to its growing popularity. These various social media sites have become the mecca of information because of their less costly and easy accessibility. Although these sites were developed to enhance our lives, they are seen as both angelic and vicious. Growing misinformation and fake content by malicious users have not only plagued our online social media ecosystem into chaos, but it also meted untold suffering to humankind. Recently, social media has witnessed a reverberation amid the proliferation of fake news which has made people reluctant to engage in genuine news sharing for fear that such information is false. Consequently, there is a dire need for these fake content to be detected and removed from social media. This study explores the various methods of combating fake news on social media such as Natural Language Processing, Hybrid model. We surmised that detecting fake news is a challenging and complex issue, however, it remains a workable task. Revelation in this study holds that the application of hybrid-machine learning techniques and the collective effort of humans could stand a higher chance of fighting misinformation on social media.

Introduction
The introduction of social media has made news content easily available for consumption (Granik & Mesyura, 2017). Even though the development of social media is a blessing to mankind. Conversely, it has also affected our lives negatively due to the untold suffering it has brought to us. Unlike the traditional media (newspaper, TV, and Radio) Social media has ushered in a new trend in news known as ‘fake news’ where malicious or misleading information is rapidly spread. The work of Klyuev (2019) posits that even though social media was created to enhance communication, it has almost replaced the mainstream media. A vast majority of people no longer watch television or listen to the radio, even if they listen to it, it will be done on social media. Fake news can be traced as far back as in 1439 when the printing press was invented (Klyuev, 2019), however, the discourse on fake news gained prominence especially during the 2016 US presidential election.
With the growing popularity of social media, we are increasingly being exposed to a plethora of fake news. Fake news has caused enormous damage to our society and hence emerged as a potential threat not only to press freedom but to democracy as well (Gereme & Zhu, 2019; Granik & Mesyura, 2017; Kai & Huan, 2019; Zhou & Zafarani, 2018). There has not been any clear definition or acceptance of the concept of fake news (Granik & Mesyura, 2017; Kai & Huan, 2019; Zhou & Zafarani, 2018). Therefore, for us to accept what is considered to be fake news, one must first understand what news is, authentic or genuine news.

News or ‘authentic news’ is regarded as any authentic information, any development or recent happenings that are not yet known, and such information is brought to the attention of the public. Based on Jack Fuller (1996) in (Tanikawa, 2017) ‘News is a report of what a news organization has recently learned about matters of some significance or interest to the specific community that news organization serves’ (Tanikawa, 2017). Gans (2004) gave a precise and widely acceptable definition of news, he contends that news is information which is transmitted from the source to recipients by journalists who are both – employees of bureaucratic, commercial organizations and also members of a professional group. They process, summarize, and change what was made available to them into information appropriate to their recipients. (Gans, 2004)

This definition makes us understand that news has an author; it is the duty of a journalist to give accurate and concrete news to its followers. This gives us an insight into why fake news is spreading so fast, this is because fake news has no author, journalists are licensed to give news or work for a news organization, those on social media works for themselves and propagate fake news for financial gains such as the Macedonia teenage group. Revealed by Brummette et al. (2018) regardless of potential benefit, the proliferation of fake news is further exacerbated by the social media outlet. News is generally regarded as an output of journalism, a discipline deemed to give relevant, independent, and credible information (Tandoc et al., 2018).

In order to attempt a true meaning of fake news, we borrow the definition from Lazer et al. (2018) who allude that ‘fake news is fabricated information that mimics news media content in form but not in organizational process or intent. Fake-news outlets, in turn, lack the news media’s editorial norms and processes for ensuring the accuracy and credibility of information’. Brummette et al. (2018) coined the term ‘ideologically motivate fake news’ to resemble those who are not driven by financial benefit in participating in fake news but are fabricated to enhance unique principles as well as beliefs, this will lead to smearing misinformation which is contrary to other people’s belief and principles (Brummette et al., 2018).

Fake detection takes several forms with some authors focusing on stance detection (Islam et al., 2019; Küçük & Can, 2020; Ma et al., 2018) this model tries to get the position of an individual whether he or she is for, against, or neutral in something. Detecting the position of someone is a fundamental step in knowing if such a person is for the truth or against it (Islam et al., 2019).

Prior surveys to fake news detection strategies have been a useful guide to this study given the fact that fake news is a hot issue nowadays. (Gyöngyi et al., 2004) applied a ranking algorithm known as TrustRank to detect malicious web pages. The idea is analogous to PageRank and they rank web account base on their link within the network. Review by Karataş and Şahin (2017) focus on social bots detection model on three social...
networks platforms namely; Facebook, Twitter, and LinkedIn and posit that some bots are benign in the sense that they automatically respond to customers’ need faster than real humans and could attend to many customers within a short period, weather updates and news pushing are important elements of social bots. However, nowadays social bots have been created for malicious functions such as spreading false information. This survey is different in ours in that it focuses on social bots detection which is just a tool used in spreading fake news, rather our work focus on detecting fake news irrespective of which particular tools are used to spread it. Zhou and Zafarani (2018) did a survey on fake news detection methods and opportunities. They classified fake news into four distinct categories. Knowledge-based which includes manual facts checking as well as automatic facts checking, style-based, i.e. How fake news is written, user-based fake news analyses study which investigates fake news from a user’s perspective (Zhou & Zafarani, 2018). Here, they classified users into two categories such as malicious users and normal users. The propagation-based study as well as credibility-base analyses. These are all geared toward finding truth in news content. Our work is different in that we did an in-depth overview of various detection models and select only those models which have high accuracy rate as compare to the previous author who did a general review, we further classified the different type of fake news and the motives which is an essential criterion in detecting fake news. Fake news has different types and motives, for instance, a clickbait type of fake news aimed at getting clicks for financial gain and a politically motivated type fake news aimed at supporting a candidate in an election. The work of Aniyath (2019) centres on data mining perspective on fake new characterization and detection. In characterization, the author classified fake news in two features such as on Traditional media as well as on social media. The detection models were based on news content and social content while giving a narrative approach to those models.

A study closer to this is that of Klyuev (2019) who did an overview of various semantic approaches in filtering fake news, he focused on Natural language processing (NLP), mining of text to verify their authenticity. Machine Learning (ML) including to detect social bots as well as automatic facts checking. His approach differs from ours in the sense that he took a narrative approach to explain how various detection methods work without considering the different types of fake news and their motives. Contrary we give a state-of-the-art approach by detailing each detective model with a working example and comparing their success rate. Also related is the work of Oshikawa et al. (2018) which focuses on an automatic method to detect fake news using Natural Language processing. The survey by Oshikawa et al. (2018) is based on one form of detection method i.e. Natural Language Processing. Contrary to our work, we gave details of different types of detection models including both automatic and manual-facts checking as well as hybrid, we go further to include recommendation system and graph network-based fake news detection model.

This paper is a revised and expanded version of the earlier work which was presented at the 12th Asian Conference on Intelligent Information and Database Systems ACIIDS 2020 (Collins et al., 2020).

In a nutshell, this paper made the following contributions:

For the best of our knowledge, we are the first to examine fake news detection models by studying the different types of fake news. We give a concrete review of recent trends in
combating and fighting malicious content on social media. Finally, we prove that the spread of fake news is further enhanced with the use of social bots.

The goal of this study is to examine the various type of fake news as well as the trend in combating them. We surmised that fake news has different types with different motives and so one method cannot be used to detect all fake news because of the different goals and objectives of those spreading them. The rest of the paper is organized as follows: in Section 2 we focused on how fake news is propagated on social media, Section 3 give details account of the various ways in which fake news are classified. While in Section 4 we detailly discussed the various detection models with a working example. Section 5 discusses the open challenges and made the concluding remark in Section 6.

How fake news proliferate on social media

The proliferation of fake news on social media has short-term as well as long-term implications for its consumers which can result in a reluctance to engage in genuine news sharing and posting due to fear of such information being misleading, this is because fake news constitutes two major ways in which they are proliferated through the social media which are; disinformation and misinformation.

Misinformation refers to those who share fake news without knowing that it is fake mostly simply because they see their friends or others sharing it (Alina et al., 2017). The echo chamber effect contribute enormously to this aspect, the social media system is made of an algorithm that recommends certain news or information to a consumer due to the group in which he/she belongs to on the social media, their prior history, circle of friendship such that when a friend view something, another friend is recommended the same thing and it will notify the user that such content has been viewed or liked by his/her friends which will motivate such an individual to also share or like it. This recommendation algorithm also acts as a motivating factor for the consumer to share content even when they do not know the veracity of such content.

People who have the same belief or are in the same political party will spread and share information that favours their political aspiration without proper verification. Cognitive theories (Kai & Huan, 2019) holds that human beings are generally not good at detecting what is real and what is authentic and posit that due to the gullible nature of human being, they are prone to fake news. Kai and Huan (2019) Contends that people usually tend to believe something that conforms to their view (confirmation bias) and will share it without verification because it is in accord with their thinking and will distort those that are not in accordance with their view even if there are factual.

Disinformation refers to those who are aware that such information is fake and continue to spread it either for political or financial gains. This aspect is further exacerbated using social bots and trolls (malicious accounts). Social bots and trolls are potential sources of fake news on social media. Social bots here refer to an online algorithm that interacts in human forms. Although social bots were initially created to respond to customers’ needs by some companies, some ill-minded individuals have used social bots to spread malicious and misleading information, Social bot easily retweets and follow thousands of account on twitter as well as share a post on Facebook within a very short time. Dickerson et al. (2014) used the sentiment to detect bots on twitter and found out that human gives stronger sentiments than bots. While trolls refer to human control
account, they are so many accounts that are trolls account control by human beings also meant to spread malicious and distorted information. Figure 1 shows a social bot account that runs automatically and spreads false and misleading information. Freeman and Hwa (2015) build a cluster to detect trolls and malicious accounts on the social media network. Using a supervised machine learning pipeline for classifying an entire cluster of accounts, they were able to detect whether an account is a troll account or legitimate.

The reason why consumers quickly believe in fake news has been highlighted by the cognitive psychologist (Kai & Huan, 2019) such as; by consensus, if others believe in it then the consumer will also believe in; consistency, if such information favours his/her belief pattern, popularity, how many places such information is found, fake news usually spread like wildfire and achieve high scalability especially with the use of social bots and hence will be all over social media within a twinkle of an eye. A psychological study by Roozenbeek and van der Linden (2019) has proven that attempt to correct fake news has often catalyzed the spread of fake news especially in cases of ideological differences i.e. a republican attempting to correct fake news given by democrat will spark backlash and even made consumers believe more in the fake news.

**Classification/type of fake news**

In this section, we made a classification of the different types of fake news. In detecting fake news, it is important to distinguish the various forms of fake news which include clickbait, hoax, propaganda, satire and parody, and others as seen in Figure 2.

**Clickbait**

Clickbait is a fake story with eye-catchy headlines aimed at enticing the reader to click on a link. Clicking on the link will generate income to the owner of that link in the form of a pay per click (Alina et al., 2017; Biyani et al., 2016). A study by Biyani et al. (2016) finds most clickbait headlines to be enticing and more appealing than normal news. They define 8

![Figure 1](image-url). Showing sample of social bots account.
types of clickbait such as Exaggeration, Teasing, Inflammatory, Graphic, Formatting, Bait-and-Switch, ambiguous, Wrong and contend that clickbait articles usually have misleading information in form of gossip with low quality that is usually not related to the headlines (Biyani et al., 2016). Clickbait has proven to be a very lucrative business especially to the Macedonia teenagers (Alina et al., 2017), the Macedonia city of Veles is now termed the fake news city as fake news producers are already preparing for the 2020 US presidential election (Alina et al., 2017).

**Propaganda**

Propaganda is also a form of fake news, although date back during wartime, propaganda was famous in war reporting where journalists often report false information to save the public from panic especially during first and second world wars. According to Tandoc et al. (2018) propaganda refers ‘to news stories which are created by a political entity to influence public perceptions’. States are usually seen as the main actor of propaganda, and recently it has taken a different turn with politicians and media organs using it to support a certain position or view (Alina et al., 2017). Propaganda type of fake news can easily be detected with manual fact-based detection models such as the use of expert-based fact-checkers as well as crowdsourced-based technique.

**Satire and parody**

Satire and Parody are a widely accepted type of fake news, this is done with a fabricated story or by exaggerating the truth reported in mainstream media in the form of comedy (Brummette et al., 2018). According to Tandoc et al. (2018), Satire is a form of fake news that employs humorous style or exaggeration to present audiences with news updates. The difference with a satirical form of fake news is that the authors or the host present themselves as a comedian or as an entertainer rather than a journalist informing the public. However, most of the audience believed the information passed in this satirical form because the comedian usually projects news from mainstream media and frame them to suit their programme. Satirical and comic news shows like *The John Stewart Show* and *The Daily Show with Trevor Noah* has gained prominence in recent years.

Although both satire and Parody uses comedy to pass out information in the form of entertainment, satire uses factual information and modified or frame it to mean something else, contrary to parody, the entire story is completely fake such that if someone is not familiar with such site he/she is meant to believe the story. A good example of a parody site is *The Onion* and *Daily Mash* which has often misinformed people as they
often fabricate eye-catching and human-interest information. For instance, The Onion in 2017 reportedly posts fake news as revealed by Tandoc et al. (2018) which many people believe in it, ‘North Korea successfully detonates nuclear scientist’. Many people believed in this because such a fabricated story came at a time when the world was on alert because of the North Korea Nuclear threat.

**Hoaxes**

Hoaxes are intentionally fabricated reports in an attempt to deceive the public or audiences (Rubin et al., 2015; Tandoc et al., 2018). Since they are done deliberately, it is well coined such that at times, the mainstream media report it is believing it to be true. Some author refers to this type of fake news as large-scale fabrications and alludes that hoaxing has often caused serious material damage to its victim. It is usually aimed at a public figure (Rubin et al., 2015). Sucipto et al. (2018) formulated a TextRank algorithm based on the method of the PageRank algorithm to detect hoax news reported in the Indonesian language. Using Cosine Similarity to calculate the document similarity, the author could rank them in order of their similar nature and then apply the TextRank algorithm. The result of the study was quite impressive given the fact that it was done in the Indonesian language.

**Other (Name-theft, framing, journalism deception)**

Name-theft refers to a fake news source that attempts to steal the identity of a genuine or authentic news provider in order to deceive the audience to believe that such information is coming from a well-known source. This is usually done with the creation of a website that mimics an already existing authentic news website, for instance, a producer of fake news in order to deceive the public may use credible news source websites such as (cnn.com to cnn1.net, foxnews.com to foxnewss.com). This is usually done with the inclusion of the site logo which easily deceives consumers into believing that such information is coming from the site they already recognized as genuine. There is also the manipulation of video to suit their narrative as well as photoshop all aimed at deceiving the public.

Framing is also one form of fake news; this aspect tries to deceive the reader by employing some aspect of reality while making it more visible meanwhile the truth is being concealed. Logically, people will understand certain concepts based on the way it is coined, consumers will normally perceive something differently if framed in two different ways although it all meant the same thing. Framing is meant to give misconceptions and conceal the fact, framing became more popular during the US presidential debate when most media will give misconceptions about what the political aspirant actually said. For instance, suppose a leader X says ‘I will neutralize my opponent’ simply meaning he will beat his opponent in each election. Such a statement will be framed such as ‘leader X threatens to kill Y’ such a framed statement has given a total misconception of the original meaning.

Journalistic deception is another form of fake news, although we already mentioned above that journalists are those licenses to give credible information, at times journalist usually change the narrative of a certain story in order to conceal the truth. The different between journalistic deception and framing lies with the author, framing can
be done by anybody, but journalistic deceptions are done by journalists usually in a well-known media outlet.

**Fake news detection models**

Due to its rapid development and the complexity of solving it, some scholars allude that the utilization of artificial intelligence tools and machine learning techniques should be applied (Granik & Mesyura, 2017; Kshetri & Voas, 2017) (Figure 3).

In this section, we vividly explain the various fake news detection models citing working examples.

**Experts or professionals facts-checker approach**

Expert or professional fact-checkers are a small group of professionals in various disciplines who are capable of verifying the veracity of certain news items and decide whether such information is fake or authentic (Zhou & Zafarani, 2018) posit that the strength of expert-based fact-checking techniques lies in the fact that they are small in number thus, easy to manage and have a high accuracy rate. A study by Pennycook
and Rand (2019) explains that an expert-facts checker is a natural approach to verifying fake news which uses professional fact-checkers to determine which content is false, and then engaging in some combination of issuing corrections, tagging false content with warnings, and directly censoring false content, e.g., by demoting its placement in ranking algorithms so that it is less likely to be seen by users.

However, some professional fact-checkers are not independent and work for an organization and often have a lot of limitations. The expert-fact checking technique is slow especially in a situation where they are given a large volume of information to verify due to their small number, also the fact the process is manual. During the 2016 US presidential election as well as the Brexit referendum, most expert fact-checker could not respond to a growing number of fake news that was being proliferated. Most fact-checkers have often come under strong criticism for being biased and political. Some examples of prominent fact-checker sites includes; Snopes which deals with political and social issues, Hoaxslayer focusing on various field including health, religion, and economics, Fullfact, TruthOrFiction, The Washington Post Fact Checker, PolitiFact, FactCheck mostly focus on American politics. Due to the limitation of the expert-based fact-checkers, the crowdsourced technique is seen as a good alternative.

**Crowdsourced approach**

Crowdsourced or ‘wisdom of the crowds’ approach is based on the premise that no matter how smart someone is, the collective effort of individuals or groups supersedes any single individual intellectual capacity. Brabham (1982) see crowdsourcing as, ‘an online, distributed problem-solving and production model that leverages the collective intelligence of online communities to serve specific organizational goals’. The weaknesses of expert-based fact-checkers have prompted many to seek the ‘wisdom of the crowds’ technique. Pennycooka and Rand (2019) used crowdsourced judgments of news source on social media and discovered that the crowd is more effective than professional fact-checker, in judging the news source quality laypeople got a similar rating with professional fact-checkers. In a set of 60 news websites, they classified them into 3 groups, 20 renowned mainstream media websites such as (cnn.com, bbc.com and foxnews.com) and 22 websites that are hyper-partisan in their coverage and reporting of facts i.e. (breitbart.com, dailykos.com) and lastly 18 websites that are well known for spreading fake news such as (thelastlineofdefense.org, now8news.com) Using a set of $n = 1010$ recruited from the Amazon Mechanical Turk (AMT), they compare their judgment with those of expert-based facts-checker in a second survey and found their judgment to be accurate in the sense that even though both republican and democrats attacked certain mainstream media as biased, both rated CNN, Fox News, MSNBC, and other mainstream media as a trusted source and most of the fake news sites were listed as an untrusted site. In their study, they could identify the limitation of the ‘wisdom of the crowds’ approach, firstly, because the crowd is made up of laypeople of different fields and have little knowledge of some news site, consequently, news sites which they are unfamiliar with are marked as an untrusted site. Based on Pennycook and Rand (2019) findings, trusted mainstream media sites such as Huffington Post, AOL News, NY Post, Daily Mail, Fox News, and NY Daily News were rated as an untrusted site by the crowd
as opposed to experts fact-checkers who labelled all the above mentioned as trusted sites. 

*Fiskkit* is a modelled example of a crowdsourcing site.

**Machine learning approach**

Early machine learning method in detecting fake news was proposed by Granik and Mesyura (2017), because it is assumed that fake news is created intentionally for the political and financial benefit, so they often have an opinionated and enticing headline, at such the extraction of the textual and linguistic feature is necessary for machine learning. Granik and Mesyura (2017) used Naive Bayes classifier and classified linguistic features such as lexical features including word count and level as well as syntactic nature which involves sentence level characterization. They use datasets from BuzzFeed News aggregator which contains data from Facebook posts from major political news agencies such as Politico, CNN, ABC News. They divided the datasets into three sets namely the training dataset, validation dataset, test dataset and got 75% accuracy. Most Artificial intelligence tools for detecting and flagging fake news rely heavily on Click-Through Rates (CTR), the position of the stream page increases as the CTR increase and some fake news type such as clickbait articles usually have high CTR due to it enticing and appealing nature. Consequently, such an approach cannot be used to detect fake news types such as clickbait. Biyani et al. (2016) propose a machine learning model to detect fake news. Using Gradient Boosted Decision Trees (GBDT) their model achieves strong classification performance and saw that informality is a crucial factor of the ‘baity’ nature of web-pages. They formulate an automatic machine learning model for identifying and predicting an article whether it is a clickbait or not. Several features were used such as the URL, content, title etc. Using datasets from yahoo news aggregator, they collected 1349 (training set) clickbait and 2724 (testing set) non-clickbait web pages. They were able to identify spam and web pages by defining 8 types of clickbait such as Exaggeration, Teasing, Inflammatory, Graphic, Formatting, Bait-and-Switch, ambiguous, Wrong (Biyani et al., 2016). They employ the concept of Informality and Forward Reference. By comparing clickbait articles, they assert that most clickbait has misleading information such as gossip and most appealing headlines aimed at enticing the reader to click on the link. The landing page is usually of low quality and thus, they contend that because news aggregator site i.e. yahoo news aims to serve its user with news article via its homepage, the proliferation of clickbait article which usually has low quality increases user’s dissatisfaction rate and amplify their abandonment which is bad for business and hence detecting and removing clickbait site become inevitable. This approach is not without limitation, fake news is a broad issue with several types but this study focuses only on one type of fake news i.e. clickbait which has two ways of detecting it; firstly, it can be easily detected because the content is different from the headline and secondly, based on the fact that the content is of low quality. Some authentic news however has low quality content as well.

**Natural language processing technique (NLP)**

NLP work within automated deception detection technique which involves the application of lexical and semantic analysis, with the use of regression, clustering, as well as
classification techniques such as binary classification of text where news are classified as real and not real, in a two-class problem, where it is difficult to detect, a third-class may be added such as partially real or partially fake. Sentiment Score is then calculated using the Text Vectorization algorithm and NLTK (Natural Language Toolkit) Deception cues are identified in the text which is extracted and clustered (Klyuev, 2019). Linguistic features are a key factor to NLP including text content and style. Grammar and style detector and syntactic analyser such as Stanford parser have been reported by Klyuev (2019) and it gives accurate results. A study by Rubin and Conroy (2011) shows that truth verification with Natural Language Processing (NLP) has proven to show greater success when compared with human verification. The basic task is to identify some verbal and lexical cues which will point out linguistic differences when human tell lies as oppose to when they tell the truth. For instance, deceivers produce more total words-count and sense-based words such as those that show lower cognitive complexity, the use of more negative emotion words, extreme positive words. In a sample of n = 90, they applied human judgment technique, linguistic cue detection as well as machine learning and discovered that NLP works well when different machines learning techniques are applied.

Hybrid technique

Hybrid detection techniques emerge as an alternative to several fake news detection methods, due to the complexity and ambiguous nature of fake news, the combination of other method is imperative. According to Mahid et al. (2018), the Hybrid-based detection model involves ‘the fusion of techniques from the content-based model as well as social context-based techniques utilizing auxiliary information from different perspectives’. The failure of the single model in detecting fake news prompted scholars to find alternative measures to detect fake news accurately. Several Hybrid-based techniques do exist involving dynamic processes and a combination of some models. In this study, we discuss Hybrid Expert-crowdsourcing and Hybrid Machine-crowdsourcing detection method.

Expert-crowdsourcing approach

The hybrid expert-crowdsourcing approach is relatively a new method that emerges as a result of the weaknesses of the expert-based as well as crowdsourced-based fact-checker. This approach involves the combination of the two-manual fact-checking systems by applying human knowledge as opposed to automatic facts-checking involving the use of the machines. The key idea behind this approach is that where experts failed, the crowdsourced approach can complement and vice versa (Mahid et al., 2018). Recently, Facebook has announced the combination of an expert-crowdsourcing approach in fighting the proliferation of fake news on its network. The expert-based has often been accused of being politically biased, not independent and very slow in detecting fake news (Vedova et al., 1957). While a study by Pennycook and Rand (2019) allude that the crowd is limited in many areas since they are composed of laypeople and at such, they will give the wrong prediction to content which they are unfamiliar with. Therefore, it is imperative that since the crowd is unbiased and acting independently, larger in number and thus can easily work on a large volume of information, the aggregation of
the crowds’ decision can be sent to the expert which will yield better results since experts are familiar with many areas.

*Human-Machine approach.*

Most machine learning algorithms developed to automatically detect fake news have often failed. This is because all news does not have the same writing pattern and involves several topics with salient features. A study by Shabani and Sokhn (2018) found out that one of the limitations of automatic fake news detection is low accuracy, those machine algorithms developed to detect fake news through news contend are prone to low accuracy due to the fact that most language use in writing fake news bypass the detection process. While the wisdom of the crowd as seen already is a good approach but slow and time-consuming and lack expert knowledge because usually crowd are compose of laypeople (Pennycook & Rand, 2019), the combination of machine learning algorithms and the collective effort of humans has proven to yield better fruits, especially in the area of detecting fake news automated by social bots.

One of the hybrid machine-crowdsource technique was proposed by Shabani and Sokhn (2018), they propose a model that uses a hybrid machine-crowd approach to detect fake news and satire. They use a dataset from the Fake vs Satire public dataset. The model employs the fusion of the collective effort of human with that of the machine learning to enhance decision-making model which predict whether a news is fake or not. Firstly, crowdsourcing was used to classify news from Satire and fake news and distinguish them which was difficult to detect by the machine. By applying the machine learning techniques they employ baseline classification algorithms such as logistic regression (LR) and got 80.18%, Support Vector Machine (SVM) with result amounting to 80.82%, Random Forest (RF) with 72.34%, Gradient Boosting (GB) with an accuracy rate of 72.13% and Neural Network (NN) which gave a positive result of 72.13% and Neural Network (NN) which gave a positive result of 81.16%, all these gave a baseline (Naive Bayes) result of 79.1% accuracy. The baseline features were further improved on which gave an accuracy rate of 81.64% compared to the previous 79.1%. While the crowdsourcing task on fact-checking achieved an accuracy rate of 84%, they designed the hybrid fake news detection model which involves a combination of the previous two results, and they got an overall accuracy rate of 87%. This is a very good result with high accuracy as compared to previous studies. The work of Wang (2017) achieved a similar result as the author applied a hybrid crowdsourcing-machine technique in detecting fake news on social media by framing a 6-way multi-class text classification problem, the author design a hybrid convolutional Neural Network model (CNN) to integrate meta-data with text and got higher results (Wang, 2017) With the application of crowdsourced, they gathered over 12,000 manually labelled short statements (LIAR) dataset from politifact.com API of which those datasets are mostly used for fact-checking. By randomly initializing a matrix of embedding vectors to encode the metadata embeddings, the author employs 5baselines which includes Logistic regression (LR) a Support Vector Machine (SVM) Bi-directional Long Short-Term memory networks model (Bi-LSTMs), Convolutional Neural Network model (CNNs) as well as majority baseline. The SVM and LR gave a good performance to the classification problem as compared to the other baselines, while the CNN gave an overall high accuracy. This model as posits by Wang (2017) supports rumor detection and topic modelling.
**Graph-based method**

The homophily aspect of the social network ensures that connected users in a graph network have the same traits, view similar content such as the same news article (Zhou & Zafarani, 2019). On the other hand, malicious users will have similar behavioural patterns and hence articles from these malicious users can easily be recognized and flag as fake. Zoltan The graph network fake news detection model investigates news content from homogeneous and heterogeneous networks (Zhou & Zafarani, 2019), a typical example is the truth tree or stance network: that is if one for or against, such a network is constructed and classify news articles that are fake from those that are authentic. A random walker traversing within the network beginning from authentic news will land in another authentic news and vice versa. The random work proposed by Jia et al. (2017) was effective in tracking fake accounts on social media, the work, although it is essential in truth detection. The work is aimed at combating Sybil attack on social media which these Sybils or social bots as tools use in spreading fake news. Zhou and Zafarani (2019) examine the graph network base fake news detection. They use ground truth datasets from PolitiFact and BuzzFeed, which have been by fact-checkers as truth or false. They divided the network into communities, triads, and nodes in the network. The result proves to yield better results as the method could detect fake news before, they are being spread.

Couple to that, Ren and Zhang (2020) propose a fake news detection model known as the Hierarchical Graph Attention Network (HGAT). Their method represents news articles as nodes and matches related nodes or vertices together and fake news is then identified from using classification tasks. Using a real-world dataset from PolitiFact, news articles were weighted as neighbours and the same neighbour nodes were aggregated in the schema node. The model employs the Heterogeneous Information Networks HIN-based fake news article and their result outperforms other states of the art fake news identification graph model.

**Deep learning approach**

Deep learning attempts apply neural networks to determine the authenticity of news articles. Abedalla et al. (2019) employ a combination of several deep learning algorithms such as Convolutional Neural Network (CNN), Long Short-Term Memory network (LSTM), and Bidirectional LSTM (Bi-LSTM) and they applied a four-class label relating to news article headlines and propose a 3-type model of which the best performance of their model got 71.2% accurate rate. Also, Liu and Wu (2020) in their proposal titled ‘A Deep Network for Fake News Early Detection on Social Media’ examined deep neural network in areas of rumor detection, they address the problem of fake news by taking a critical examination of the social characteristics of fake news in the early stage before propagation. Using datasets from Twitter and Sina Weibo sites. They propose a deep learning model called FNED which facilitates early detection.

While the study in Ajao et al. (2018) used a hybrid CNN model and introduced three neural network variants such as LSTM, LSTM including dropout regularization as well as LSTM with convolutional neural networks (CNN). The datasets consist of 5800 tweets in which they applied ten-fold cross-validation on the entire dataset. In the course of the experiment, they observed that LSTM outperform the other model with outstanding accuracy of 82.29,
followed by LSTM-CNN 80.38 with the LSTM dropout regularization performing lowest with 73.78. However, the result is quite impressive as it outperforms other baseline models.

**Recommendation system approach**

The recommender system has gained prominence recently with several companies relying on recommendation algorithms to target its audience such as Netflix (Gomez-Uribe & Hunt, 2015), Amazon (Linden et al., 2003), Youtube (Davidson et al., 2010). These systems have proven to be useful in fighting fake news too on social media. In areas of academic recommendation, Hoang et al. (2017) examine academic event recommendations based on research similarity and the interaction between authors. The recommendation system approach tries to verify some news content deemed to be authentic and then recommend these news articles for consumption (Özgöbek et al., 2019). Mizgajski and Morzy (2019) examine recommendation systems in the online news industry and posit that most recommendation system uses human emotions to recommend content. The collaborative filtering recommendation method (Garcin et al., 2012) recommends news content based on ratings and comments from others. While the content-based method recommends news, items based on similar contents (Garcin et al., 2012). Francesco Barile and collaborators Garcin et al. (2012) proposed a recommendation model for news filtering based on collaborative filtering as well as content-based techniques. They peddled in two parameters known as the Past P which represents news that has been consumed already. In other words, the Past P represents a history of news articles consumed which is an essential criterion for the collaborative filtering method since it is based on historical behaviour. The next parameter represents future F which indicates the type of content to be recommended in the future for the reader. The content-based system which makes use of similar content based on what items the reader previously consumed is also introduced to improve the model. Using the probabilistic topic modeling technique, they could learn which content is similar that could be recommended. They used datasets from the websites of two daily Swiss French newspapers called Tribune de Geneve (TDG) and 24 Heures (24H). In the course of evaluating their result, they noticed that the collaborative filtering method outperforms the other methods.

Vo and Lee (2018) proposed a fact-checking URL recommender system to combat fake news. The motivation of the study stemmed from the effort of the so-called ‘guardians’ in combating fake news on social media. Tweets from these guardians were collected which contains URL ranging from different aspects such as politics and fakhtography. Their work is based on the premise that fake news is being spread through some URLs that can be traced and identified. In order word this method attempt to combat fake news by attacking the source. Comparing the tweets coming from certain URLs or URLs contained in tweets that are deemed to be an authentic website, these URLs can be flagged off the social media. The datasets contain 231,377 fact-checking tweets from six fact-checking websites such as Snopes.com, Politifact.com, FactCheck.org, OpenSecrets.org, TruthOrfiction.com, and Hoax-slayer.net. In comparing their results, it got quite remarkable results as it outperforms other baseline models.

The work proposed in Xiao et al. (2015) gives an insight into the news recommender system based on time sequence, unlike the traditional method of recommendation system which relies on content-based and collaborative filtering. This technique
debunks the notion of traditional news recommender method such as news aggregation by focusing on what the user would like to read (Xiao et al., 2015). Using datasets from popular Chinese news sites www.pkbig-data.com, they gathered 10,000 users, by preprocessing they removed those users which were considered to be inactive users, and thus, the final datasets were 7192 as well as 63,714 rating behaviour from the users. The basic supposition is that many news aggregators aggregate news and due to their large volumes it is difficult for the reader to choose which one to read, predicting the type of news the reader will read among tones of the news article is the main tenet of this paper. The time that the reader reads the news is important as well as the location (Xiao et al., 2015). The author employs the Jaccard similarity measure to compute the pairwise of the user similarity. The experimental results show that Time-dependent collaborative filtering as well as time-order dependent content-based filtering outperform the traditional Jaccard similarity collaborative filtering method.

Discussion and challenges

The discourse on fake news detection models reveals that base on the existing models, detecting fake news will remain a potent challenge. More sophisticated models are required. Manual facts checking which include the use of experts, as well as crowdsourced judgment in checking the veracity of certain news content has yielded some fruits. However, manual fact-checking is still faced with a lot of limitations such as labour, and the amount of time require especially when they are faced with large volumes of information. The automatic fact-checking method can deal with large volumes of information within a very short time, however, it has a lot of limitation because most automatic machines learning algorithm trained to detect fake news is based on certain lexical and textual contents as well as style. Words and language used, the manufacturer of fake news is also improving on new techniques to bypass this algorithm and hence, manual facts-checking will always be required. The graph-based method has proven to have a certain degree of success in detecting fake news on social media. The social media networks yield financial benefits not only to it creator but to it users as well and consequently, owner of these social networks are often reluctant to flag and remove some items or information on their site for fear of losing their financial gains and this is a challenge to many users. Facebook and YouTube have often come under strong criticism for allowing certain fake information on their platforms. Also, while there is conflicting information regarding two different parties, it becomes difficult to authenticate the facts. Fake news, especially in countries with highly centralized partisan politics such as the USA, political discourse within the ranks of Republicans and Democrats will always spark backlash unless since contents favouring one party will be deemed authentic and vice versa and this one of the challenges for these social media owners to deal with. Therefore, the use of an independent fact-checker in such a case will always be required which are also expensive and time-consuming.

Conclusion and future work

This study provides a synthesis of trends in combating fake news and other misinformation on social media. Fake news is nothing new, however, with the introduction of the
social media, fake news witnessed unprecedented growth during the 2016 US presidential election. This paved the way for researchers and other stakeholders to find a lasting solution. Revelation in this study indicates that the proliferation of fake news on social media has often made people reluctant to engage in genuine news and information sharing for fear that such information is false and misleading. Further revelation surmised that the dividend that this fake news pays makes the practice rampant especially in form of clickbait. A study by Standford University indicates that during the 2016 US elections, popular fake news sites had 159 million visits triggering a lot of reverberation within the online social media ecosystem.

The debate on fake news detection has been a challenging one due to the complex and dynamic nature of fake news. In this paper, we did an overview of fake news detection models taking into cognizance the various types of fake news. It is a reality that fake news has caused enormous damage not only to democracy but to the freedom of speech due to its rapid spread on social media and hence detecting them become imperative. We recommend that fake news can be verified based on source, author or publishers and experts can be able to distinguish between those genuine sources and fake sources. For instance, the Macedonian teenagers that are well known for manufacturing fake news can be identified on their clickbait sites and such site removed from the network.

Social bots and trolls account have often acted as a catalyst in generating and spreading fake news which is a potent challenge. Hence, future work is required in areas of social bots’ detection, the main problem is not the fake news rather it is the sharing and spreading of the fake news that is causing more harm. The use of social bots in sharing fake news makes it go viral and it has further exacerbated the proliferation of fake news as these contents are shared and like automatically making it difficult for experts to detect.

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**Notes on contributors**

**Botambu Collins** received his M.Sc. degree in Political Science from the University of Buea, He is currently pursuing a second master in computer engineering at Yeungnam University, South Korea. He has contributed to over 5 publications in various reputable journals/conferences. His research interests include social computing, Social network and information mining, machine learning, recommender system, Human-computer interaction, collective/swarm intelligence, and natural language processing.

**Dinh Tuyen Hoang** received an M.S. degree in computer science from the University of Science and Technology - The University of Da Nang, Viet Nam in 2013. He is currently an assistant professor in the Department of Computer Engineering, Yeungnam University, South Korea. He has contributed
to over 21 publications in various reputed journals/conferences. His research interests include machine learning, recommender system, knowledge engineering, and natural language processing.

Ngoc Thanh Nguyen received the Ph.D. degrees in computer science from Wroclaw University in 1989. He is currently full Professor of Wroclaw University and head of Department of Information Systems. He got distinguished Scientist of ACM in 2009. He was ACM Distinguished Speaker and IEEE Distinguished Visitor (2009-2013). He is also chair of IEEE SMC Technical Committee on Computational Collective Intelligence and general chair of two Conferences ICCCII and ACIIDS. He has contributed to over 300 publications in various reputed journals/conferences/books. His research interests include computational collective intelligence, knowledge integration, big data, inconsistent knowledge processing, and multi-agent systems.

Dosam Hwang received the Ph.D. degree in Kyoto University, Kyoto, Japan. He is a full professor of the Department of Computer Engineering at Yeungnam University in Korea, whose research interests mainly include Natural Language Processing, Ontology, Knowledge Engineering, Information Retrieval and Machine translation. He has once served as the Head of Yeungnam University’s Computer Engineering Department for five years between 2005 and 2009. He has also held a position as a principal researcher at KIST (Korea Institute of Science and Technology) and as an invited professor at KAIST (Korea Advanced Institute of Science and Technology). He has so far been not only a chair of several international conferences but also a committee member of many international organizations as well. More specifically, for example, he has been the Assistant Secretary of ISO/TC37/SC4 for language resource management since 2005, and the Secretary of Korean TC for ISO/TC37/SC4 at the same time. In 2006, He was the Director of Korean Society for Cognitive Science (KSCS), and for the Korean Information Science Society (KISS), he has been serving as the Society’s Director and the Mentor of a knowledge engineering study group since 2007. In addition to this, he has also participated in several Korean national research projects such as a project on machine translation system (1985-1990), the national IT ontology infrastructure and technology development project called ‘CoreOnto (2006–2009)’, and ‘Exobrain (2013-2014)’, the project focused on the construction of deep knowledge base and question-answering platform. He is now in charge of an intelligent service integration based on IoT Big Data as part of Korea’s another principal national research project ‘BK+ (2014–present)’. In recognition of his such great commitment and contribution to the relative fields of study, He has been honored as a Distinguished Researcher of KIST in 1988 by Korea’s Ministry of Science and Technology (MoST) and awarded a prize for Good Conduct from Kyunghee High School in 1973. He had more than 50 publications.

ORCID

Dosam Hwang  http://orcid.org/0000-0001-7851-7323

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