Towards an Understanding of Fake News

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Abstract. Fake news articles are intentionally fabricated to be deceptive and can be proven that they are false. Fake news and spread of misinformation are important concepts which may have serious real world consequences. Even though this concept exists for so many years, with the advancements in technology the speed of diffusion of misinformation and, how people consume and produce news has changed a lot. So the effort towards detecting fake news quickly and correctly has became a challenge. Today most of the fact checking is done by professional journalists but the research towards the automatic detection of fake news increases rapidly. For automatic detection of fake news, linguistic and machine learning techniques are the most frequently used techniques. In this paper, we analyze these techniques in three main groups: Content based methods, user based methods and network based methods. We also give a short introduction to the concepts and present some preliminary research results towards an understanding of fake news.

It was not so long ago that the term "fake news" started to appear frequently in the media. Even though the terms like deception, hoax, clickbait and credibility detection of news articles are within the focus of researchers for some time, with the frequent use of the term "fake news", a new defition and more specific work towards detecting it was required.

Even though the term "fake news" is quite new, there was always some newspapers trying to take more attention from the readers through exaggerated headlines and articles containing misinformation [7] [1]. In the internet era, where every individual have an opportunity to publish and be visible by many others, it is not surprising that the generation of fake news has increased. One of the main reasons of generating fake news is the economic gain which can be acquired by getting more clicks or generating paid fake content [5] for parties who want to get more clicks. Fake news can cause sudden changes in stock market and this can easily be converted to an economic gain by the parties who published the fake news articles [2]. Another common reason for generating fake news is trying to create a deception and/or a political bias within users in order to get more supporters. On the other hand where to draw the line between fake news and expression of opinions is important.

There are many reasons that the fake news gained so much attention in the last couple of years. Especially the 2016 US elections played an important role for the public attention on fake news. The fact that fake news actually causes some real world problems [4] [6] is another reason that the public reaction has increased.

Obviously social media is an important way of getting news for especially younger generation [17]. There are two aspects of the news on social media: Traditional news shared on social media and social media as a source of news (through users who shared events nearby). The second aspect is sometimes used by the traditional media houses to generate news articles. Both aspects, intentionally or unintentionally, can lead fake news to spread even more.

According to some research people are not very good at distinguishing real news from fake ones. In [18] it is suggested that humans can distinguish only 70% of the fake news. In another study it is mentioned that 75% of people classified the fake news as accurate news [26]. [23] suggests that people tend to classify news articles that they do not agree as fake news. The confusion and bias of the readers bring the demand for approved news from trusted sources.

Today fake news detection is mostly done by the manual work of professional journalists. Fact checking web pages are available in many languages all around the world [3]. On the other hand, the amount of research going on towards the automatic detection of fake news is increasing rapidly. The collaboration between the researchers and journalists has an increasing importance towards the development of automatic fake news detection systems.

In this paper we give a brief state of the art to the automatic detection of fake news. The paper is structured as follows: In Section 1 the definition of fake news is given with different aspects. In Section 2 the diffusion mechanisms of fake news is introduced. Commonly used techniques towards automatic detection of fake news is discussed in Section 3. A brief summary of the important research findings is given in Section 4. Finally, the conclusions is given in Section 5.

1 Defining Fake News

Automatic detection of fake news has many challenges. Defining fake news and setting the right scope for detecting it is one of the basic challenges. The scope of fake news is usually different within different research about fake news detection. For example, clickbaits (the content which is specifically designed to attarct more attention from the readers) are seen as implicated in fast spread of fake news by some researchers [11], while others does not count this aspect. Similarly satirical news is classified as a type of fake news by some researchers [25], while it is not by some others [29]. There is a similar debate about rumors, conspiracy theories, hyperpartisan news and hoaxes too. A more general term used for fake news and misinformation detection is called deception detection. In [24] authors define deceptive news in three main categories: Intentionally fabricated, large scale hoaxes and humorous news taken seriously. On the other hand, in [29] a narrower definition of fake news was accepted which only includes the news

articles that are intentionally and verifiably false [8]. This definition of fake news does not include satire, hoax, rumors, conspiracy theories and unintentionally created misinformation.

Keeping the fake news definition as narrow as possible for automatic fake news detection research has more advantages in order to keep the focus down to the core elements and eliminate ambiguity. But we should also keep in mind that there are more complicated challenges and it is important to:

- Draw the line between fake news and expression of opinions.
- Distinguish humour, satire, fauxtire and irony: The satire and humouristic news articles sometimes classified as fake news because they does not contain real events and sometimes they can mislead readers. Also detecting the humor within a true news story is challenging and can be a false cue in order to detect the fake news automatically.
- Consider fake items in a true story: Sometimes the news article can contain fake elements. These elements does not make the whole story fake but can cause deception. These fake elements are usually harder to detect than detecting the whole fake news article and they make it hard to classify the article as fake or not or to decide the level of fake elements in the article.

In this paper we assume the following definition of fake news: "Fake news articles are intentionally fabricated to be deceptive and can be proven that they are false."

2 The Diffusion of Fake News

The diffusion of fake news can be through different media but obviously social media has the greatest share on spread of fake news. The very dynamic nature of social media and the fact that every individual is also a publisher in it, makes social media a suitable medium for diffusion of any information. But in social media fake, inflammatory, emotional and one-sided news spread quicker than many serious, real news articles [21]. Understanding the spread mechanisms of fake news helps us to prevent them spreading more and even to detect them. The value of social media as a news source can not be ignored. Social media has a value as a quick and first hand source of news events [32] with an increased event coverage [19]. On the other hand, due to the high noise levels and lack of validation mechanisms, extracting true news from social media is highly challenging. Still, social media is commonly used as a source of news for various news web pages and it has become a prioritized source of news for especially the younger generation [17]. Besides, strong personal biases exist when it comes to the perception of news. According to [23] people tend to classify the news articles that they do not agree with as "fake news". Obviously these strong biases will affect what they share on social media and the spread of fake news. All of these aspects of social media put it in a very important position for fake news diffusion.

According to [13] the spread of fake images on Twitter as a representative of a news, was mainly (%86) distributed through retweets and a few through original tweets.

Social bots are another important thing to look at in order to understand the spread mechanisms of fake news. In [28] authors suggest that bots play an important role in spreading the misinformation on social networks, they are mostly active in the early phases of the spreading and they target the influential users that has a bigger chance of spreading the false information.

3 Commonly Used Detection Techniques

With the increase in attention to fake news, there is also a fast increase in the number of recent research in this topic. In this section we summarize the commonly used automatic detection techniques for fake news.

3.1 Content based methods

Content based methods use content cues in order to detect fake news. Content cue implies to any kind of content related cue to detect fake news. Most of the content cues are textual cues, so we find it useful to classify the content cues as textual and non-textual cues. A more detailed classification of cues towards clickbait detection is proposed in [11]. Content based methods include the analysis of any kind of content available in the news like text, image, video or sound in combination with various machine learning techniques.

Textual content Many of the existing research look for textual cues in order to detect fake news. This is also how professional journalists approach to manual fake news detection. Understanding and analyzing the text for fake elements is the most natural way that we can think of. In order to detect textual cues, lexical, semantic, syntactic and pragmatic leves of analysis are usually used. Writing style analysis is one of the most commonly used techniques towards the detection of misinformation in news [20], [21]. In addition to writing style some research addresses the language use analysis. In [15] authors suggest a method that includes stylistic, complexity and psychological feature analysis by using NLP and sentiment analysis. In [14] linguistic (n-gram) features, credibility features (capitalization, punctuation etc.) and semantic features (DBpedia and embeddings) are used for analysis. Another research for detecting clickbaits proposes a linguistic approach with different classifiers (e.g. SVM, Random forests etc.) with an accuracy of 93% [10]. Even though clickbait detection is not directly related with fake news, they can give us a clue about the fake news. Of course this does not mean that every clickbait headline refers to a fake news article. Some research does not include the full text analysis of news articles. In [31] authors suggest a method only by analyzing the headlines. Fake news detection on social media might be a little bit more challenging due to the difficulty of reaching the original source of news and the noisy text. In [16] authors propose a method of

detecting fake news by exploiting the conflicting information on Twitter. They suggest that opposing viewpoints can help detecting fake news. Fake News Challenge [1] leverages the use of machine learning and different artificial intelligence techniques for fake news detection. The first part of the challenge was about stance detection in news. In [22] authors applied several neural network architectures and two novel architectural variations for the stance detection of fake news challenge.

Non-textual content Online news articles usually include more than just the text. Images, URLs, sound or video files are often available with the news text. Also the metadata of existing elements, web traffic information, image captions can be classified as non-textual cues since they are not the direct part of the news article [11]. The analysis of such cues can give us interesting results in the detection of fake news. Image analysis is one of the most used non-textual content analysis. In [12] authors proposed an automatic image verification method for online news articles which has almost %73 of accuracy.

3.2 User based methods

User based fake news detection methods depend on the idea that user behaviour can give clues about the misinformation. Any kind of user interaction analysis take place in this category. User comments which can be taken as a textual cue without the identification of belonging to a particular user. But analyzing the comments in a relation with particular users can be classified as a user based method. In [30] authors detect the hoax posts on Facebook by analyzing the users who liked them. Even though there are some research towards the unreliability of people identifiying fake news [23], in [27] crowdsourcing was used to identify the fake news.

3.3 Network based methods

Network based fake news detection methods include web traffic analysis, web metadata analysis [11] as well as user network analysis. In [13] authors models how some tweets get viral on Twitter by analyzing the social network graph of users. In [9] authors model a social network as a directed weighted graph and then calculate the probability of nodes transmitting information to each other in order to contrast the spread of misinformation. They also mentioned the source identification problem on a social network which addresses the problem of identifiying the infected nodes on a network by misinformation. Also tracking the news items to its original source can give us strong clues about the reliability of news.

[1] http://fakenewschallenge.org/

3.4 Hybrid methods

Sometimes two or more of the methods above can be used together in order to achieve more accurate results in fake news detection. One example is [26] where authors considered the three generally agreed upon characteristics of fake news: Text, response received and source. They propose an architecture called CSI (Capture, Score, Integrate). In this architecture recurrent neural networks is used to capture news article representation, user behaviour over time is used to score users and two previous outputs are integrated and the result is used for classification.

4 Research Findings

Although there is limited work on automatic fake news detection, there are some interesting preliminary results that may help us shape fake news detection systems in the future:

- The textual characteristics of fake news articles share many similarities with satire news. Fake and real news are substantially different. [15]
- News articles with a hyperpartisan world view was successfully distinguished from more balanced news. Fake news detection is difficult via style analysis alone. [21]
- A linguistic approach with different classifiers (e.g. SVM, Random forests etc.) managed to detect clickbaits in online news with an accuracy of 93%. [10]
- The diffusion pattern of information can be useful for detecting the hoax. [30]
- Opposing viewpoints can help us detecting fake news, e.g. by analyzing conflicting information on Twitter. [16]
- Users are quite biased when it comes to detecting fake news personally. The perception of what is fake and what is not can be very different from one person to another, and fake news related keywords are often used to express disagreement. [23]

5 Conclusions

In this paper we give a short state of the art towards an understanding of fake news. Fake news is an important concept which may have serious real world consequences. Even though the scope of fake news differs (ex: including satire or rumors as fake news), the challenges exist for the automatic detection of misinformation for all. The diffusion mechanisms of fake news is an important step towards understanding and preventing the spread of misinformation. The importance of social media in the spread of fake news can not be underestimated. Deeper understanding of human psychology on fake news could be helpful to develop tools for detection and prevention of misinformation. The existing methods

for automatic fake news detection are mostly based on lingusitic and machine learning techniques. In addition to these methods image analysis and crowd-sourcing methods were applied. With the increasing popularity of the term "fake news", the research towards automatic detection also increases rapidly. The manual fact checking done by professional journalists give the researchers opportunity to understand the nature of misinformation and work more efficiently towards the automatic detection of fake news.

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