



INTERNATIONAL
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Ranking Systems For Fake News Detection

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SCHOOL OF SCIENCE & TECHNOLOGY

A thesis submitted for the degree of

Master of Science (MSc) in Information and Communication Systems

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THESSALONIKI – GREECE



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Abstract

In this thesis we analyze the ranking systems for fake news detection. The dissertation is divided into 2 parts. In the theoretical and in the analysis of various models (FakerFact, Index, CSI, FNED) for detecting false news. In the theoretical part some definitions are mentioned in order to make the subject more understandable, some important events with fake news (2016 US Elections, 2017 French Elections, 2020 Covid - 19) and finally an analysis is made for the EU, for the principles and values and how responded to the fake news challenge. As far as the technical part, there is a lot of discussion in the literature about machine learning in fake news detection and in the latest models it seems to be taken into account. The article concludes that fake news can have devastating consequences for health and electoral issues. Also, no articles were found in the literature that combine something technical with something more theoretical, which means that the two sides may not communicate properly with each other.

Velonis Aristeidis

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1 Introduction

Humanity has made rapid evolution in technology in recent centuries. This development dates back to the 19th century with the First Industrial Revolution and the invention of the locomotive which was a huge step for that time and gave another opportunity to the production process, its cost and efficiency. Later, at the end of the 19th century, came the Second Industrial Revolution in America, due to another great discovery, electricity. This Revolution laid the foundations for the coming technological explosion. Without electricity, we could not have the Internet, smart devices, or even computers. In 1969 we had the Third Industrial Revolution. Then we had the discovery of the transistor and the microchip. Thus, computers, IT, electronic circuits, came into our lives and since then are constantly evolving.

Since then, there were no huge discoveries, but the development of this sector has given huge advantages, has created many other sectors and is evolving very fast. Through IT, we have the Internet, which has changed our lives radically and continues to change it constantly.

1995 was the starting point in the first period of e-commerce. This was characterized by tremendous growth and innovation and basically offered the sale of simple retail goods. This was a new field in which there were huge financial benefits and especially in the period 1997-2000 more than 12,000 e-businesses were created (Schneider & Perry, 2001). E-commerce was a perfectly competitive market in which customers had plenty of options. Another beneficial issue was the lowered prices. So the product would be based on pro-

duction costs plus the profit of the store (Laudon & Traver, 2017). But at the beginning of 2000, it seemed like there was a decline, as more than 5,000 businesses closed. This period has been mentioned as the collapse of "dot-com" but more than \$ 200 billion were invested in that three years. From 2001 onwards we had the consolidation phase. Companies have grown, there has been something like globalization. And finally, there was the phase of the renaissance of e-commerce from 2007 to 2010 (Laudon & Traver, 2017). There came the smart devices, we had social media, so many sectors developed in parallel, such as Digital Marketing.

In the last decade we have the Fourth Industrial Revolution. We are in the information age. Now algorithms are everywhere. Not just computers and programs, but cars, robots and many other devices. It's the season in which all the above are evolving much faster than any other time.

Information is constantly being disseminated, as billions of people now have access to the internet. And at this point, after many of the benefits offered by technology are mentioned, we have the rise of fake news via the internet and through social media. Fake news has always existed. However, the increased information flows also create some lies around various issues, which can now affect our judgment and consequently our lives. This is the subject of this dissertation.

The reason I chose this topic was because I wanted to see how a fake news detection systems work and on the other hand, how it can be used within a society. Because, another peculiarity of the time, is that the way of governance has changed. In the framework of the cooperation of the states, there are organizations, which take joint decisions and are followed by the states, which vote for them. So, a political is-

sue arises here. How can an organization use all these tools to prevent the problem, where there are so many countries, and the volume of the information is so big? How can work a complex organization like the EU? The above questions arose from a lecture we had with Professor Vassilios Peristeras, when he told us in a lecture that within an organization there are difficulties in communication between technical professions and those involved in policy making, or in something more theoretical. And I fully understand this, because my own professional profile is purely theoretical and I chose this post-graduate to be able to understand in the future in the work environment, someone who has only technical knowledge. So, this dissertation also has a theoretical approach, which will be referred to in the methodology.

At this point, the steps of the dissertation should be mentioned.

The first chapter is the methodology. There will be an analysis that will show where I searched for the bibliography, how many sources I found and how I used them.

In the second chapter I start with the problem definition and as a result we will have the Research Questions (RQ). Then it is necessary to mention the definitions of fake news and some of their characteristics, so that we know all the categories, what they mean and how many subcategories there are. Next, I will refer to the impact of fake news in general and then I chose some examples from electoral processes and situations, such as that of Covid - 19, to understand what exactly happened. The combination and this series that I place, I consider to be the best because the reader understands what fake news is, what impact it has and what incidents exist at the moment. Finally, I would like to state briefly what the EU has done about this. Some brief historical facts are mentioned, which have their signifi-

cance. It becomes more understandable how much progress the EU has made, what principles it has and how fake news is ideologically opposed to it. And this is not easy to understand, because there are states that seem to use such practices quite often.

Finally, reference is made to the fake news detection ranking systems and some models (FakerFact, Index, CSI, FNED) that I found from the literature. The dissertation concludes that there are indeed many solutions, but a massive solution is urgently needed in order to prevent this phenomenon. That is, many of the models seem to succeed in the experimental stage, but without being tested with real data. However, there were some very good models that mainly used machine learning techniques in order for the algorithms to understand faster. As far as the EU is concerned, it proves that in addition to algorithms, legislation or action plans and corresponding policies are needed, because these are problems in electoral processes, which, through fake news, can affect electoral behavior.

2 Methodology

2.1 Problem Definition

Fake news is not a new phenomenon. They exist since information was shared with persons (Bojjireddy et al., 2021). We have several examples from history. Even Thucydides talks about the importance of the validity of the sources he uses to write his work. The Peloponnesian War was a work that contained the objectivity and validity of the news because the way Thucydides collected information was the many and varied testimonies. In addition, we have to include and the story of Socrates and fake news. Socrates was accused of corrupting young people by teaching. So in the beginning this case was formulated as an accusation and then it was finalized, leading to his conviction and death (Diakomanoli, 2021).

It is worth mentioning two other examples, more modern, in which we encounter the phenomenon of fake news. First, in 1835 a newspaper from New York, named *The Sun*, published some articles about the life and how it looked like (Pennycook & Rand, 2021). An even more recent example is the Propaganda Ministry of Nazi Germany. Although the definition of propaganda may not coincide entirely with that of fake news, I believe they are in the same family. Propaganda can also mean hiding some news, which is the same with misinformation. The same result with fake news. Both have their consequences. But all this is food for thought for the whole thesis, regardless of whether the purely main part will analyze the fake news detection systems.

In our days, society has access on the Internet and there are many platforms for someone to be informed. There are many information

flows, and the problem is the quality of the news. Besides that, people tend to trust the news that came from social media and not from the traditional media, such as TV or the radio. The fact that people "believe" the news from social media more, create a big gap. Social media became an instrument of political influence (Richardson, 2017).

The spread of fake news does not only exist in the field of information, but also in the field of business, in which there is another, separate literature, as their existence can affect other areas, such as competition and consumer protection.

The rise of fake news is not a new phenomenon although it has dominated the news lately (Vinet & Zhedanov, 2011). Besides that, the Internet came after propaganda and misinformation. In the fake news bibliography, the term "began" to exist since the US Presidential election in 2016 (Bean, 2017; Chatfield et al., 2017; Tschitschek Sebastian, Singla Adish, Rodriguez Gomez Manuel, Merchant Arpit, 2013). In addition, the 2016 US elections were the crucial point with the UK referendum because they raised the question of how traditional media and surveys could have predicted so incorrectly. In addition, another fact was the "fake" announcement of Pope Francis about the support of Donald Trump (Figueira & Oliveira, 2017). This phenomenon had a direct impact on Facebook as well, as there was a lot of criticism for the fact that a lot of fake news came from unchecked websites (Figueira & Oliveira, 2017).

Another issue that exists in the literature is the many plausible websites that look like the official ones. The difficulty between fake and real news is that fake news seem to be very real (Ruchansky et al., 2017). For example, there is the official site abcnews.com.go and

there was a "fake news" site with the URL of abcnews.go.com (Figueira & Oliveira, 2017).

Fake news can affect public opinion, malevolent parties to sway the results of public events like elections (Ruchansky et al., 2017), has the ability to significantly influence public perception and awareness (Chatfield et al., 2017).

Besides, fake news is not a new phenomenon. But the difference that exists in relation to the past is the Internet, and the information age. Therefore, fake news is much more frequent, because the information flows through the internet are much faster. I believe that this is partly the main reason why there are many papers in this field since 2016. The fame of fake news is also proven in the Google Trends tool (Kapantai et al., 2021). According to Kapantai et. Al (2021), the frequency of the Google Search "fake news,, has increased tremendously since 2016.

Locating fake news especially on social media and in general is a very difficult process because the human eye. A study showed that in a plausible article 75% could not finally determine whether it is fake or not (Edkins, 2016). Given this increasing speed of our information these days, there is an urgent need to find ways to quickly control whether information is valid or not (Azevedo, 2018). Certainly, the evolution of algorithms that detect fake news helps significantly in combating this phenomenon. But what has been observed in the literature is that there are so many algorithms, that everyone deals with a specific piece and with the help of specific tools. Can a good idea stick to another algorithm?

Since there is a large number of papers for fake news detection, I will try to classify them, as far as possible, so that all those who have a

semi-technical and theoretical background, can understand how such algorithms work and what they are looking for. This, I consider to be a very good step for this work, because it can help in the collaboration of two very different areas, the theoretical and the practical, which so far seems to be needed. Because the reasons for the spread of fake news cover both categories. The psychological-social factor is involved, as well as the technical one.

2.2 Research and Methodology design

This dissertation consists of two basic parts. The first is the literature review and the second is the analysis of some of the existing models.

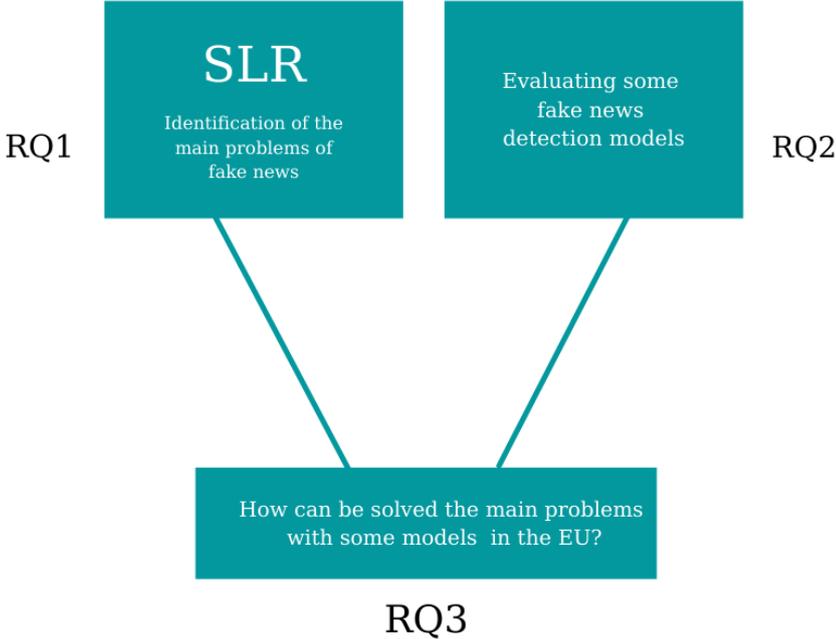


Figure 1. Research process

RQ1: What are the main problems created by fake news?

RQ2: How does a face news detection system work?

RQ3: How can be solved the main problems with some models in the EU?

The first step was to collect the articles. I used Mendeley software in order to organize all of the papers that I needed.

The keywords were the following:

1. Fake news
2. False news
3. Disinformation
4. Misinformation
5. Fake news detection systems

Then, the next step was to find in the following digital libraries:

1. ACM
2. Springer
3. Science Direct
4. Google Scholar

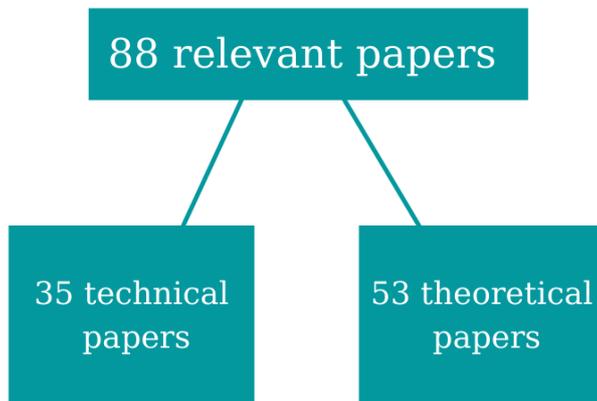


Figure 2. First Filtering

According to the first filtering in Figure 2, I had to filter again because some papers did not were available to read them.

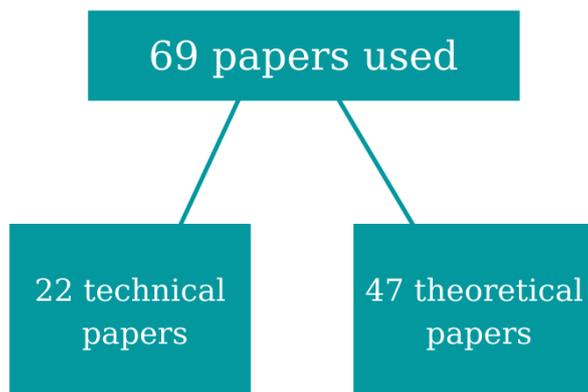


Figure 3. Second Filtering

So, I used 69 papers that exist all of them in the bibliography. Of course, there are some papers and a book for example (Laudon & Traver, 2017; Schneider & Perry, 2001; Voskopoulos, 2009) that I used them in order to find some general information about the Introduction or the history of the EU. These sources are not counted in Figure 3.

3 Main Body

3.1 Systematic Literature Review.

3.1.1 The definitions of fake news

There are plenty of papers that try to give a definition around fake news, or around synonyms. Besides that, it is not clear what people mean when they refer the term "fake news"(Romy Jaster & Lanius, 2021). According to Kapantai's et al. (2021) typology, the fake news' synonyms are: (1) false news, (2) false information, (3) disinformation, (4) misinformation. Another synonym is (5) malinformation (Diakomanoli, 2021). And there is a further analysis of these terms. The terms above may seem like synonyms, but based on Wardle & Darakshan (2017) there are three different types - categories that disrupt information. The first is disinformation, the second misinformation and the third is malinformation. Disinformation is information that is false and created with the intent to harm individuals, a country or even an organization. Misinformation is information that is false but not harmful and finally, Malinformation is information that is based on reality but is used to harm individuals, organizations, countries, etc. This must be mentioned before the definitions, in order to understand that while these words may exist as keywords, in reality they can sometimes have different meanings. In general, however, and based on the broader literature and methodology we found, all the above terms do not differ from each other.

Fake news is maybe as old as humanity (Burkhardt, 2017), and a very old problem (Soll, 2016) . The spread of fake news in the media,

however, begun between 1800s and 1920s (McNair, 2018). There are many definitions according to the literature. According to dictionary.com¹, fake news is (1) "*false news stories, often a sensational nature, created to be widely shared or distributed for the purpose of generating revenue, or promoting or discrediting a public figure, political movement, company, etc.*", (2) "*a parody that presents current events or other news topics for humorous effect in an obviously satirical imitation of journalism*" and (3) "*sometimes facetious*".

Tandoc et al. (2018) believe that the term "fake news" has six types of definition. (1) news satire, (2) news parody, (3) fabrication, (4) manipulation, (5) advertising and (6) propaganda. Jaster and Lanius (2021) mentioned that a clear definition of fake news is urgently needed. They have already mentioned that fake news is "*news that lacks truth and truthfulness*" (Jaster & Lanius, 2018). By analyzing this, they created a table with some characteristics. To be more detailed, they split their first definition of 2018 in two pieces. Lack of truth, and lack of truthfulness. In the first piece, the unique characteristics are the false utterance and misleading utterance. In the second piece, the lack of truthfulness has two other unique characteristics. The intention to deceive and the disregard for truth. These two categories with their characteristics belong to "fake news". So, according to Jaster and Lanius (2018) analysis, fake news is the false and misleading utterance, the intention to deceive and the disregard for truth. In addition, Tandoc et al. (2018) recognized also six main categories according to the existed literature.

Weiss' et al. (2020) approach is very interesting, because they give us another perspective - dimension on how fake news can be defined. They mention that fake news can be approached from various per-

¹ <https://www.dictionary.com/browse/fake-news>

spectives such as propaganda, misinformation, the role of rumors and the spread of fake news and finally the role of satire. According to the survey with the faculty members of California State University that they have done, they concluded that opinions on the definitions are different. They believe that there is little in common in the different branches of definition of fake news. Thus, they consider it necessary to develop a more consistent definition of fake news.

At European level, the European Commission has set up a Group of Experts to confront fake news in 2018². Its definition defines misinformation as all forms of false, inaccurate or misleading information designed, presented and promoted to intentionally cause public harm or for profit (Diakomanoli, 2021: 21). Most of the fake news spreads are created by frauds looking to make money quickly (Mustafaraj & Metaxas, 2017).

However, Tuters (2018) mentioned that there are different definitions, but I noticed that they have more or less the same meaning. Certainly, the main argument of all definitions is the quality of information, and in fake news, their lack. For example, according to the Cambridge Dictionary, fake news are fake stories that appear on the internet and are often created to try to get a message across politically, or as a joke³. One similar to the definition above, is that fake news are articles that deliberately target false information, in order to pass on a "different" message (Allcott & Gentzkow, 2017). The aim of misinformation is to divert attention from a particular issue and to divide, to sow doubt by distorting and falsifying facts, thus confusing people and shaking their faith in institutions and established political processes (Diakomanoli, 2021: 21).

² https://ec.europa.eu/greece/news/20181303_Fake_news_online_el

³ FAKE NEWS | meaning in the Cambridge English Dictionary

In conclusion, based on the above definitions that exist in the literature, we can understand that fake news is not a very difficult or even technical term, but it is something that is generally understood. What should worry us is the generality of the definition. This generality that exists in many papers, I believe can affect readers and by easily understanding the term, they may not delve deeper. And if they do not go deeper, there is a possibility that the theory is not properly understood, but also where the phenomenon comes from. What I would timidly try to do, is to write a conclusion about how I define and understand the term fake news.

Fake news is false information, which can take many forms, coming from many media. The reasons can be political, business or even health issues and their main purpose is to convince people of something. Based on this definition, we must distinguish the various aspects. That is, the forms can be (1) news satire, (2) news parody, (3) fabrication, (4) manipulation, (5) advertising and (6) propaganda as mentioned by (Romy Jaster & Lanius, 2021; E.C Tandoc et al., 2018), the distribution of information can be social media, blogs or even influencers, the reasons can be health, business issues and especially political issues and the basic goal is to influence public opinion, to convince more and more people. The reasons could be so many, such as gaining power, popularity or even misleading (Burkhardt, 2017).

3.1.2 The impact of fake news

We live in an era that we can find so much information about an issue. Computers are now chip, and almost the 50% of the world has

access in the web⁴. Many factors, either governmental or not, have their own strategy to run false-news campaigns and manipulate people (Zannettou et al., 2019). Fake news can also exist not only in journalists or media. In the literature, fake news cover many fields, such as the business sector, the political, pharmaceutical etc. (Figueira & Oliveira, 2017; Jandrić, 2018; Kapantai et al., 2021). The theme is that in all the sectors that have been mentioned, the consequences could be crucial. The best example at this time could be Covid – 19 and the dialogue between vaccination. So, many organizations, such as the EU urges European citizens to be informed from valid sources, such as ECDC, WHO and the EU.⁵ In this situation anti-vaccination protesters pose a very huge problem. The continuation of the pandemic.

Fake news has concerned many scholars from different disciplines (Edson C. Tandoc, 2019). And this makes sense because fake news cannot be classified as a science. On the contrary, their theory fits many topics. Therefore, it can affect any sector. This is even explained in the literature. Searching the e-libraries, and clicking on the term fake news, misinformation etc., I found as titles many papers that had to do for example, "business and fake news", or even "pediatrics and fake news".

Wardle & Darakshan (2017) made a very interesting and accurate research in my opinion, giving very useful and nicely sorted information. Their research includes six important criteria for better understanding misinformation. (1) Factors: There can be many official

⁴ <https://www.statista.com/statistics/617136/digital-population-world-wide/#:~:text=As%20of%20January%202021%20there,the%20internet%20via%20mobile%20devices>.

⁵ https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/fighting-disinformation_en

organizations, private sectors, political parties, or unofficial associations, such as activists or NGO's. In addition, there could be interests groups or even conspiracy theorists. The main characteristic of all of these groups is that exert a great influence on society and reinforce various messages. (2) Organization: This is the categorization of the above factors. They can act through public relations firms, pressure groups, or even troll factories. Based on the latter category, there are many subcategories, such as right- trolls, left- trolls, or specific hashtags. (3) Motivation: The three main subcategories are economic, political and psychological reasons. Economic reasons mean the profit from misinformation. That is, one pays someone to publish some fake news. Political reasons mean the form of advertising of a politician, bringing out a possibly wrong image of the politician, with lies, in order to persuade the people to like him and then to vote him. (4) Common goal: Different factors target different types of audiences which may be for example social groups with different interests. (5) Use of automated technology: A factor can automate a message and spread it. This is easier and cheaper. One such example is memes, which are used to spread an ideology by various extremist groups. (6) Misleading of harmful purpose: There is a possibility of misleading or even harming the public.

Another version of fake news should be noted. Sometimes, it is believed that many media outlets intentionally upload fake news, so that they can have more clicks on their links and have more ads, and therefore more revenue (Nagaraja et al., 2021).

The best we can do to make the impact of fake news more understandable is to record a series of well-known events that shook society and "started" the fake news literature.

3.2 Fake News incidents

3.2.1 Fake news and US Elections

News spread plays a very important role in a democratic system of societies and states and especially in the case of fake news, people can be affected from the content (Wilder & Vorobeychik, 2018). One of the most famous fake news "campaigns" which was a shock for 2016, was the subject of fake news in the US presidential election (Au et al., 2021; Fourney et al., 2017). We have known and mentioned that there has been fake news since the term "information" came into being, that is, forever, but we have not seen but we had never seen such a turn. During the pre-election period in 2016, it was found that on Twitter many bots, which were responsible for spreading fake news. The main characteristics of their behavior were that they targeted users with great influence through answers and tags, while at the same time these bots were multiplying. Thus, the question arose as to whether such strategies could influence public opinion, and therefore have an impact on the election result (Bovet & Makse, 2019).

Bovet & Makse (2019) in their research gathered all the tweets (170 millions) from 11 million users that were related to Donald Trump and Hillary Clinton, the two basic candidates for the US Presidency. They compared the spread of fake news coming from some websites that produced such news and other that produced valid news and all of these, from different political points of view. Bedi et al. (2019) mentioned that the fake news shares were at the highest level in 2016. The impact of social media in the political field is a fact. The media often try to polarize by creating large groups with the result that the people who "live" online in such a group, do not have major political disagreements with each other (Lee, 2019). Twitter usually connects

users more easily with common ideologies and views (Cantarella et al., 2020). In addition, it has been mentioned that social media platforms, particularly Twitter and Facebook, allow posting freely, without being diagnosed as to whether the content everyone uploads is real (Spohr, 2017).

In 2016 the social media usage rates were very different compared to the past. To be more detailed, in 2006 only 16% of the users of the process participated in social media, while in 2016 this percentage amounted to 77% (Lee, 2019). American users were polarized, and fake news became more widely known worldwide from that period. Such an issue could have the greatest impact on the democratic electoral process, especially in an area where users "consume" and share a lot of such news (Lee, 2019).

Through these facts, there is another interesting finding. In April 2016, a survey was conducted that measured the ideologies between people with a master's degree and those with less education. Research has shown that people with a master's degree tend to be more liberal, while people with either a basic education or not tend to be more conservative (Pew Research Center, 2016).

To make clear what the above paragraph means, it should be noted that the fake news that made positive comments to Hilary Clinton was a total of 41 and was shared 7.6 million times, while those of Trump, were a total of 115 and were shared 30 million times (Allcott & Gentzkow, 2017).

Another problem of the USA at that time was the hybrid war that broke out with Russia. Russia is also responsible for the increase in fake news, as it did so in order to spread chaos and used a network

of hackers, Twitter bots and bloggers to have a steady stream of fake news in the US (Lee, 2019). At the same time, it should be noted that Trump took advantage of all these events with fake news, basing his policy there. It was observed that every 40 days, he told a lie from the beginning of his term (Leonhardt & Thompson, 2017).

This year may have marked the "beginning" of fake news and of course the scientific community has tried to find ways to solve this problem. Allcott & Gentzkow (2017) pointed out a few areas that can provide solutions. Some of the suggestions were to give social planners more information on actions and global issues, in order to inform better and more validly the world. In addition, another suggestion was that technology companies should reconsider their algorithms in order to have a filter and deal with fake news. Finally, based on the research of Lee (2019) it was stated that it is the responsibility of governments to regulate the flow and deal with fake news and set the example of the USA, where in 2016 they had fraud laws in 27 States. The question, however, was who is ultimately responsible for resolving this phenomenon. Or we may have to decide what to read to get the right information. This is something we will keep analyzing it further in the conclusion. It is definitely an issue that concerns both Law and Political Science. It should be the states, it should be a supranational organization, such as the European Union. The right question I think is not who it should be, but which area can be most effective.

3.2.2 2017 French Elections Fake News

There was a lot of discussion about fake news and propaganda in the French elections of 2017 (Morgan, 2018). During the campaign for the French Presidential Elections of 2017, the fake news stood in fa-

vor of Le Pen, who for the first time in the history reached the second round of elections and she shared that Macron's campaign is financial supported by Saudi Arabia (BBC, 2017). The most popular news so far, is considered a series of cyber attacks on revealing unknown and sensitive information about the candidate Emmanuel Macron (Ferrara, 2017).

An important factor was the participation of users, because while in general many of the fake news were easily recognizable, there were actions such as an email that was sent with the subject "correspondence documents and photos from Macron and his team" (Mohan, 2017).

Another important issue was Twitter bots. In fact, it is rumored that there is a black market with Twitter bots and this happened because some of the bots - Twitter accounts, were found to participate in the US Presidential elections a year ago. This issue, has also been mentioned many years ago (Edwards, 2013). Something that, if true, is a very harmful for the democratic electoral process, as it can affect the vote. Through this problem, we understand the enormous power that all these platforms now have. Of course, Ferrara also mentioned the following important. That the same group that supported Trump could have made such a campaign, with the aim of tarnishing Macron (Broderick, 2017).

Research has shown that voters tend to be 15% more likely to believe the news about a politician they like (Allcot & Gentzkow, 2017). Of course, it should be noted Based on a survey of French voters, it was found that many people who were initially opposed to Le Pen's statements, in the voting intentions were ultimately positive in voting for her (Barrera et al., 2017). Obviously, the intention to vote

is not always the same as the final vote, especially if there is a long time between them. But it is something that fake news can, through this way, influence.

3.2.3 Fake news in Covid – 19

In the last two years, we have witnessed an unprecedented crisis. The Covid – 19. Suddenly, our lives changed, and no one could have predicted that they would change so much, in so many areas. Many people lost their lives unjustly, many people lost their jobs, and even today, we are fighting a great battle. While every effort is being made by doctors, infectious disease specialists, governments, organizations, there is a wide spread of fake news at this time (Van der Linden et al., 2020). The issue is that in this crisis no one will get more or less votes, but on the contrary, depending on the content of fake news, human life can be endangered (Hartley & Vu, 2020). This phenomenon seems to be increased in social media in Covid era (J. Yang & Tian, 2021).

The high flow and amount of fake news, led the WHO⁶ to warn the world about this phenomenon (World Health Organization, 2020). The misinformation about the virus and the treatment that is quite large and if one searches on the internet, is on foreign or Greek websites, one can see many blogposts with all these theories. For example, it has been reported that the virus was originally made in a Chinese laboratory (Rambaut et al., 2020). It has also been reported that the 5G network is related to coronavirus and may affect the symptoms of the infected person. We heard about former President Trump and the hydroxychloroquine he was taking, saying it was a cure to keep him

⁶ World Health Organization

from getting sick (Qiu, 2020). We have also heard that sun kills Covid – 19, or eating garlic can save someone (Bojjireddy et al., 2021).

The problem is that now a large percentage of the population generally believe all this above false information. An analysis of some coronavirus videos found that 25% of the most listened videos contained misleading news. This percentage is interpreted in approximately 62 million views (Sanders, 2020). Besides that, 28% of Americans believe in the conspiracy theory that has been heard about Bill Gates, that is, he uses the vaccine to control people with microchips (Li et al., 2020).

There are countless stories about Covid - 19. Apart from the West, a big issue with false news was also faced by India, when there was a misinformation about what the Prime Minister said. More specifically, when he appealed to the people to go out their windows and thank the doctors, something that happened in many other countries, the rumor came out that if the whole of India applauds together, then Covid-19 may lose power (Dutta, 2020). An extra case should be noted at this point. People spent more time on their computers and smartphones during the virus. The more you use, the more likely you are to read fake news (Apuke & Omar, 2021). And in the case of the virus, as long as false news is spread, it can contribute to the spread of the virus (Tasnim et al., 2020). Because many may think that one way or another the right way is enough to avoid getting infected.

Another study gives us basic insights into the behavior of people on social media during the coronavirus period. And in fact, this will be a key discussion in the conclusions, as I believe that algorithms for fake news detection can cover a very large percentage of fake news flow, but in no case can they offer a complete solution. Yang & Tian (2021)

in their study, reported how a third person influences fake news on social media. That is, one user relatively easily believes what a friend upload. This turned out to increase during the pandemic period. And so another question that arises is whether algorithms have the ability to understand such behaviors in the media. Is it really possible?

3.3 EU actions and initiatives

3.3.1 A brief history of the EU. Why the fight against fake news is so important?

The European Union is a huge supranational organization, which I believe has helped the Member States a lot in many areas, with its innovative policies. It is an organization whose structure is quite complex, and often confuses many people about how it works. The truth is that it does have a complex structure, as there are 3 main institutions (European Commission, European Council and European Parliament), each of which has serious responsibilities for the lives of European citizens. Nevertheless, over the years there have been innovations in many areas to improve the quality of life and at the moment the European standard of living is very high. In order to approach the policy of fake news and exactly what the European Union is doing on it, a brief analysis of both its history and its operation will be made, because there are issues that need to be addressed in this paper.

Let us not forget that the European Union did not always have that name. It started a few years after the Second World War and until then it was devastated. War no longer had a place on the European continent and the states entered into a process of cooperating with each other. So, based on the problems of that time, the European Coal and Steel Community was created in 1951 in the Treaty of Paris and officially started in 1952. The main purpose of the ECSC was to have a common control of coal and steel, substances that were necessary for the army. Thus, with the common participation of all, it was quite difficult for one country to use it to build an army and attack another. It was very important for that time, because a few years ago, there were two world wars (Voskopoulos, 2009).

Then, in 1957, we had the Treaty of Rome with the Treaty establishing the European Atomic Energy Community, called the Treaty and the Establishment of the European Economic Community. The EEC Treaty started with the idea of a Single Market. It was easier for states to work together economically without tariffs, which was increasingly leading to European Integration. The goal was to achieve the freedom of movement of goods, persons, capital and services, to have a trade policy in countries other than the EEC. It was the first stage of Social Policy and at the same time the European Union was beginning to build institutions with various bodies, such as the European Parliament⁷.

Many years later, in 1992, we had the Maastricht Treaty⁸. Of course, there were many other important milestones in the 70's and 80's but here the aim is to highlight the very rapid development of the European Union, to come up with the latest policies and in the effort to fight fake news. This is because I believe that there are areas and policies that can be combined with each other. In the Maastricht Treaty, the EEC will now be officially called the EU. Europeans were talking about a Common Monetary Policy, a Common Defense, but also more cooperation on internal issues.

The last major milestone in the history of the EU is the Treaty of Lisbon, which has been in force since 2009. The EU has been functioning from 2009 until today, as there has been no other treaty for the last 13 years. With the Lisbon Treaty, the EU now has clear goals and values. More specifically, some of its main objectives are to promote peace, individual freedom, open borders within the EU, to protect the

⁷ <https://www.europarl.europa.eu/about-parliament/en/in-the-past/the-parliament-and-the-treaties/treaty-of-rome>

⁸ <https://www.europarl.europa.eu/about-parliament/en/in-the-past/the-parliament-and-the-treaties/maastricht-treaty>

environment, to ensure that there is no social exclusion, to promote innovation and research and to respect the human rights⁹.

All the above principles that have been briefly mentioned do not keep pace with the practice of fake news. Based on the above definitions, the EU seems to be ideologically opposed to all of this. Besides that, the fact that we now have a Common Market, a Common Digital Market and so many common policies between states means that states now have a lot in common. Thus, influencing a percentage of states in elections and fake news undermining the democratic process in them, can lead to a large inequality, which will have an impact across Europe and in terms of democratic legitimacy in the institutions (eg Council and European Parliament) and in the overall result and representation of Europe there will be no meritocracy.

3.3.2 The EU's response to the fight against fake news.

The EU started its active action since 2015. The European Council launched the East StratCom team to fight fake news¹⁰. The prefix East refers to the eastern states and specifically to Russia. A year later, the European Commission laid some further foundations on the Hybrid Threats Framework¹¹. To be more detailed, it used some other EU initiatives and actions and concluded that the information exchange function of the Member States should be improved so that there is better communication, cybersecurity systems should be improved, situations should be prevented, there should be solidarity and

⁹ https://european-union.europa.eu/principles-countries-history/principles-and-values/aims-and-values_en

¹⁰ <https://eeas.europa.eu/headquarters/headquarters-homepage/2116/-questions-and-answers-about-the-east->

¹¹ https://ec.europa.eu/defence-industry-space/eu-defence-industry/hybrid-threats_en

defense readiness, and finally better cooperation between NATO and the EU.

In 2018, before the 2019 European elections, there was a debate and there were some rules to ensure Europe's electoral process, which are threatened by other countries or private interests. These measures are essentially some guidelines on what exactly states should do. In particular, there should be transparency on the internet, measures to deal with "attacks" by misinformation campaigns, so that the elections can be valid (Diakomanoli, 2021:67). So, in the same year, the European Commission drafted the Action Plan against fake news and misinformation¹². Within this plan, there were some tools that would help in the fight. These were some algorithms that aimed to detect bots, a Code of Conduct and activated the GDPR, for Data Protection.

Another initiative before the European elections was EUvsDisinfo, a website that posted some examples of misinformation and is essentially a database of about 8000 examples of fake news and there are case studies. This could be a very useful tool, but also something that even those who do misinformation campaigns would have a complete picture of. Closing, before the European elections also, many large applications such as Twitter, Facebook and Youtube also agreed on a Code of Conduct with the EU. Thus, an Early Warning System for misinformation was created, which cost € 5 million. We have to notice that fake news is better to be detected in real time (Nagaraja et al., 2021)

¹² https://www.eca.europa.eu/lists/ecadocuments/ap20_04/ap_disinformation_en.pdf

3.4 Fake news detection systems

Google has announced that it will invest \$ 6.5 million in the fight against fake news, giving this money to organizations. Also, in Google Search, one of the factors for ranking a website, is good quality content. So, when Google's algorithm detects fake news inside the website, it automatically does not go along and so the website "goes down" to the organic results (Spandana & Koustubh, 2020). At the same time, other tools are involved in detecting fake news. There is a team that manually processes spam reports, through comments and user feedback, without of course any results as to whether this had results in Covid - 19 period (Spandana & Koustubh, 2020).

Fake news detection systems also have different approaches. For example, there are systems that are based on the content of an article, the content of social media or some other features, such as tracking popularity (Zhang et al., 2015), Natural Language Processing (Nagaraja et al., 2021), external information of a text, hot topics (Z. Yang et al., 2015). It must be mentioned that many of these tools have been referred in 2015, while in this dissertation, the milestone date was 2016 and the events of the US Presidential Election. So there is the question of whether all this can now be finite. Not in terms of technology, but in terms of time. Why is it possible that such an algorithm is actually effective in an article or a social media post. But can it prevent all the ever-increasing flow of fake news? And let us not forget that before 2016, there was no such explosion of this phenomenon.

3.4.1 FakerFact

One tool that can help fight fake news is FakerFact. FakerFact, with the help of artificial intelligence can help us understand more of everything we read on the internet. This can help us because in the previous chapter it was mentioned that the countless information that is uploaded daily on social media, the reaction of other people and the psychological factor, are mixed with each other and the person comes and cannot sort information correctly. So that's why Walt exists. Its peculiarity is that it is not a plug in within a website to detect fake news. The user sends him the necessary information. Walt was trained to read thousands of documents of various types. That is, from papers and articles to satire, trolls, and hate speech. To understand more deeply, Walt will not tell you on his own whether an information is a lie or not, but based on what the user has read, he will state whether it is subjective, whether what is written may be offensive or offensive, and in the end the user will judge by himself to what will believe¹³.

3.4.2 Index

Index provides some ratings on the risk of fake news on blogs. The audit is done on each site and is based on four categories:

1. Structure: Automated and examines with the help of AI the metadata and computational signals.
2. Content: Non - automated. Understands the type of document and its style. This axis is quite similar to the way FakerFact is used.
3. Functional: This category examines whether the rules are followed, the standards that the sites follow to make the trust stronger. At this

¹³ <https://fakerfact.org/about>

point it should be noted that at European level, there are many European directives¹⁴ that explain on the websites that it is necessary to provide some extra information of the company or organization.

4. Context: This category examines the ultimate credibility of a website.

Based on the above checks, an overall score of the page is displayed which ranges from 0 to 100 points. Each category notes the respective score and an average of them comes out as a total score. There is no set limit to concluding that a site has fake news posted, but the score indicates whether there is a high risk of misinformation or not. The Index does not indicate whether the content of a web page is fake or not, but these ratings provide some sort of transparency. It can also help news agencies and technology companies make their research more credible (Srinivasan, 2019).

3.4.3 CSI

CSI means Capture, Score, Integrate. It is a model for detecting misinformation. Observes the behavior of users individually and the content that is uploaded and the overall behavior of all users. "Capture" is practically the control in the text and the answer. It measures the user's time response to content. "Score" is the measurement of the previous recording and "Integrate" is the final judgment, whether the content is fake or not (Ruchansky et al., 2017). But at the same time, CSI is trying to go beyond evaluating websites, ranking them, and identifying suspicious groups.

¹⁴ Directive 3000/11, Regulation 2019/1150.

The most basic parameter for CSI, is that in order to properly identify fake news, all three categories must be integrated. Initially the capture, which will detect the reaction of users to the articles in relation to time. Then the Score, which with a score will evaluate the suspicion for each user and finally the Integrate, which based on the above will create a tag for each article not (Ruchansky et al., 2017). More specifically, CSI uses neural networks to gather different sources of information and thus records the evolution of commitments from both users and articles. In addition, it can review each user's profile information.

So far, in all three models, there is a common thought, that of evaluation, regardless of whether some models are concerned with the exact score or some others decide with the inclination of each score.

3.4.4 FNED

FNED is a new tool for detecting fake news, which is a neural network. The three new features are firstly a device that understands the characteristics of the text, the users, but also the combinations of the response of the users and their profiles, secondly a mechanism that measures the responses of the users who are in specific ranking positions and third, a mechanism that measures the average of many areas and their overall behavior. This tool, experimentally, can detect fake news at a rate of over 90% in a period of 5 minutes and this is important because it can prevent mass tweets for example from Twitter. This efficiency can be achieved with a sample of 10% from fake news (Liu & Wu, 2020).

What Liu & Wu, (2020) are examining is whether the characteristics of the user and his profile in relation to the news that are uploaded can improve the detection of fake news, how, with which machine learning model this can work and finally if this can work with imbalanced training data. This model aims at fake news detection in social media.

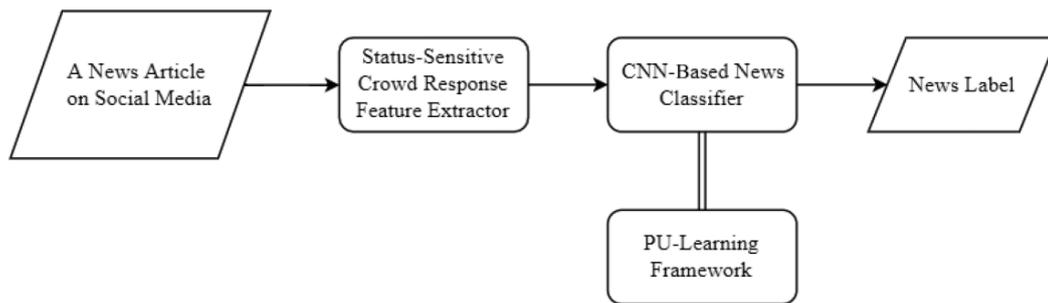


Figure 4. FNET functions. (Liu & Wu, 2020)

According to figure 4, we can see all of the functions of FNET in a simple way. We observe that in the first step as input we have the corresponding article, then that it is evaluated based on the three new features of this model. Once this is done, the news is classified along with the existing evaluations, and with the help of PU - Learning we are led to the conclusion.

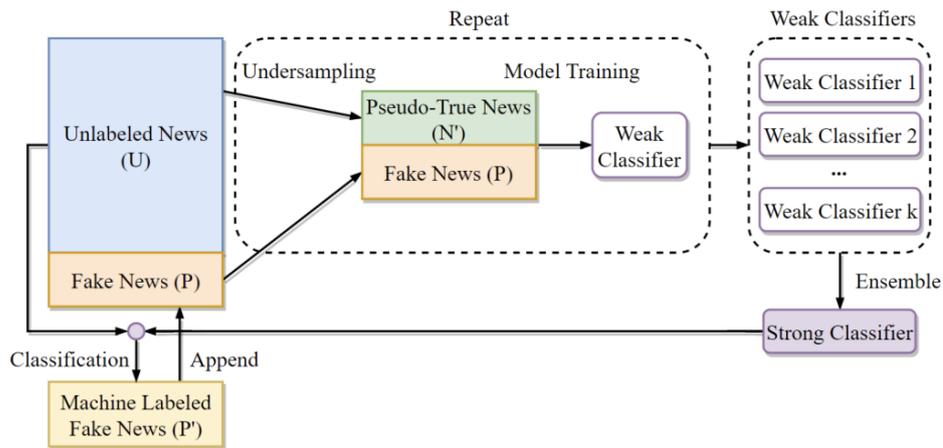


Figure 5. The structure of the proposed PU - Learning. (Liu & Wu, 2020)

At the point where we have the PU - Learning, which essentially works with the CNN - Based News Classifier, the above processing is done. So from the previous article, we now have Unlabeled News and fake news. The separation is done. After taking all this news, i.e the classified news and the classified fake news, an editing is done and we have smaller classifications. The many small classifications create a large one, and so, this is the information that the algorithm "understands" and this is repeated over and over again.

This application seems in my opinion to be one step higher than the previous examples. And this is because the previous models reach up to the second shape of figure 1. That is, the evaluation of only fake news. I believe that this is not enough today and it is finite, because the amount of fake news that is produced is huge, so such solutions are needed.

Based on figure 2, we can understand how this version works. At the same time we can combine it with figure 1 and imagine that:

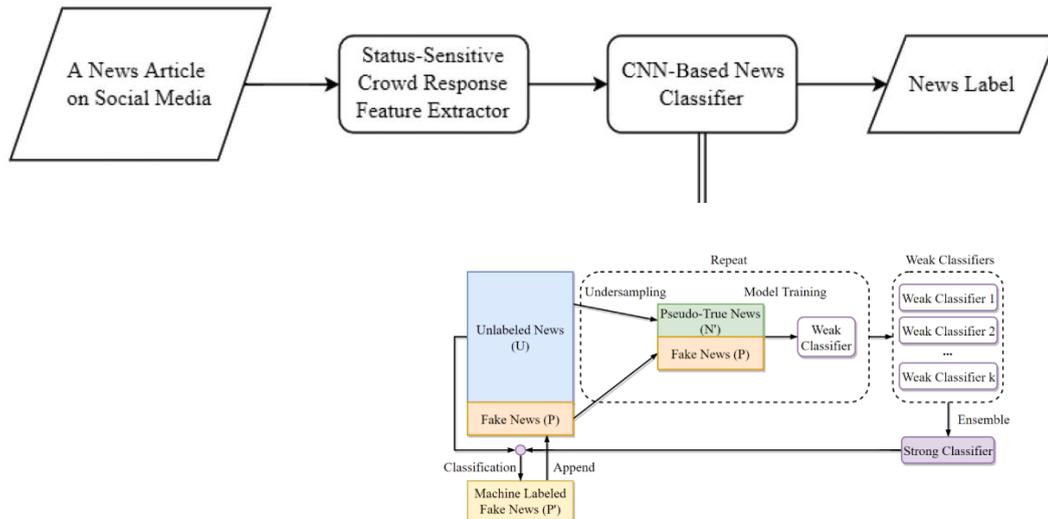


Figure 6. FNET functions with proposed PU-Learning

Liu & Wu (2020) approved in an experimental way that this model can work and PU – Learning can be used in order to increase fake news detection.

Nagaraja et al. (2021) suggest another model. What combines the two algorithms Naive Bayes and Support Vector Machine. The first algorithm is used because it is considered one of the best algorithms for text classification and the second because in a limited set of data with fairly good accuracy. The steps they suggested are as follows. First, Data collection from news headlines and fake or real characterization from the overall collection. Second, Simplify text. That is, remove punctuation marks, numbers, characters from another language. Third, check the meaning of the words from the news. Fourth, with the help of 2 algorithms, training of the datasets and machine learning. Fifth, a measure of whether the forecasts are accurate. Sixth, comparison of truth, accuracy and visualization of the two algorithms. The results of their experiment was not good enough in a small dataset. They concluded that this example should be done in a larger volume of data for better efficiency. So the following question

arises. In many papers, different results may be reported in the experiments. This does not entirely mean that the model can succeed in the "real" world.

4 Conclusions and Future Work

Fake news is a huge problem in which, however, in the last seven years a lot of research has been done at the technical and political level, with better organization of Services and combined actions. We live in an era that there is so much information and the fact that people have more and more access in the Web, arises many fake news campaigns with the manipulation of people. The problem is that fake news exist almost everywhere. In the field of business, in medical field, in media etc. and the consequences are very different with each other.

I believe that the most important problems with fake news exist in the medical sector, especially with Covid - 19 and everything that is heard in the electoral processes. That is, for health issues, which can even affect human life, and then for democracy issues. Here we need technology to provide a solution. Of course, there are many categories of programs. Some find content on a website, others on social media, others find specific characters, comments, reactions or a combination of these. What I understand is that one of the manually fake news detections can be done easily, but the problem is the high speed of fake news production in combination with the different forms or even the volume. In many articles I have noticed that the most recent literature examines the methods of machine learning in detecting false news (Bojjireddy et al., 2021; Borges et al., 2019; Cordeiro et al., 2019; Khan et al., 2021; Meesad, 2021; Nasir et al., 2021) , and this seems, experimentally, to give good success rates.

I believe that the EU has understood the problem from very early 2015. This is something very good because it means that it can better protect its citizens. However, because its actions are quite complex, I believe that the citizens are not informed about what exactly is happening. It is very positive that the EU is funding many projects to investigate the detection of fake news.

What is certain is that fake news research must be done both theoretically and practically. That is, the technicians should do research on algorithms and the theorists should look more at impact, information and other issues of international politics as well as issues of better organizational operation. This means that there must be a proper and adequate way of communication. One side to understand the other. If this is achieved, I believe that there will be even better results in the EU. This dissertation was an attempt to highlight both different aspects.

As for future research, of course we cannot predict anything since we do not know the technological trends in the short term. The growth is very large, and we do not know what we can see in the near future. Of course, this does not only refer to solutions, but also to threats. With the new trends, not only better and more accurate algorithms will come out, but new forms of threats will also come out and probably be more difficult to detect. They will be more realistic.

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