

# Efficiency comparative analysis of techniques in misinformation detection in healthcare data\*

Alžbeta Žiarovská

Slovak University of Technology in Bratislava

Faculty of Informatics and Information Technologies

`xziarovska@stuba.sk`

26. september 2023

---

\*Semestral project in subject Engineering Methods, ac. year 2023/24, guidance: MSc. Mirwais Ahmadzai

**Abstract**

...

## 1 Introduction

In this article I am going to discuss the current situation regarding spread of misinformation in the medical field. This topic is very important in the aftermath of the global COVID-19 pandemic. More specifically I am going to make an analysis and comparison of different misinformation detection methods and their efficiency. During the pandemic we have seen a great rise of misinformation on the Internet, which provide danger to our society or even lives. [War18] The main problem in my perception is, that the easy access to all the information on the Internet, which does not necessarily has to be true, can increase fear and anxiety and ultimately lead to the delay of diagnosis and receiving the effective healthcare in case the information are not perceived correctly.[WMTS19] The paradox is, that the machines might actually be the solution, as I am going to discuss various methods to recognize misinformation using technology. [Cha22]

I am focusing on comparing fact-checking and machine learning models as a way to find the medical misinformation. The fact-checking can be done manually or automatically which is introduced more deeply in Section 4.1.[BS21] The other side I am taking a closer look at are machine learning techniques including Naïve Bayes, Support Vector Machine and BERT-based model called Disease Myth Buster.[BS21][Cha22] I introduce these techniques and compare their efficiency in order to establish which one is the most suitable for a specific situation in healthcare.

In the Section 2 I am giving a brief introduction into the terminology used in the article.. In the Section 3 the term misinformation is described, how it differs from disinformation [GL20]. Also a brief summary of historical development of misinformation spread is given. [PM18] It is also important to mention affect that medical fake news might have on our lives, which I address as well. [W<sup>+</sup>22] The last but not least, in Section 4, I am taking a closer look at some of the methods used for misinformation recognition. I going to introduce them in a way, that would be easily understandable for all readers and state some of their outputs, so I can compare their effectiveness and possible impact for the future in Conclusion. 5

## 2 Terminology

**Natural language processing** (NLP) is a way for programs to understand language used by humans on daily basis by using various algorithms and limitations. It was originally closely related to information retrieval from written documents, however, over the time, their paths have divided and they no longer have such a vast crossing. [NOMC11][Lid01]

**Term frequency–inverse document frequency** (TF-IDF) represents a numeric value of how relevant is the specific word for the document in the set of documents. This technique finds its application both in text mining and information retrieval. [CAS16]

**Transfer learning** is a concept of dedicating a new and unusual task where already known knowledge and tools are used for its solution. It is a part of the machine learning, where source tasks are being relocated in order to satisfactorily complete the given task. [Cha22][TS10]

## 3 Misinformation in healthcare

**Difference between misinformation and disinformation** The terms *misinformation* and *disinformation* are much the same, however, a small, but crucial difference can be distinguished. The difference between the two is a intention with which the false information is made accessible to the public and spread. Whilst the misinformation is usually created without direct intention of misleading and spreading false, meaning the person who put the information into the world might not actually know it is not true. On the other hand, disinformation is essentially created to spread false information. An example of such activity can be political propaganda.[GL20] [CEL15] Even though the terms are not meaning the same, for the purpose of this article they are used as synonyms, because the author's

knowledge, whether the information is factual, is negligible in the scope of its false recognition.

**Historical development of concept of misinformation** Humankind has shown its resourcefulness throughout the whole timeline by various inventions alternating from practical inventions to theoretical laws of psychics. Nonetheless, the creativity does not only apply to useful and factual creations. The yearn for spreading not true information, either for amusement or with a goal of hurting someone, is old as a humanity itself. [Bur17]

The very first use of misconception was spoken, whereas the printing was not found yet. The emperors used to control the information generally believed in order to strengthen their reign and power over the people. [Bur17] Later, with Gutenberg's invention of press a lot has changed. Accessibility of knowledge has become easier and so did the spread of misinformation. [PM18] In the 16th century the writers have started to create completely false stories and plays in order to offer entertainment, but the drive was not only positive. During the French Revolution a rumor (in France called *canard*) was used to discredit the queen Marie Antoinette, which doubtlessly did not help her in the later events of the French Revolution. [Bur17]

Later, when the mass media took their place, the misleading was often used in order to change the opinion of the public during the times of war. For example during the World War II the Nazi propaganda was reaching the peaks of political propaganda ever. [PM18] Afterwards the Cold War has started and a important part of it was fight over public perception, which again resolved in race of misleading the public. [PM18]

As we have entered the era of the internet, everybody can contribute to the chain of communication and share their own truth, whether with or without the intention of doing harm. The rise of the *hoax* is enormous and numerous fake websites were created.[Bur17] The ways of popularizing the misinformation has changed, as new

inventions were developing, and so did the way of fighting them. Nowadays the information revolution by the Internet has brought many ways of spreading false information, but the way of their detection is not yet perfectly defined and therefore there is need for effective adaptive mechanisms.

**Health care misinformation** [WMTS19][CEL15]

**Societal context** [W<sup>+</sup>22] page 8 [WMTS19]

## **4 Misinformation recognition techniques**

### **4.1 Fact-checking technique**

#### **4.1.1 Manual fact-checking**

**Technology and people**

#### **4.1.2 Automatic fact-checking**

### **4.2 Machine learning technique**

**Definition**

**Text processing**

#### **4.2.1 Naïve Bayes**

#### **4.2.2 Support vector machine**

#### **4.2.3 Disease Myth Buster**

**Ethics and sustainability**

## 5 Conclusion

Je nejaké riešenie a aké? Je vaše riešenie podobné iným (hoci aj z inej oblasti a len v z určitého hľadiska)? O čom je článok, k čomu ste ním prispeli a čo zostáva otvorené?

Z obr. 1 je všetko jasné.

Aj text môže byť prezentovaný ako obrázok. Stane sa z neho označný plávajúci objekt. Po vytvorení diagramu zrušte znak % pred príkazom `\includegraphics` označte tento riadok ako komentár (tiež pomocou znaku %).

Figure 1: Rozhodujúci argument.

## 6 Iná časť

Základným problémom je teda... Najprv sa pozrieme na nejaké vysvetlenie (časť 7.1), a potom na ešte nejaké (časť 7.1).<sup>1</sup>

Môže sa zdať, že problém vlastne nejestvuje[BS21], ale bolo dokázané, že to tak nie je [BS21]. Napriek tomu, aj dnes na webe narazíme na všelijaké pochybné názory[BS21]. Dôležité veci možno *zdôrazniť kurzívou*.

## 7 Ďalšia časť

Toto je ďalšia časť, v ktorej idem urobiť odsek.

Toto je odsek. haha.

### 7.1 Nejaké vysvetlenie

Niekedy treba uviesť zoznam:

- jedna vec
- druhá vec

---

<sup>1</sup>Niekedy môžete potrebovať aj poznámku pod čiarou.

– x

– y

Ten istý zoznam, len číslovaný:

1. jedna vec

2. druhá vec

(a) x

(b) y

## References

- [BS21] Yashoda Barve and Jatinderkumar R Saini. Healthcare misinformation detection and fact-checking: a novel approach. *International Journal of Advanced Computer Science and Applications*, 12(10), 2021.
- [Bur17] Joanna M Burkhardt. History of fake news. *Library Technology Reports*, 53(8):5–9, 2017.
- [CAS16] Hans Christian, Mikhael Pramodana Agus, and Derwin Suhartono. Single document automatic text summarization using term frequency-inverse document frequency (tf-idf). *ComTech: Computer, Mathematics and Engineering Applications*, 7(4):285–294, 2016.
- [CEL15] John Cook, Ullrich Ecker, and Stephan Lewandowsky. Misinformation and how to correct it. *Emerging trends in the social and behavioral sciences: An interdisciplinary, searchable, and linkable resource*, pages 1–17, 2015.
- [Cha22] Garima Chaphekar. *Unmasking Medical Fake News Using Machine Learning Techniques*. PhD thesis, San Jose State University, 2022.



- [GL20] Andrew M Guess and Benjamin A Lyons. Misinformation, disinformation, and online propaganda. *Social media and democracy: The state of the field, prospects for reform*, 10, 2020.
- [Lid01] Elizabeth D Liddy. Natural language processing. 2001.
- [NOMC11] Prakash M Nadkarni, Lucila Ohno-Machado, and Wendy W Chapman. Natural language processing: an introduction. *Journal of the American Medical Informatics Association*, 18(5):544–551, 2011.
- [PM18] Julie Posetti and Alice Matthews. A short guide to the history of ‘fake news’ and disinformation. *International Center for Journalists*, 7(2018):2018–07, 2018.
- [TS10] Lisa Torrey and Jude Shavlik. Transfer learning. In *Handbook of research on machine learning applications and trends: algorithms, methods, and techniques*, pages 242–264. IGI global, 2010.
- [W<sup>+</sup>22] World Health Organization (WHO) et al. Infodemics and misinformation negatively affect people’s health behaviours, new who review finds. 2022, 2022.
- [War18] Haider Warraich. Dr. google is a liar. *New York Times*, 2018.
- [WMTS19] Yuxi Wang, Martin McKee, Aleksandra Torbica, and David Stuckler. Systematic literature review on the spread of health-related misinformation on social media. *Social science & medicine*, 240:112552, 2019.