

An Intelligent System to Protect Diabetic Patients from Misinformation on Twitter



Sharifah Alshehri, Nourah Alessa, Maryam Alhawiti, Amal Majdua, Nojood Aljehane, Mohammed Alotaibi

Abstract: Diabetes is a chronic disease requiring careful management and accurate health information access. Diabetic patients are particularly vulnerable to misinformation on social media, as they may be more likely to seek alternative treatments and self-medicate. This can have severe consequences for their health and well-being. Also, the spread of misinformation on social media, including Twitter, can negatively impact the health and treatment of diabetic patients. In this research, we propose developing an intelligent system to detect and mitigate the spread of misinformation about diabetes on the Twitter platform. The system will utilize artificial intelligence and natural language processing technologies to identify and classify tweets containing false information about diabetes. The proposed system has the potential to protect diabetic patients from the negative consequences of misinformation and support the provision of accurate health information on social media.

Keywords: Diabetes, Misinformation, Fake, NLP, Monitoring

I. INTRODUCTION

Diabetes is a significant public health concern that can have disastrous effects on those diagnosed with it and financial consequences. It is a leading cause of cardiovascular disease, kidney failure, blindness, and lower limb amputations. It also negatively impacts the quality of life and increases the risk of depression and anxiety [1]. According to the International Diabetes Federation's Diabetes Atlas, 537 million people globally will develop diabetes in 2021. This number is expected to increase to 643 million in 2030 and 783 million in 2045. In the MENA region, diabetes currently affects 73 million adults in the Middle East, has claimed 796,000 lives and is expected to

affect 95 million people by 2030 and 136 million by 2045. Regarding the percentage of people with diabetes between the ages of 20 and 79, Saudi Arabia ranks first in the Arab world with a rate of 20.9% and a total of 10.9 million people in 2021. Sudan comes in second with a rate of 18.7% and a total of 4.3 million individuals [2]. The proliferation of mobile phones and web application technology has connected the world in a virtual platform through social network applications such as Twitter, Facebook, and Instagram. As a result, billions of people join these platforms monthly, and social media usage continues to grow. According to global media insight [3], there will be 4.9 billion active social media users worldwide in 2023, representing 61% of the world's population. The number of social media users increased by approximately 400 million after the pandemic, bringing the total number to 3.9 billion. This year, the total number of social media users is expected to reach 4.59 billion, a significant increase of 330 million from last year [3]. In January 2022, the number of social media users in the Kingdom of Saudi Arabia (KSA) reached 29.30 million, or 82.3% of the total population, according to the Saudi Digital Report 2022. On average, Saudi Arabians use social media for three hours and twenty-four minutes.

Among internet users, 87.4% use WhatsApp, 78.10% use Instagram, and 71.9% use Twitter. These platforms have 30.67 million, 27.40 million, and 25.23 million active users, respectively [3]. Social media platforms have allowed people to easily share information about their health conditions and experiences, which can be beneficial in terms of helping physicians and caregivers understand patients' beliefs and knowledge about specific diseases. However, the problem is that some of the information shared on social media can be false, and each patient's circumstances and environments are unique. This can lead to the spread of false news and rumors, as well as the use of complementary and alternative medicine by some diabetic patients without consulting their doctors or considering the potential risks and effectiveness of such treatments. Furthermore, there are no clear laws for publishing on social media; this allows the network to be used to spread false news and rumours. In the field of health, the quality of health knowledge that is shared through social networking sites varies greatly, and the lack of information leads to the spread and exchange of rumours among users, which may contribute to the impact of this rumour on health due to this misinformation and its practice without validation. Moreover, some diabetic patients use complementary and Alternative Medicine to treat their diabetes [4].

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A study conducted in multiple hospitals and medical centres in Saudi Arabia (KSA) in 2019 [5] found that diabetic patients often use herbal treatments rather than following their physicians' prescribed treatments. This was discovered through interviews with 289 type 2 diabetes patients and 105 physicians. Another study [6], found that 68% of participants regularly used herbal treatments, including cinnamon, ginger, and fenugreek, as self-medication, with most of their information on using herbs from family, friends, and social media. Many of the participants (71.4%) did not consult with or inform their doctors of their decision to use these remedies, and about half believed they were both safe (46%) and effective (54%) in treating diabetic symptoms. In this paper, we aim to design an intelligent tool to curb the dissemination of false information on social networking platforms, specifically Twitter, which can adversely impact individuals with diabetes. The proposed solution involves creating an intelligent system to identify and flag rumours and fake news related to diabetes on the Twitter platform. The proposed system will utilize artificial intelligence (AI) and natural language processing (NLP) techniques to detect any misinformation about diabetes on Twitter. The paper structure will be a system for monitoring misleading tweets about diabetes on Twitter based on artificial intelligence (AI). The paper is organized as follows: (I) Introduction, (II) Related work (III) Proposed system overview (IV) Results and discussion (V) Conclusion and future work.

II. RELATED WORKS

Diabetes affects millions of people worldwide, and its management requires a considerable amount of knowledge and self-care. In recent years, social media platforms have become an important source of information for many people with diabetes, but they also serve as a source of misinformation as well. This can lead to confusion, anxiety, and poor self-management of diabetes, which can lead to serious health complications. Several studies have shown that diabetes misinformation is a major concern among patients, especially those who obtain information about their condition through social media. Studies have examined how diabetes misinformation is spread and how it impacts social media platforms such as Twitter, Facebook, and Instagram.

A recent study in 2022 [7] discusses the impact of social media on diabetes and obesity and how it can spread misinformation that can be harmful to individuals. The author notes that social media has become a popular source of health information for many people, but the accuracy of this information is not always guaranteed. Authors highlighted some of the common types of misinformation that circulate on social media related to diabetes and obesity, including unproven remedies and treatments, false claims about the causes of these conditions, and conspiracy theories about the pharmaceutical industry. Moreover, the author also discussed the potential consequences of this misinformation, including delays in seeking proper medical treatment, a lack of adherence to evidence-based recommendations, and increased stigma and discrimination towards individuals living with these conditions. They conclude by suggesting that healthcare professionals and researchers should engage with social media to help combat

misinformation by providing accurate and reliable information to the public. The author also recommends that social media companies should take responsibility for monitoring and removing harmful content related to diabetes and obesity. Overall, they highlighted the important role that social media plays in shaping public perceptions and understanding of diabetes and obesity, and the need for accurate information to be promoted to prevent harm to individuals. Moreover, another researcher conducted systematic review study [8] on the prevalence of health misinformation on social media. The purpose was to identify the prevalence of health misinformation on social media and the types of misinformation that are most commonly shared. The study reviewed a total of 69 articles that met the inclusion criteria. The articles were published in web of science database until March 2019, and they covered a wide range of social media platforms, including Facebook, Twitter, YouTube, and Instagram. The authors found that health misinformation on social media is widespread and can lead to negative health outcomes. They identified that the majority of health misinformation relates to alternative medicine, vaccination, and cancer treatments. The study also revealed that health misinformation on social media tends to be more popular and widespread than accurate health information. Misinformation can spread rapidly on social media platforms due to the ease of sharing, and it often goes unchecked. The authors note that the impact of health misinformation on social media can be significant, as it can lead to harmful health behaviors and increased healthcare costs. Authors recommend that healthcare providers should address this issue by providing accurate information to patients and the public and developing strategies to counteract health misinformation on social media. The authors also suggest that social media platforms could play a role in combating health misinformation by developing algorithms that identify and flag misinformation and by working with healthcare providers to provide accurate health information to users. Furthermore, another systematic review study [9][10] examines the spread of health-related misinformation on social media. The authors analyzed 57 studies published between 2012 and 2018, and found that health-related misinformation is widespread on social media and can have significant negative impacts on public health. The review identified several types of health-related misinformation on social media, including false claims about the effectiveness of treatments, conspiracy theories, and anti-vaccination propaganda. The authors noted that misinformation can spread quickly on social media due to the ease of sharing and the use of algorithms that prioritize sensational or controversial content. Authors concludes with recommendations for addressing the issue of health-related misinformation on social media, such as promoting digital literacy and critical thinking skills to help individuals identify and evaluate reliable health information, and encouraging social media platforms to take greater responsibility for monitoring and removing false information.

Overall, the study highlights the urgent need for action to address the spread of health-related misinformation on social media and its potential impacts on public health. Based on the results of above studies, it appears that misinformation about diabetes on social media poses a significant concern for patients with diabetes. It can lead to confusion, poor self-management, and negative health outcomes. Consequently, patients with diabetes should be taught to critically evaluate health information found on social media and to seek out reliable sources. It's also important for healthcare providers, diabetes organizations,

and social media platforms to develop strategies to combat misinformation about diabetes on social media. This can be done by providing accurate and up-to-date information and promoting media literacy among patients with diabetes.

III. SYSTEM OVERVIEW

This section will describe and discuss the proposed system. The whole picture of the system is depicted in the following figure:

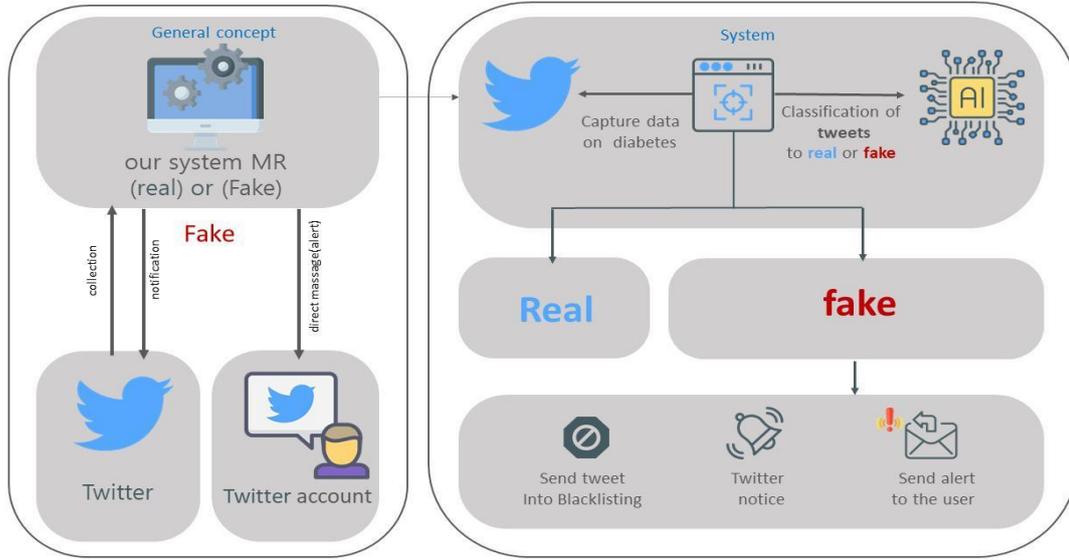


Figure 1: System Architecture

The proposed system aims to provide a solution to the problem of misinformation about diabetes on social media platforms, specifically Twitter. Using AI and NLP techniques, the system can classify tweets accurately as true, or false, thus limiting the spread of incorrect information about diabetes. The system will be able to monitor Twitter feeds and capture tweets that contain specific keywords related to diabetes and then classify those tweets based on their content and credibility. This will help to improve the quality of health knowledge shared on social media platforms and ultimately benefit the health of diabetic patients.

A. The system consists of two components:

a. The Twitter platform:

The Twitter platform will be an integral part of the proposed system. Our system will be designed to monitor and capture all tweets that on Twitter. The tweets will be retrieved and processed by the system, which will be able to identify specific tweets based on a list of predetermined keywords related to diabetes.



Figure 2: a sample of Twitter Message

Proposed System:

The proposed system includes two main modules (1) capturing tweets module and (2) the natural language module.

1) Capturing module

The "Capturing Module" of the proposed system has been developed using the Python programming language to monitor the feeds on Twitter. This module is designed to capture specific tweets that contain a predetermined list of keywords related to diabetes, including "diabetes", "diabetic", "diabetic complications", "diabetic folk medicine", and "diabetic foot". These keywords were chosen based on recommendations from physicians. Once a tweet containing one of these keywords is identified, it will be forwarded to the next module of the system for further processing.

2) Natural language processing module

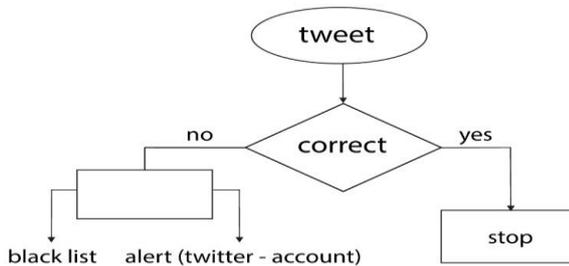


Figure 3: workflow of detection

This module was developed using NLP techniques to analyze the captured tweets. It will classify the tweets into two categories: true and false. The NLP module will use the trained algorithm to classify the captured tweets into one of the two categories. The classification process will also include some additional techniques to ensure the accuracy of the results, such as stemming and lemmatization. If the tweet is incorrect, the system will notify the Twitter account that post that tweet via the direct message as shown in figure 4



Figure 4: Example of the system response

his/her tweet is wrong and should be removed. Moreover, it will be added to the blacklist of the wrong tweets. Then, the system will double-check after a short period of time, if the Twitter account removes the tweet or not, if not, the system will send another alert and will also send spam to Twitter management.

3) The blacklist of tweets

The physician will use the blacklist of tweets to establish an awareness program to increase awareness of diabetes.

IV. DISCUSSION

The spread of inaccurate information about diabetes can also be done by those who are not experts, such as influencers, celebrities, and others who may not have medical training or expertise. This can lead to confusion and misinformation among patients and may negatively impact their health outcomes. As a result, patients may need help to distinguish between accurate and inaccurate information. Several interventions have been proposed to address this problem to combat misinformation about diabetes on social media. One approach is to use mobile health technologies, such as smartphone apps, which can provide patients with accurate, evidence-based information about diabetes. These apps can track blood sugar levels, monitor medication schedules, and provide educational resources. However, this concept will not stop the misinformation on social media.

Moreover, Patient education interventions, such as workshops and brochures, can also be effective at preventing misinformation. These programs can be used to educate patients about the causes, symptoms, and management of diabetes. They can also provide patients with the skills and knowledge to distinguish accurate from inaccurate information. This solution is cost and needs time to cover all diabetic patients.

However, media literacy programs, which aim to improve the ability of patients to evaluate health information critically, are ineffective in preventing misinformation about diabetes. These programs may be more effective when combined with other interventions, such as mobile health technologies and patient education programs.

Overall, it is essential to have a multi-faceted approach in preventing misinformation about diabetes and providing accurate information. This could include utilizing credible sources, fact-checking, and providing educational programs to the public to increase their knowledge and ability to discern precise details. We believe the use of AI technology can contribute in solving this problem while a special AI model will be developed to capture any tweets about diabetes and evaluate its health accuracy if it is not accurate, the model will alert the twitter account who tweet that content to delete and also will alert twitter management to take action. We are planning to contact Twitter company to add our tools to their platform directly to make direct decision for such information.

V. CONCLUSION AND FUTURE WORK

In conclusion, spreading false information about diabetes on social media is a significant concern that can severely impact patient health. While various interventions, such as mobile health technologies and patient education, have been proposed as means of combatting misinformation, further research is necessary to identify the most effective strategies. It is crucial to raise awareness among patients and healthcare providers and empower them to critically assess information on social media and consult with their healthcare providers when in doubt. Additionally, efforts to promote credible sources and fact-checking can also reduce the spread of misinformation. To address this issue the use of AI technology specially Natural Language processing to automatically and critically evaluate the contents of any tweets includes diabetes or any related vocabs. In the future , the author start collecting tweets that includes diabetes in Arabic language , they collected until now 23000 non-duplicated tweets. The next step is to label the collected tweets by the help and collaboration with physician from the faculty of medicine at the University of Tabuk whom started on this phase now. Next authors will develop the AI model that will evaluate the accuracy of the tweets and give an alert when it find the tweet is incorrect.

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Authors Contributions	Maryam @ Sharifah (Introduction - Related Works - Conclusion and Future Work), Nourah @ Amal (System Overview-Related Works - Discussion) Nojood Aljehane Double review, Mohammed Alotaibi Final review

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AUTHORS PROFILE

Sharifah Alshehri Master's degree in Data Science from the University of Tabuk. An enthusiastic person who is fascinated by the fields of statistics, artificial intelligence, and natural language processing. I've built a solid academic foundation to support my hobbies by earning a BSc in Mathematics and an MSc in Data Science. My journey has focused on examining the enormous possibilities of data, which has led me to pursue a career in the fascinating fields of artificial intelligence and natural language processing. I constantly seek to broaden my knowledge and be at the forefront of new developments because of my analytical attitude and unquenchable curiosity. I am committed to making significant contributions to the field of data science, motivated by my unrelenting passion and desire to have an impact that will last a lifetime.

Nourah Alessa a highly motivated and accomplished computer science graduate with a master's degree in data science. I have a strong interest in the field of graphic design and I have developed a keen eye for detail. My passion for business intelligence has led me to apply my data science skills to analyze complex data sets, extract relevant statistics, and provide valuable insights for informed decision-making. My dedication and determination have enabled me to excel in my areas of interest, and I always strive for success and excellence in everything I do. With my diverse skill set and passion for innovation, I am poised to make a significant impact in the tech industry

Maryam Alhawiti Bachelor of Mathematics, Master's graduate in Data Science from the University of Tabuk. I am Interested in the field of data science and machine learning, I trained at the Center for Industrial Innovation and Robotics summer of 2022. And also in the National Center for Artificial Intelligence (NCAI) Cooperative Internship 2023. I am eager to use my skills to make a positive impact on the world. I found my true calling in Data Analysis, Natural Language Processing (NLP), and related research. I eagerly dive into complex data sets, extracting valuable insights. Through continuous learning and active participation in the data science community, I am determined to leave a lasting mark in the field of data science. I am also interested in volunteer work in general and with the Ministry of Health in particular. And I think it's important to give back to my community.

Amal Majdua Bachelor of Mathematics at King Khalid University, Master of Data Science at Tabuk University I am a highly skilled professional with a strong educational background in Mathematics and Data Science. My expertise lies in machine learning and data analysis, with proficiency in various areas such as object detection, scraping, data mining, information retrieval, search engines, data processing, big data, deep learning, data visualization, statistical analytics, computing, and natural language processing (NLP). I have the ability to analyze large datasets, develop predictive models, and uncover patterns and trends. I am passionate about leveraging these skills to tackle complex problems and derive meaningful insights from data.

Nojood Aljehane is serving as an Associate professor in artificial intelligence. Nojood served as Vice Dean Faculty of computing and information Technology at University of Tabuk. She got her PhD in artificial intelligence from the united kingdom in 2018. She is interested in AI, computer vision, Natural Language Processing and health informatics. She has many publications in highly impact factor journals.



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Mohammed Alotaibi received the B.S. in computer Science from KingSaud University in July 2008 and M.S. degrees in Computer and Information Networks, Essex University, UK (Jan, 2011), respectively. He got Ph.D. in health informatics from Kingston University London in March 2015. He has served as assistant Prof. and then associate prof at the faculty of computers and information technology, and a researcher in the Artificial Intelligence and Sensing Technologies (AIST), at the University of Tabuk since August 2015 until now. He owned three research project funds from different organizations. He is now a research leader of a research group that focus on using robotic and AI in chronic diseases which owned a research fund worth 100,000 Saudi Riyals.

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