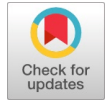


# An Intelligent System to Protect Diabetic Patients from Misinformation on Twitter



Sharifah Alshehri, Nourah Alessa, Maryam Alhawiti, Amal Majdua, Resan Aljohani, 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

## 1. 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 worldwide are expected to 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 enabled people to easily share information about their health conditions and experiences, which can be beneficial in 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 rumours, 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 governing the publication of content on social media, which allows the network to be exploited for the spread of false news and rumours. In the field of health, the quality of health knowledge shared through social networking sites varies significantly, and the lack of information leads to the spread and exchange of rumours among users, which may contribute to the impact of this misinformation on health due to 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 patients with type 2 diabetes 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 have a detrimental impact on 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, utilising artificial intelligence (AI). The paper is organised 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 essential source of information for many people with diabetes, but they also serve as a source of misinformation. 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 significant concern among patients, especially those who obtain information about their condition through social media. Studies have examined the spread of diabetes misinformation and its impact on social media platforms, including 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 the public with accurate and reliable information. The author also recommends that social media companies take responsibility for monitoring and removing harmful content related to diabetes and obesity. Overall, they highlighted the critical role that social media plays in shaping public perceptions and understanding of diabetes and obesity, as well as the need for accurate information to be promoted to prevent harm to individuals. Moreover, another researcher conducted a systematic review study [8] on the prevalence of health misinformation on social media. The purpose is 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 the Web of Science database until March 2019 and 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 adverse 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 address this issue by providing accurate information to patients and the public and by 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 analysed 57 studies published between 2012 and 2018 and found that health-related misinformation is widespread on social media, with 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 rapidly on social media due to the ease of sharing and the use of algorithms that prioritise sensational or provocative content. The authors conclude 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 underscores the pressing need for action to counter the spread of health-related misinformation on social media and its potential impact on public health. Based on the results of the 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 adverse health outcomes. Consequently, patients with diabetes should be taught to critically evaluate health information found on social media and seek out reliable sources. It's also essential 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 describes and discusses the proposed system. The whole picture of the system is depicted in the following figure:

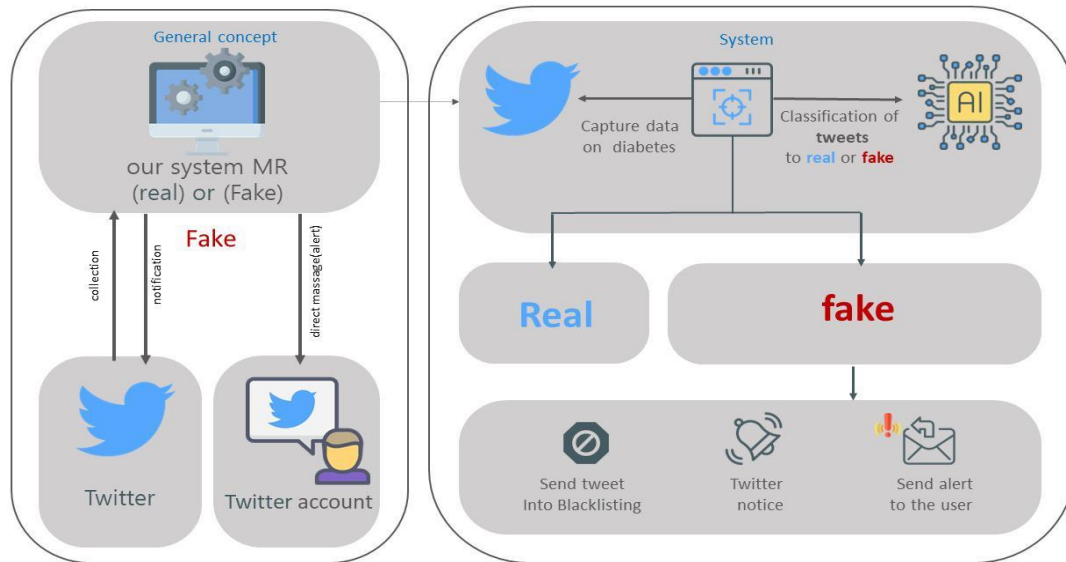


Figure 1: System Architecture

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 accurately classify tweets as true or false, thereby 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 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) the capturing tweets module and (2) the natural language processing module.

### 1) Capturing Module

The "Capturing Module" of the proposed system has been developed using the Python programming language to monitor Twitter feeds. 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

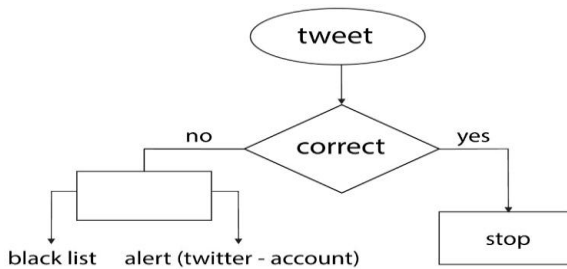


Figure 3: Workflow of Detection

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 utilise the trained algorithm to categorise the captured tweets into one of two categories. The classification process will also incorporate additional techniques to ensure the accuracy of the results, such as stemming and lemmatisation. If the tweet is incorrect, the system will notify the Twitter account that posted that tweet via a 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 to see if the Twitter account has removed the tweet. If not, the system will send another alert and also report the issue to Twitter management as spam.

### 3) The Blacklist of Tweets

The physician will utilise the blacklist of tweets to establish an awareness program aimed at increasing awareness of diabetes.

## IV. DISCUSSION

The spread of inaccurate information about diabetes can also be facilitated by those who are not experts, such as influencers, celebrities, and others who may lack medical training or expertise. This can lead to confusion and misinformation among patients, potentially affecting their health outcomes negatively. As a result, patients may need assistance in distinguishing between accurate and inaccurate information. Several interventions have been proposed to address this problem and 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 costly and needs time to cover all diabetic patients.

However, media literacy programs, which aim to improve patients' ability 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 adopt a multifaceted approach to preventing misinformation about diabetes and providing accurate information. This could include utilising credible sources, fact-checking, and offering educational programs to the public to enhance their knowledge and ability to discern precise details. We believe the use of AI technology can contribute to solving this problem. At the same time, a specialised AI model will be developed to capture tweets about diabetes and evaluate their health accuracy. If it is not accurate, the model will alert the Twitter account that tweets that content to delete and also will alert Twitter management to take action. We plan to contact Twitter directly to add our tools to their platform, allowing them to make a direct decision regarding 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 combating misinformation, further research is necessary to identify the most effective strategies. It is crucial to raise awareness among patients and healthcare providers, empowering 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, specifically natural language processing, is necessary to automatically and critically evaluate the contents of any tweets that include diabetes-related vocabulary. In the future, the author will begin collecting tweets that contain the word "diabetes" in the Arabic language; to date, they have collected 23,000 non-duplicated tweets. The next step is to label the collected tweets with the assistance and collaboration of a physician from the Faculty of Medicine at the University of Tabuk, who has now initiated this phase. Next, authors will develop an AI model to evaluate the accuracy of the tweets and provide an alert when it identifies an incorrect tweet.

## DECLARATION

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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** holds a 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 Bachelor of Science (BSc) in Mathematics and a Master of Science (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 continually strive to expand my knowledge and stay at the forefront of new developments, driven by my analytical mindset and insatiable curiosity. I am committed to making significant contributions to the field of data science, driven by my unwavering passion and desire to have a lasting impact.

**Nourah Alessa** is 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 analyse complex datasets, 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 consistently strive for success and excellence in all that 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 Centre for Industrial Innovation and Robotics in the summer of 2022. Additionally, in the National Centre for Artificial Intelligence (NCAl) 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 committed to making a lasting impact in the field of data science. I am also interested in volunteer work in general and specifically with the Ministry of Health. I believe it's essential 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, including object detection, data scraping, data mining, information retrieval, search engine optimisation, data processing, big data analysis, deep learning, data visualisation, statistical analytics, computing, and natural language processing (NLP). I can 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.

**Resan Aljohani** BA in Mathematics and MSc in Data Science, graduated in 2023 from the University of Tabuk. I possess in-depth knowledge in the field of data science and am particularly interested in data analysis and interpretation. I completed a training program in data analysis and big data, and I also obtained scientific certificates that enhanced my experience and knowledge in data science and data analysis. I look forward to gaining more knowledge and developing my scientific, practical, and creative skills to achieve the desired goals.

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