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A Social Media Based Clinical Decision Support System for Diagnosis and Management of Malaria

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Abstract:

Social media has been a means through which people connect to share information of all kinds; its usage is rapidly on the increase. Facebook has 1.6 billion daily users, YouTube has 149 million daily users, WhatsApp has 1 billion daily user and Snapchat receive 109 million daily users. This implies that social media is becoming a way of life and it has been of tremendous help in several segment of life, from commerce to marketing and lots more. Decision Support System optimizes the social media data in making informed health choices. For world, a prototype of a social media application was developed and it showed how quick and smart choices can be quickly arrived while maximizing clinical decision support system in the area of diagnosis and management of malaria even while still 'getting in touch'.

Keywords: Social media, clinical decision support system, malaria, diagnosis

1. Introduction

Social media is a means to connect people through information sharing. It has been of great help in various domains like education, businesses and human resource management. Social media is becoming part of our daily routine. Only Twitter attracted 105 million users to post news, announcements and up to date information on some issues. Facebook established community of more than 400 million users. Likewise, over 800 million unique users visit YouTube each month. Social networks hold potential to be utilized in various sub-domains of healthcare like disease management, maintaining health wellness, patient education, professional training and many more (WHO, 2018). Keckley (2010) enlisted many of such applications of social networks in the domain of healthcare.

The use of social media in healthcare requires in depth analysis of dual sides; social media side and healthcare side. The most general categorization of social media can be based on the parameters like nature of social media, type of people using it and the kind of sharing contents. Clinical decision support system is computer-based programs that analyze data within electronic health record (EHRs) to provide prompts and reminders to assist health care to providers in implementing evidence based clinical guidelines at point of care. A Clinical Decision Support System (CDSS) is an active knowledge system, where two or more items of patient data are used to generate case-specific recommendations (Chen et al, 2002). This implies that a CDSS is a Decision Support System (DSS) that uses knowledge management to achieve clinical advice for patient care based on some number of items of patient data. This helps to ease the job of healthcare practitioners, especially in areas where the number of patients is overwhelming. Clinical decision support system (CDSS) offers clinicians, patients, staff or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care in general. A CDSS can obviously be seen as a computer application that analyses data to help healthcare providers make clinical decisions. Computer based methods are increasingly used to improve the quality of medical services (Rouse, 2014).

Clinical Decision Support System (CDSS) is one of the focused areas that is considered for social media canonicalization in healthcare. Very recently, UC Lab proposed the initial design of comprehensive architecture for Smart CDSS where one of the important inputs mentioned for decision making is social media (Afzal, 2012). Smart CDSS is envisioned to help physician at the time of diagnosis and medication with three types of diverse inputs including clinical data, sensory data and social media generated data. Social Media input to CDSS on one hand assist the physician in decision

making at time of observation and medication. On the other hand, it helps the patients to get guidelines on their current health status. Other than DSS, social media can provide interesting stories regarding some common diseases like malaria and terminal diseases like cancer and kidney problems which health professionals can gain experience from and also, the social media users who are interested can obtain educative information.

2. Problem Statement

Millions of people make use of the social media like Facebook, twitter etc. on a daily basis. Social media exist with great benefits and huge potentials. This has heralded an unlimited opportunity for the advancement in the way of life of the general populace especially in businesses, governance, education etc. The norms have been so transformed in all sectors. However, the health industry has not been impacted, hence this study.

3. Aim and Objectives

The aim of this research works is to develop a social media based clinical decision support systems for the diagnosis and management of malaria.

The objectives are as follows:

- To acquire information based on clinical decision support system (CDSS)
- To design algorithm and models for the proposed system
- To translate the algorithm into a social media application

4. Review of Related Work

Several studies have been presented in the past that shows how Decision support system has improved the health decisions and delivery of medical practitioners, and these have also enhanced the health of the patients. Some of them are thus presented.

4.1. Mycin

Mycin is a medical diagnostic expert system which was designed at Stanford University in 1972. MYCIN is intended to provide physicians with advice about the diagnosis and drug therapy for bacterial infections. It identifies the organisms responsible for an infection from information concerning the patient's symptoms and test results. It arose in the laboratory that had created the earlier Dendral expert system, but emphasized the use of judgmental rules that had elements of uncertainty (known as certainty factors) associated with them.

4.2. Malaria Decision Support System Used in Kenya

The Malaria Decision Support System (MDSS) is used for the continuous surveillance, monitoring, and evaluation of malaria control programs in Kenya. The MDSS integrates all continuous surveillance, monitoring, and evaluation requirements of a malaria control program. The tool combines best practices for data collection, storage, management, and use and is based on advanced software that is user friendly, flexible, and configurable to meet individual program needs. The MDSS accommodates data from other sources and historical data and empowers the user to extract data through intuitive dynamic and static queries. The tool includes automated tools supporting intervention planning, disease outbreak alerts, and resource allocation.

4.3. GIDEON (Global Infectious Diseases & Epidemiology Network)

Another expert system used in medical diagnosis is the Global Infectious Diseases & Epidemiology Network, GIDEON. In addition to diagnosis, GIDEON is used for simulation and informatics in the fields of geographic medicine and infectious diseases, and Clinical Microbiology. The expert system was designed to diagnose all the world's infectious disease, based on symptoms, signs, laboratory testing and dermatological profile. Though, GIDEON is country specific. The database incorporates 327 diseases, 205 countries, 806 bacterial data and 185 antibacterial agents. Gideon's diagnostic module enables the user to access all epidemiological parameters, clinical hints, diagnostic tests, and optimal therapy

5. Design Models

5.1. Architectural Design

The conceptual model of the proposed for world system is shown in figure 1. It defines the structure, behaviour and detailed view of the system.

Figure 1: Architectural Design of the System

5.2. Use Case Diagram

The use case diagram as shown in fig 2.0 represents users', admins' and health practitioners' interaction with the system showing the relationship between the various level of user and the cases they are involved in.

Figure 2: Use Case Diagram of the Proposed Model

5.3. Sequence Diagram

Figure 3 depicts the sequence diagram. It shows the various level of interactions within the system arranged in time sequence. Its details are the operation carried out by user upon user request from gaining authentication to running a diagnosis operation gaining authentication to running a diagnosis operation.

Figure 3: Sequence Diagram of the System

5.4. System Flowchart

The flowchart shown in fig 4 represents the various the various processes and workflow within the system. It represents the step by step approach of various operations to be performed.

Figure 4: Diagram Showing the Flowchart of the Proposed Model

6. Results and Discussion

6.1. Registration Module

The registration module as shown in fig 5 is used by visitors and new user to have their data saved into the system for recognition. The user provides their desire and unique username and password which will be used for login in the subsequent usage of the application.

Figure 5: Screenshot of the Registration Module

6.2. Login Module

The system contains user data which deserve to be respected and protected, the system restricts unauthorized user. Users are to provide their unique username and password which will be cross checked by the system for user verification as shown in fig 6. Only verified users are given access to the system.

Figure 6: Screenshot of the Login Page

6.3. The News Feed Module

The news feed as shown in fig 7 is displayed to the user who has been authenticated by the system. It displays news feed from users within the system and also embed links to other module within the system.

Figure 7: Screenshot of the News Feed Module

6.4. Profile Management Module

The user profile module is where user can edit their basic information, upload or update profile display picture, display name, medical data, create post and also preview list of their published posts as shown in fig 8

Figure 8: Screenshot of the Profile Management module

6.5. The Diagnosis Module

The diagnosis module is where user perform malaria diagnosis operation, the diagnosis is based on fuzzy methodology of malaria diagnosis. Users are diagnosed based on sets of fuzzy rules that are derived from malaria study and treatment practitioners. These rules are based on the twenty identifier and noticeable symptoms of malaria. The user data is gathered by taking his or her feelings against each symptom. Samples are in shown in fig 9 and 10.

Figure 9: Screenshot of the Diagnosis Module A

Figure 10: Screenshot of the Diagnosis Module B

6.6. Diagnosis Result

The data are transformed into fuzzy logic data and passed into the inference engine. The inference engine accesses the rules in the rule base using Naives-bayes algorithm to fetch the best rule that diagnose the user symptoms variable and data. The decision in the inference engine is passed to the difizzifier for representation which gives out a human friendly diagnose result as shown in fig 11

Figure 11: Screenshot showing Diagnosis Result

7. Conclusion

Building a health-care system with low cost and better services in which the information is coming for diverse modalities is a collaborative and challenging issue. In this research paper, we describe the design and development of a Social Media Based Clinical Decision Support System (SMBCDSS) that provides standards-based health-care services for malaria diagnosis.

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