# CDSS: Integration of Social Media Interaction Engine (SMIE) in Healthcare for Chronic Disease Patients

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## *Abstract*

Chronic disease may leads to other life threatening health complications like heart disease, stroke, and diabetes that diminished quality of life. This paper points out the importance of social media interaction in existing CDSS for chronic diseases. The proposed system monitors health conditions, emotions and interests of patients from patients' tweets, trajectory and email interaction which are passed to CDSS for personalized healthcare services. Through these features, patients can get continuous relevant recommendations from the system, so they may improve their health conditions without social isolation. It also helps the health practitioners to understand the lifestyle patterns and better decision making about treatment.

***Keywords:*** Social Media; CDSS; Healthcare; Personalization.

## 1 Introduction

Chronic disease accounts for more than 75% of health care expenditure and nearly an equivalent percentage of disease-related deaths [1]. Its disorders are generally characterized by long duration and slow progression. With enough care and supervision, usually these patients health condition can be improved. The applications of CDSS are diverse and have different goals; however, most of them focus on providing diagnostic assistance to medical doctors and healthcare practitioners [2-3].

In this paper, we aim to improve the patients' health by utilizing his social interaction in order to suggest them appropriate lifestyle patterns. For instance, after observing a patient daily routines, our proposed Social Media Interaction Engine (SMIE) is able to finds some complications with his lifestyle. He/she usually sleeps late; does not exercise regularly; does not take medicine on time; eats too much. Obviously, these lifestyles are not good for chronic disease patients. The proposed SMIE is integrated through social media adapter in the smart CDSS which is under development at UC Lab. The adaptor will take the information and integrate it with patient demographic to facilitate the CDSS and suggest changes in unhealthy life patterns through better way.

To achieve above goals, we design SMIE with several novel ideas. Firstly, tweet analysis extracts user interest, health conditions and sentiment from user tweets. Secondly, trajectory in terms of outdoor movement of the patient is tracked using GPS enabled location aware mobile devices, such as smart phones. Finally, email interaction analyzes the users' actions to identify significant behavior and life threatening complications in daily routines to gain knowledge about their habits and preferences. Therefore, learning patients' lifestyles becomes an important step towards allowing CDSS to provide personalized services more accurately and effectively.

## 2 Social Media and Healthcare

By monitoring patient's social activities, interests and emotions can be extracted, helping clinicians to provide better guidance to patients. Our SMIE integrates as a plug-in application, while extracting user related information after analyzing the interests, behaviour and lifestyle of users as shown in Fig. 1.

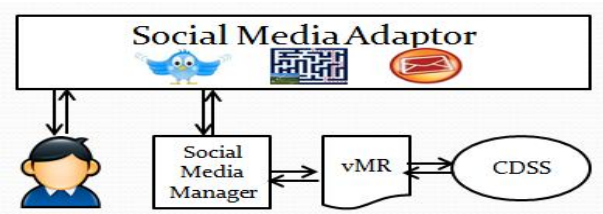


Fig. 1 The flow of social media and healthcare

For example, depression and violence symptoms can easily be identified from a person's social interests and emotions. Social media manager, a cloud based application works as a connector, performs automatic mapping of this knowledge into virtual Medical Record (vMR) [4]. A vMR for Clinical Decision Support (CDS) is a data model for representing individual medical records and clinical information inputs and outputs that can be exchanged between CDSS System. vMR is further processed by smart CDSS to provide better recommendations to a person/patient. Physicians verifies the recommendations provided by smart CDSS.

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## 3 Social Media Interaction Engine

The proposed SMIE architecture composed of three components named: tweet analysis, trajectory analysis, and email analysis as shown in Fig. 2. The detail of each component is described in the following sections.

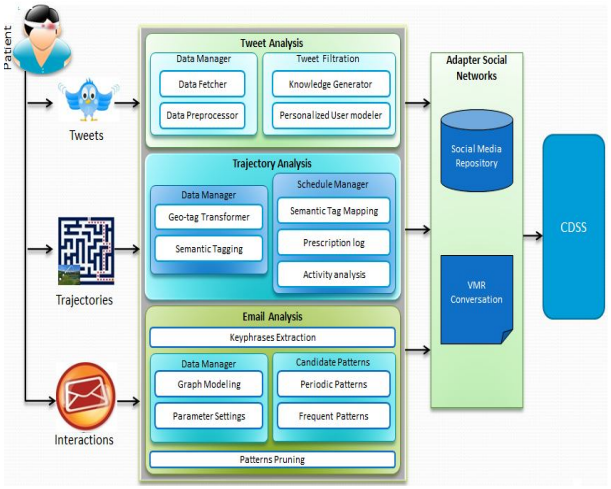


Fig. 2 The proposed architecture of SMIE

### 3.1 Tweet Analysis

In tweet analysis data manager is responsible for fetching data from twitter stream and pass the data to data preprocessor. It first removes slang and abbreviated word using slang lexicon and then separates URL from text to process text and URL separately. The pre-processed data is forwarded to knowledge generator. It generates interests, sentiments and health conditions. Knowledge generator uses Alchemy API [5] to extract user's interest from twitter data and store the extracted knowledge in personalized profile to maintain the history of user data to make it usable in future. Personalized user modeler maintains personalized profile and pass this information to smart CDSS and clinicians when required.

### 3.2 Trajectory Analysis

In this component, our focus is to record the locations at which significant activities are performed. The location coordinates of activities are converted into geographic tags using Google API [6]. Semantic tag of the location for contextual awareness is also acquired by patients. Semantic tag mapping matches the current GPS coordinates with exiting tags. Missing of any tag means that patient has visited new place. To tackle this new position an alert message is prompted to patient, asked to add semantic tag by providing GPS identification locations and visited time of that location. A prescribed schedule and suggestion for carrying out each activity according to the health and ailment condition of patient is added by the practitioner. Comparison of the prescribed and patient followed schedule is done in activity analysis and inconsistencies are forwarded to CDSS system through social media adapter.

### 3.3 Email Analysis

This component mines the patients' frequent and periodic interaction patterns that change over the time. Patient's can act in two different roles: senders and receivers. Data Manager extracts a population of interest from messy email interaction that is modeled in graphs based on predefined parameter settings and extracted keyphrases from email contents. Candidate patterns identify a set of frequent and periodic patterns to emphasize the significance and regular behavior of patients. Patterns pruning reflects the common characteristics of a typical email interaction with some unusual association between patterns. Hence, the aggregate periodicities of an entire set of mined interaction patterns can assist CDSS in better decision making.

## 4 Conclusion

In this paper, we demonstrated SMIE to extract user interests, health conditions, emotions and lifestyle from social media. Integrated SMIE output in the form of vMR with CDSS is a combination of various technologies with novel proposed ideas. This provides the users with personalized information and guidelines in order to improve the quality of life. In future work, we will look into the complete workflow of integrating the social media output with possible CDSS recommendation. This will help to investigate nature of each social network and its usefulness in decision making process. Also we will see how to align the output of SMIE for wellness of ordinary people.

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