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A Modern Perspective based Approach for Diagnosing Skin Diseases using Privacy Preserved Automated Tool

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ABSTRACT

An automated decision support system tool is developed to diagnose all possible skin diseases that occur in humans. To diagnose those skin diseases in human the automated decision support tool should contain knowledge about all the possible skin diseases and its symptoms. The inputs to this tool are in the form of texts. However the truth is that the system is a third party and cannot be entirely trusted which raises privacy concerns. Hence in this proposed work, the patient data can be encrypted using a cryptographic algorithm. The encrypted data is sent through the wireless medium to the normalization function, where it splits the data into many separate texts. The output of the normalization function is sent to the server, where it uses a matchmaking algorithm to match the splitted data with the data in the database to find a match. If a match is found then the diseases are identified easily. The input data always remain in an encrypted form. Hence, no third party can able to learn the data. The result of the diagnosis process is sent back via the wireless medium to the patient in the encrypted form itself, where the patient can decrypt it to find the actual disease. The use of this tool is to enable a patient to find out the diseases and further discuss with the doctor to find a solution.

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INTRODUCTION

Skin diseases are the common type of diseases in humans all over the world (Jaleel *et al.,* 2012*)*. There are various types of skin diseases in humans like acne, psoriasis, rashes, leprosy, melanoma etc. These diseases are caused owing to sunlight, bacterial infection or viral infection etc. The severity of these diseases varies from normal to a very high rate. Over the world's total population, 75% of the peoples are affected by any one of skin diseases. This represents a large and growing open health problem. In some countries, skin diseases are given less consideration while in other countries it is given high consideration. Some diseases may also lead to skin cancers like melanoma, benign (Garnavi *et al.,* 2011*)*. These are toxic type of skin cancers. A timely detection of these diseases may prevent a person from death (Garnavi *et al.,* 2011*)*. To diagnosis these diseases as early as possible, a privacy preserved automated tool is developed, which help patient to diagnosis their diseases at early stages itself. The use of this automated tool is to help people who are not able to meet the doctors directly and for the people who are busy in works and do not have time to visit the hospital. An automated tool is a computerized medical diagnosis process that provides health-related details. The application of this tool is to perform medical diagnosis based on a set of symptoms (Alcón *et al.,* 2009). This tool contains details about all the skin diseases and their symptoms in its database located on the server. It gains this knowledge from doctors, various web sources and medical field. This decision support system provides suggestions based on the information stored in its database and with the symptoms provided by the patient. However, all the tools developed till how doesn't provide security to the patient data.

1. Existing Method:

A decision support system is a computerized medical diagnosis process for providing health associated decisions and actions. It is helpful for patient or clinicians to diagnosis the diseases. The diagnosis process is done based on the inputs given by the clinicians (Przystalski *et al.,* 2009). In earlier works, the decision support system is developed using various techniques like SVM, Artificial neural

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networks, Wavelet-Based Texture Analysis etc for diagnosing the diseases. These techniques are used for classification of data (Jaleel *et al.,* 2012*)*, (Barakat *et al.,* 2010*)*. In existing system, it uses a machine learning tool called SVM, which classifies data based on the training and testing phase. This system does not afford security to the patient data and hence there is a chance for the third person to gain the data which is not liked by most of the users.

2. *Proposed Method:*

In the proposed method, a privacy preserved automated tool is developed to help the users to diagnose the skin diseases easily and quickly (Lin and Chen, 2011). This tool provides security to the information given by the patient and about their diseases. Security can be provided by encrypting the patient's data using Triple DES algorithms. So nobody can get the patient details, even the server cannot be able to get the patients data. The outcome of the diagnosis process also remains in encrypted form. Therefore, no third party can gain the patient data.

The proposed work involves five modules: Data collection, Client-server communication, Encryption, Normalization and Matchmaking. The workflow model for the proposed method is given below in Figure1.

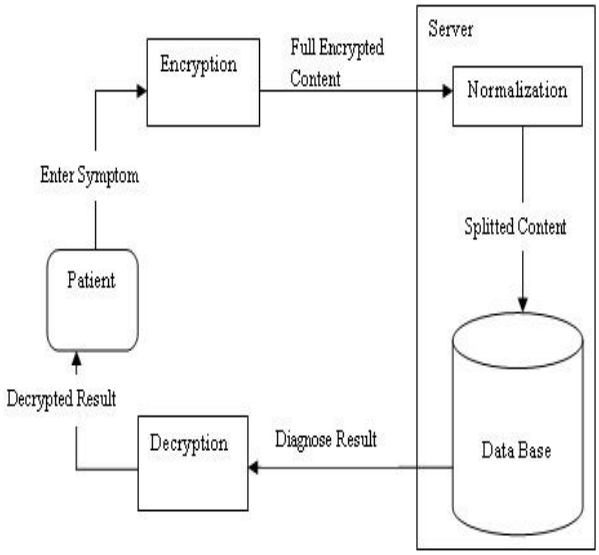

Fig. 1: Workflow model of the proposed system.

The above Figure.1 explains the proposed workflow method for diagnosing the skin diseases. The step by step procedure is given below.

1. Initially datas are collected from various resources and imported into a server using generation tools.
2. Generation tools are used for storing the datas like name of the disease and its symptoms into the database.
3. Next is to acquire the input as symptoms from the user or clinician.
4. Encrypt the input symptoms as a whole.
5. Then the whole encrypted content is divided into splitted content using normalization.
6. Now the splitted content is matched with the data already stored on the server.
7. Matching is performed using Match Making algorithm.
8. Finally, the diseases are diagnosed.

3. Methodology:

3.1 Data collection:

Initially, the datas related to different skin diseases like melanoma, abscess, psoriasis etc., and its symptoms are collected from medical resources. The symptoms are redness, itching, appearance of bumps, bleeding etc. These collected datas are encrypted using an algorithm and then kept inside a database, which is placed on the server. In this module, the datas are collected mainly for two reasons. First, the information will be used in describing and explaining the reasons for the utilization of diagnosis the disease. Second, the information is used in evaluating the outcomes of the symptoms.

3.2 Client-server:

This module shows communication between the source and destination. A server manages most processes and stores all data. A client will send a request to the server for specified data or processes. The server processes the request and sends the data to the client. Here for a client-server model, socket is used. It is a process by which a client and a server program communicate in a network. It is defined as an endpoint in a connection. Here the patient or clinician is considered as the client and server is the diagnosis system.

3.3 Encryption:

Encryption is done to provide security to the patient data. Here encryption is done using a cryptographic algorithm called Triple DES. DES is a symmetric block cipher algorithm where it uses a 56-bit key and a 64-bit plain text. Use of multiple length keys leads to Triple-DES algorithm, in which DES is applied three times. Here the algorithms are applied three times to all data block. To ensure a security the size of the key is increased (Mandeep singh Narula *et al* 2014).

The below formula shows the encryption and decryption in Triple DES using three keys

$$\mathbf{C = E_{K_1}\left[D_{K_2}\left[E_{K_3}[P]\right]\right]}$$

The same process is used in reverse for decryption process

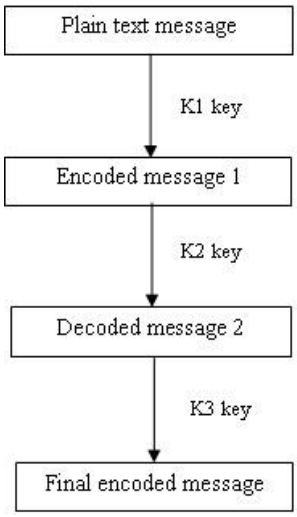

Fig. 2: Triple DES.

3.4 Normalization:

Normalization function is used to divide the data. The input to this function is an encrypted full content and the result is a splitted content. This normalization function performs the splitting of encrypted data into many separate data based on the number of symptoms provided by the patient. In normalization function, it also performs scaling. It is done to avoid the happening of errors in terms of splitting the encrypted data. To make the diagnosis process more correct and effective a matchmaking algorithm is used.

3.5 Matchmaking Algorithm:

Matchmaking algorithm is done to find the ideal match for the symptoms to identify the diseases (Ji Sun Shin *et al*, 2013).

- At first the symptoms entered by the patient is splitted into separate symptoms.
- Then each symptom is matched with the data in the database one by one.
- For each symptom, the probable disease and its symptoms are listed.
- Now the symptoms of each disease are matched with the splitted data one by one.
- If all the symptoms entered by the patient is matched with the symptoms in the database means then the disease is diagnosed easily.
- If the group of symptoms produces more than one disease, then the system will display all the relevant diseases.

RESULTS AND DISCUSSION

The performance of the diagnosis system and its effectiveness are analysed using various skin diseases and its symptoms. Here the patient datas are encrypted and send through the wireless medium to the server for diagnosing, during the diagnosing process also, the data remains in the encrypted form itself. The result of the diagnosis process is sent back to the user in the form of text. The result can be seen only by the patient and no other persons can gain the data. If the datas provided by the patient are not sufficient for diagnosing then it will affect the accuracy of the diagnosis system. While comparing the SVM algorithm with the proposed matchmaking algorithm, the proposed algorithm performs better and reduces the time taken to process the dataset.

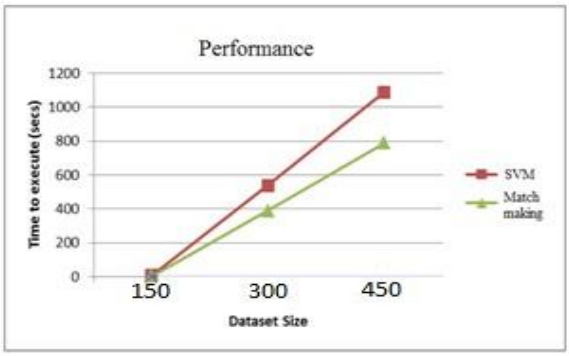

Fig. 3: Performance Analysis.

5. Conclusion and Future Work:

In this proposed work, a privacy preserved diagnosis tool is developed to help people to diagnose various skin diseases as early as possible. This tool works based on the data sets available in its database and along with the data provided by the patient. It provides accurate outcome based on the data given by its user. Besides this, it also provides security to the patient data by encrypting using Triple DES algorithm. However, this encryption provides added advantage to this diagnosis tool.

In future, this privacy preserved automated tool is designed to diagnosis multiple diseases. Along with this, the performance of the diagnosis tool can be improved by using data mining techniques for classification along with providing confidentiality to the user data. To improve the efficiency of the diagnosis process, certain additional attributes are also considered as inputs to the tool and also tries to find a solution to the diagnosed problem.

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