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A Skin Disease Detection System for Financially Unstable People in Developing Countries

Rahat Yasir, Md. Ashiqur Rahman and Nova Ahmed

Skin diseases are among the most common health problems worldwide. As skin diseases normally take a bit time to be cured and need continuous medicine it is sometimes hard to carry on the treatment specially for the poor people in developing countries like Bangladesh. In this article we propose a method that uses .different types of computer vision based techniques to detect different types of skin diseases based on different types information's collected from patients. As per the proposed method there will be two version of this system one will be a desktop application for algorithm develop and checking, and the other version will be a mobile phone application that will be the handy version of the proposed system. The system will be detecting 9 different skin diseases commonly occurred among the poor people in Bangladesh.

Keywords: Skin Disease, Off the Record, Medical Image processing, Neural Network, Mobile Computing, Telemedicine.

1. Introduction

Skin diseases normally occur in human body for several issues. Like scabies occurs in human due to a little bug, acne due to dust and oil glands in the human skin, vitiligo occurs due to fungal attack, foot ulcer for wearing shoes for long time, eczema due to a certain bacteria. Usually most of the skin disease take some time reveal in the skin and need long term treatment. These treatments some time get too expensive to bear for a family in Bangladesh whose monthly income is less than $40 or 3000 BDT per month. A statistics shows that more than 52% of the families in the rural areas of Bangladesh don't have a permanent job they just work as daily workers. In this circumstances spending such money for health problems is impossible for them. Sometimes they go to quack to get some cheap medicine and treatment, which eventually damage their body in the near future.

Considering these factors the researchers decided to build a system for the financially unstable people in developing countries. First of all we searched for those skin diseases which are very common in this subcontinent. After doing such studies we found nine diseases that people suffers most and treatment of these diseases might get expensive in some cases. The diseases are Eczema, Acne, Leprosy, Psoriasis, Scabies, Foot Ulcer, Vitiligo, Tinea Corporis and Pityriasis Rosea. At first we went to a well reputed government hospital to collect sample data (image) and user information about these selected diseases. We also conducted a small survey on the

patients asking some questions regarding how this type of system will help them, how to they want the system to be developed etc. After getting all these information's we started design the system. We have used eight different types of algorithms for image pre-processing (YcBcr, gray image, sharpening filter, median filter, smooth filter, binary mask, histogram and sobel operator). Our system will take ten different features from image pre-processing results and user inputs (liquid type,

Rahat Yasir, North South University, Bangladesh.
Md. Ashiqur Rahman, North South University, Bangladesh.
Nova Ahmed, North South University, Bangladesh.

liquid colour, elevation, duration, feeling, gender, age). These features are used for training and testing purpose of our feed forward artificial neural networks (ANN). Using artificial neural networks (ANN) as knowledge base appears to be a promising method for diagnosis and possible treatment routines. Even though there have been several researches conducted to detect dermatological skin diseases using Computer Vision based techniques but almost every one worked for only 2-3 diseases.

Among them hashim et al [1], wahab et al [3], Nasir et al [2] and Shamsul et al [15] have used different types of image pre-processing algorithms for feature extraction purpose. Kabani et al [6], Nidhal et al [11], Shamsul et al [15] have used different types of neural networks for dermatological disease detection. Grald et al [4], Shang et al [7], Nibaran et al [13] have applied different types of image classification and segmentation algorithms in their proposed method.

In this article next we will talk about related works regarding this topic then we will discuss in brief about the architecture, methodology, discussion and conclusion

2. Related Work

Detecting different types of skin diseases from colour image is a very challenging task in computer vision. Finding out different features from the colour skin images of the infected area of different skin diseases and detecting them with a high accuracy rate is the primary purpose of this research.

Researchers are working on several algorithms that can be used to detect different types of skin diseases. Hashim et al [1] applied different types of matlab tools in images to produce their histograms and colour distribution particularly in the region concerned. Nasir et al [2] compared certain colour space (RGB,CMY, HSV,YCbCr and rgb colour) model of the skin lesions that can be employed to distinguish three types of psoriasis skin diseases infecting the Malaysian population. In the result they saw only RGB colour space is suitable for discriminating psoriasis skin lesions. Shang et al [7] compared algorithms of segmentation feature parameter of FCM image segmentation algorithm. Nibaran et al [13] compared 4 feature extraction operators with Support Vector Machines (SVM) based classifier. Wahab et al [3] presented a texture classification system for three skin diseases (AV,BCC,DLE) and accuracy rate was 70-70-100. Gerald et al [4] have introduced an approach that produces accurate overlays of thermal and visual medical images.

Chang et al [8] proposed an automatic facial skin defects detection and recognition system. A support-vector-machine (SVM) based classifier is used to classify the potential defects into spot, acne and normal skin and accuracy rate was *98.0%*. Hatice et al [9] proposed a software tool diagnosis of erythematosquamous diseases by using the basic and weighted K-NN algorithms on medical data.

Kabari et al [6] crated a artificial neural networks system that predict diagnosis and routine treatment for skin diseases patients and their accuracy rate is *90%.* M. SHAMSUL et al [11] proposed an automated dermatological diagnostic system. They have used different pre-processing algorithms like ours and used feed forward back propagation artificial neural networks for training and testing purpose. Shuzlina et al [12] elaborates a prototype with back propagation neural network (BPNN) to assist the dermatologist. The use of two feature selection methods namely Correlation Feature Selection (CFS) and Fast Correlation-based Filter (FCBF) help by providing a smaller number of features with greater accuracy and faster response time and accuracy rate was *91.2%*. Nidhal et al [15] proposed a psoriais diseases detection system. They used feed forward neural networks to classify input images to be psoriases infected or non psoriasis infected.

In this research we are trying to implement similar approach like [6],[11] in order to detect different types of skin diseases from colour image.

3. Architecture and Methodology

The system will work on two phases- first pre-process the colour skin images to extract significant features and later identifie the diseases. At first we will be using the colour skin images and then apply 8 different image processing algorithm on it to find some visual pattern and significant features like average colour code of infected area, infected area size in case of pixels and shape or edge detection of an infected area. Then the system will take some user inputs like gender, age, duration, liquid type, liquid colour, elevation and feeling. We will train user input values along with colour skin image extracted features to train and test into a feed forward back propagation artificial neural network to identify the dermatological disease. We

divided the whole system into two parts. The first version will be a desktop application, this application will be made to check the algorithms we decided to develop the system. The second version will be the more important one, this will be a mobile phone application which will be a portable system that will be able take photos of the infected area of the skin and take some basic user inputs and the application will instantly take all the inputs from image and user information and will compute and tell which skin disease has occurred. The second version of the system will be moreover a diagnosis system. We are planning to include treatment in the application so that the patients get a overall view of which medicine he/she should go for. Here we have shown the complete architecture of the system below.

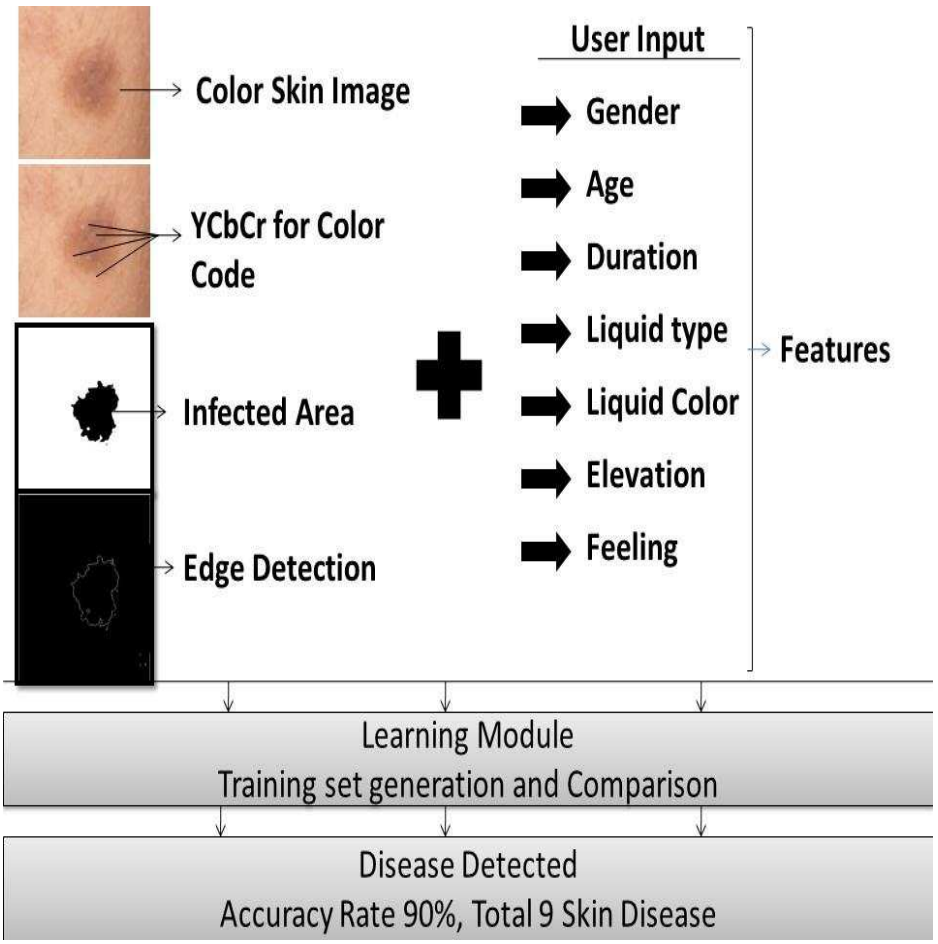

Figure 1: Complete Architecture of the system.

4. Data Collection

Our first task was to collect necessary data's (image, information) of patients. For fulfilling this purpose we went to Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh, Department of Dermatology. We took images of total 128 patients of 9 different diseases from the dermatology department.

Disease Name	Number of Patients	Images taken
Eczema	7	28
Acne	25	152
Leprosy	5	24
Psoriasis	12	99
Scabies	40	277
Foot Ulcer	6	35
Vitiligo	15	62
Tinea Corporis	10	66
Pityriasis Rosea	8	32

Table 01: Data Collection Table

A specialized doctor was present to validate and record the external data of the patients such as disease history, feeling in diseased part of body, elevation of the diseased region etc.

Camera	Sony Cyber shot DSC-W550
Focusing	The camera was focused manually to adjust the variable nature of natural light
Image Resolution	14.1 Megapixels
Shutter Speed	1/20 to 1/125 seconds (based on natural lighting)

Table 02: Camera Specificatio

5. Patients Statistics

During the data collection process we did three things.

1. took sample images of each disease
2. collected basic patient information for each disease
3. gathered user opinion about our system

We collected data of 128 patients from the hospital. We are very thankful to the nurses, stuffs, intern doctors of Sir Salimullah Medical College and Mitford Hospital who helped us enormously during our data collection because the data collection process we went through is not possible without the help of the officials and of course the patients who were so helpful and showed patience in a government hospital and in a country like Bangladesh.

Patient	Number
Male	86
Female	42
Total	128

Table 03 : Patient Statistics

Skin diseases in a certain area or country depends on its climate and environment. After our whole data collection process we realized that skin diseases based on bacterial and fungal disease occurs in huge number among the poor the people of Bangladesh. The main reason behind this scenario is unhealthy lifestyle they lead. The below graph shows the whole scenario of the diseases among the patients.

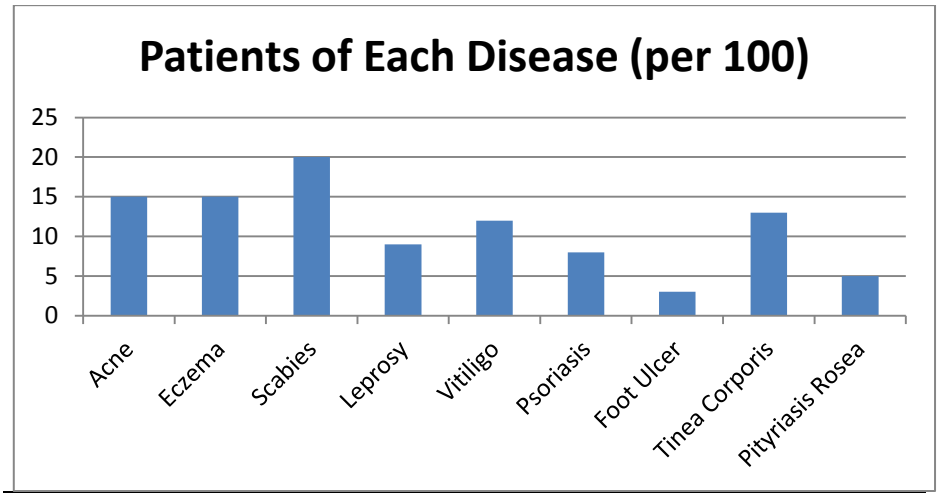

Figure 2 : Percentage of patients for each disease.

From the above figure we can see that in every hundred skin disease patients, people suffering from scabies is the highest (20%). Acne and Eczema patients are also very common in Bangladesh (15%). People suffering from Tinea Corporis and Vitiligo are not small in number. Psoriasis and

Leprosy patients are not high in number. We found very minimum number of patients of Foot Ulcer and Pityriasis Rosea.

6. Survey

As we said earlier we gathered some user opinion about our system during data collection period. A total of 73 people participated in this independent survey. Among 52 participants were intern doctors and 21 people were patients suffering from different skin diseases. We collected all responses and generalized them in such manner so that we can see the whole scenario of the society.

Our first question was about the general feelings of the participants towards this project. The below graph shows the result

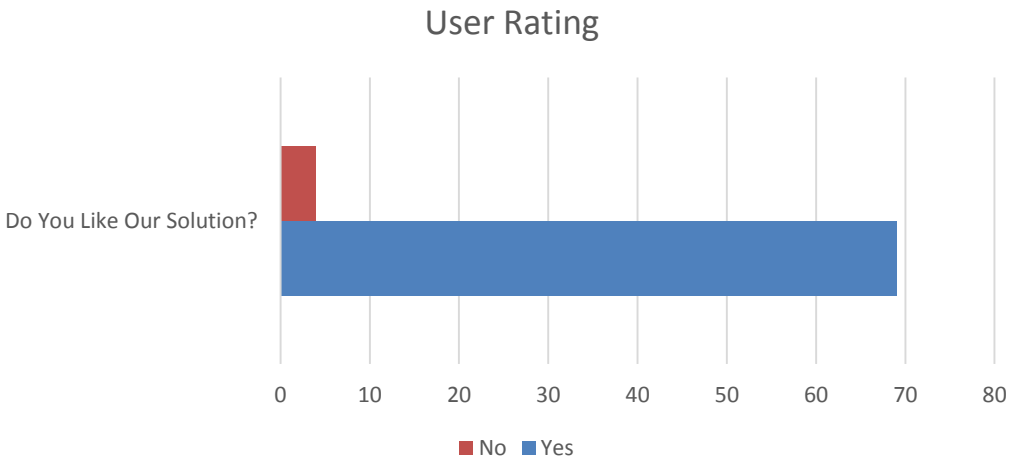

Figure 3 : Survey Response.

We can see that 95% of the participants liked our solution.

The second question was about rating this solution. The below graph shows the result.

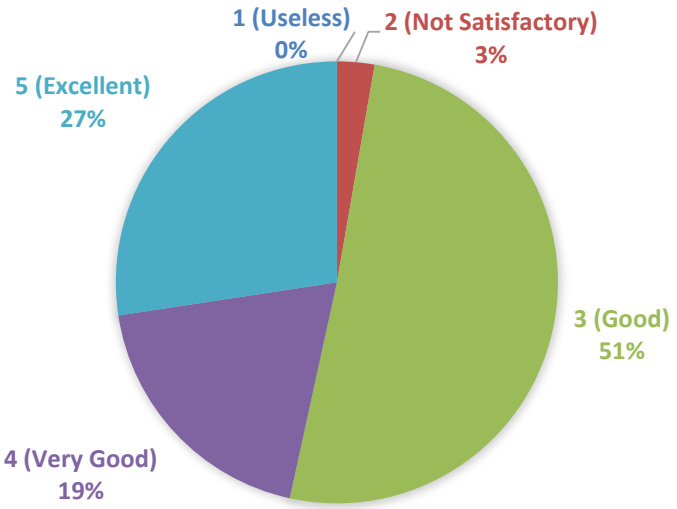

Figure 4 : Survey Response.

Most of the participants appreciated this solution. 37 participants given their response as "Good", 14 participants as "Very good", and 20 of them said this is "Excellent".

Third question we asked the participants that which disease among the 9 diseases we are trying to detect will be difficult for our solution. The below graph shows the result.

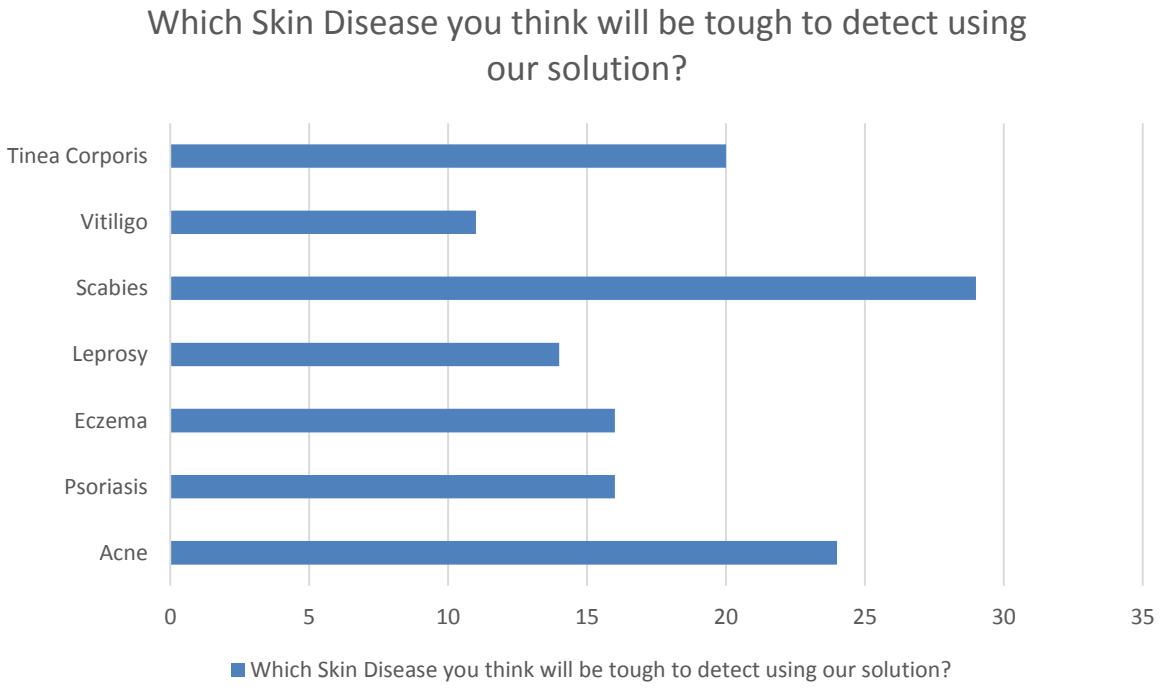

Figure 5 : Survey Response.

The response of this question differed from person to person. About 40% participants think that Scabies will be difficult to detect, 33% of them voted for Acne. Psoriasis and Eczema will be difficult said 22% of participants for each the disease. 27 % of the participants also thinks Tinea Corporis is the disease.

We asked the participants to give their opinion about detecting a disease from some information based on an image and some user inputs in the fourth question. The below graph shows the result.

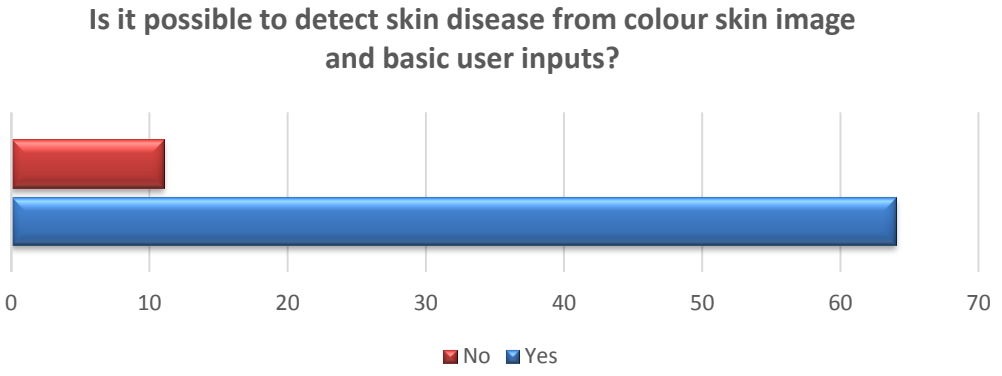

Figure 6 : Survey Response.

88% of the participants gave positive answer and 11 of the participants are not that quite satisfied.

The fifth question was about the opinion of the participants if they think the user input we are considering are sufficient or not. The below graph shows the result.

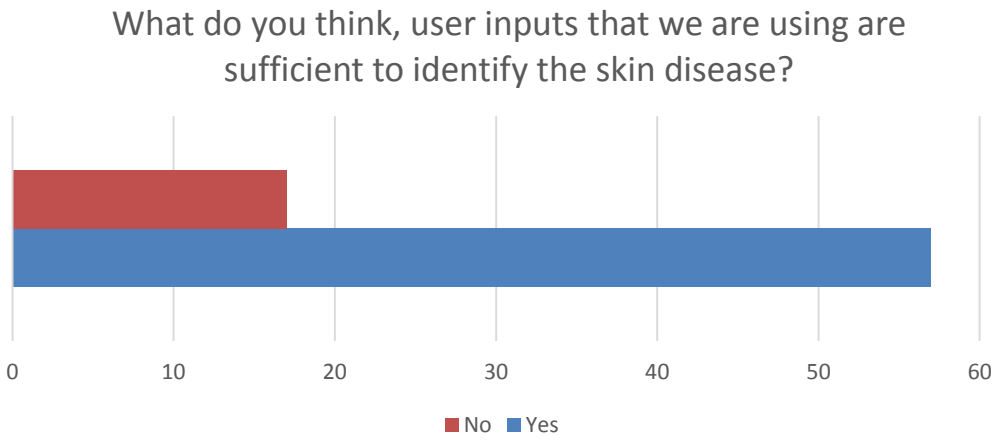

Figure 7: Survey Response

7. Acknowledgement

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8. Conclusion

People of developing countries suffers mostly for different types of skin diseases. Sometime they don't pay heed to any visual changes in their body and at the initial stage they think soon they will be fine. But a simple visual change in the body is the cause of a deadly skin disease. We are developing our system for skin disease patients of developing and under develop countries. We have interviewed many skin disease patients and collect their valuable feedback and our system is the feedback of their valuable feedback. Most of the people liked our solution and the averaging user rating of our solution is more than 3.5.

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