International Journal of Scientific Research in Computer Science, Engineering and Information Technology
ISSN : 2456-3307 (www.ijsrcseit.com)
doi : https://doi.org/10.32628/CSEIT217244

Proposed System for Remote Detection of Skin Diseases Using Artificial Intelligence

Prof. Sandeep Manohar Chaware[1], Apurv Deshpande[2], Archita Palkar[2], Durvesh Bahire[2], Riya Singh[2]
[1]B.E. (CSE), M.E. (IT), Ph.D. (Engineering), Marathwada Mitra Mandal's College of Engineering, Pune, Maharashtra, India
[2]B.E Scholar, Marathwada Mitra Mandal's College of Engineering, Pune, Maharashtra, India

Article Info
Volume 7, Issue 2
Page Number: 263-267

Publication Issue :
March-April-2021

Article History
Accepted : 07 April 2021
Published : 13 April 2021

ABSTRACT

Skin diseases are prevalent diseases with visible symptoms and affect around 900 million of people in the world at any time. More than a half of the population is affected by it at an indefinite time. Dermatology is uncertain, unfortunate and strenuous to diagnose due to its complications. In the dermatology field, many times thorough testing is carried out to decide or detect the skin condition the patient may be facing. This may vary over time on practitioner to practitioner. This is also based on the person's experience too. Hence, there is a need for an automated system which can help a patient to diagnose skin diseases without any of these constraints. We propose an image based automated system for recognition of skin diseases using Artificial intelligence. This system will make use of different techniques to analyze and process the image data based on various features of the images. Since skin diseases have visible symptoms, we can use images to identify those diseases. Unwanted noise is filtered and the resulting image is processed for enhancing the image. Complex techniques are used for feature extraction such as Convolutional Neural Network (CNN) followed by classifying the image based on the algorithm of softmax classifier. Diagnosis report is generated as an output. This system will give more accurate results and will generate them faster than the traditional method, making this application more efficient and dependable. This application can also be used as a real time teaching tool for medical students in the dermatology domain.

Keywords : Dermatology, Image Processing, Artificial Intelligence(AI), Neural Network, Automated Disease Diagnosis, Convolutional Neural Network(CNN)

I. INTRODUCTION

According to ScienceDaily, skin diseases are the one of the leading causes of human illness.[1] Skin diseases may be caused by infections, fungi, bacteria, allergies, or viruses. A skin disease may cause a change in the texture or colour of the skin. Skin diseases are usually chronic and infectious, and some can also develop into melanoma (skin cancer). Therefore, skin diseases must be diagnosed early to reduce their development

and spread. The diagnosis and treatment of a skin disease takes longer time and causes financial and physical cost to the patient. In general, most of the common people do not know the diagnostic details of a skin disease. In some cases, skin diseases show symptoms after several months, during which the disease grows further. This is due to lack of medical knowledge in the public. Sometimes, a dermatologist find it hard to detect the type of the disease, and may require expensive test equipments. Advancements in the laser and photonics based medical technology has made quick and accurate diagnosis possible. But the availability of the equipment is still limited and very expensive. Therefore, we propose an image processing technique. This method takes the digital image of infected skin disease then uses image analysis to diagnose the disease. Our proposed method is simple, fast and does not require costly equipment other than a smartphone camera or a computer.

II. LITERATURE SURVEY

1. Nawal Soliman ALKolifi ALEnezi[2] has described the method of detection of skin disease by using pre-trained Convolutional Neural Network (AlexNet) and SVM. It detects three main skin diseases namely melanoma, Eczema, and Psoriasis. Image resizing is done for preprocessing and the system gives an idea of the possible algorithm to be used for classification. Even though the system gives good accuracy very few skin conditions are considered and the dataset taken into consideration is also small.

2. K.M.Meiburger, Savoia et.al.[3] shows that the proposed approach can effectively segment and extract texture parameters from dermoscopic and Nurugo Derma smartphone-acquired images and subsequently classify the presence or absence of a reticular pattern of the skin disease. The proposed method is very inexpensive and it is easily accessible and usable but the study is limited by its small database size and the lack of classification between benign and malignant lesions.

3. Msc. Yasir Salam et.al.[4] have built a system wherein they take an image and then using MATLAB they process it to help the doctors to recognize eczema and the rate of infection. Foot layer detection is more comfortable in this approach but only face and hand.

4. Rathod et.al.[5] proposes a system that will use a computational method to analyze the image data predicated on various features of the images. Skin images are first filtered to remove unwanted noise and also processed for enhancement of the image. Feature extraction is done using complex techniques such as Convolutional Neural Network (CNN) which classifies the image based on the algorithm of softmax classifier and obtains the diagnosis report as an output.

5. Alaa Haddad et.al.[6] aims to detect skin disease from the image of the skin. For analyzing this image, certain filters are applied to remove noise or unwanted things, and then the image is converted to grey to help in the processing to get useful information. This paper provides a guideline for which algorithm can be possibly used and also provides an insight into what image processing steps can be taken. The only drawbacks that it has are; only 4 skin diseases are considered and it gives feedback directly to the user with no expert consultation for low accuracy cases leading to a possible wrong diagnosis.

6. Ajith, A., Goel, V., Vazirani, P., & Roja, M. M proposes a system that will detect the diseases using DCT with 8, 16, 32 and 64 coefficients. DWT with different levels of decomposition and SVD with

different number of singular values were also implemented to detect diseases.

III. MATERIALS AND METHODS

3.1. DermNet dataset is a free dataset of around 23,000 images gathered and labelled by Dermnet Skin Disease Atlas available on Kaggle. This dataset contains 23 classes of skin diseases. Distribution of DermNet dataset used in this work is given in Table below.

Table 1. Overview of DermNet Dataset and Distribution of Classes.

Class Label	Abbreviation	Super-Class Name	Np. of Images	No. of Sub-Classes
0	ACROS	Acne and Rosacea	912	21
1	AKBCC	Actinic Keratosis, Basal Cell Carcinoma, and other Malignant Lesions	1437	60
2	ATO	Atopic Dermatitis	807	11
3	BUL	Bullous Diseases	561	12
4	CEL	Cellulitis, Impetigo, and other Bacterial Infections	361	25
5	ECZ	Eczema Photos	1950	47
6	WXA	Exanthems and Drug Eruptions	497	18
7	ALO	Alopecia and other Hair Diseases	195	23
8	HER	Herpes, Genetal Warts and other STIs	554	15
9	PIG	Pigmentation Disorder	711	32
10	LUPUS	Lupus and other Connective Tissue diseases	517	20
11	MEL	Melanoma and Melanocytic Nevi	635	15
12	NAIL	Nail Fungus and other Nail Disease	1541	48
13	POI	Poison Ivy and other Contact Dermatitis	373	12
14	PSO	Psoriasis Lichen Planus and related diseases	2112	39
15	SCA	Scabies Lyme Disease and other Infestations and Bites	611	25
16	SEB	Seborrheic Keratoses and other Benign Tumors	2397	50
17	SYS	Systemic Disease	816	43
18	TIN	Tinea Candidiasis and other Fungal Infections	1871	36
19	URT	Urticaria	265	9
20	VASCT	Vascular Tumors	603	18
21	VASCP	Vasculitis	569	17
22	WARTS	Common Warts, Mollusca Contagiosa and other	1549	26
		Total	**21844**	**622**

IV. SYSTEM ARCHITECTURE

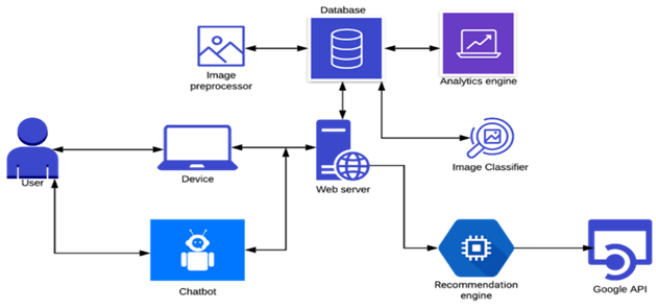

Figure 1. System Architecture

The overall system architecture shows the different modules in the system and how they are connected.

4.1. User

The User will be the person who wants to self-diagnose. He/She will interact with the system via a device which can be connected to the internet like a smartphone, laptop, desktop, tablet and likewise or through the chatbot.

4.2. Chatbot

The chatbot will be targeted for the platform Whatsapp as it is one of the most widely used social media platforms as of date. It can also be migrated to platforms such as Telegram, Discord at a later date.

4.3. Web Server

The server will host the website and will be directly connected to the database. It will be connected to most of the modules directly and will interface with them as required.

4.4. Image Pre-processor

The image pre-processor will perform certain preliminary processing on the image uploaded by the user to make it easier for classification. This processing will include image smoothening, background filtering, resizing, denoising and image conversion.

4.5. Image Classifier

This module will classify the image to actually diagnose the skin disease. It will use a CNN to perform the classification.

4.6. Analytics Engine

The analytics engine will run analytics on the data present in the database and provide statistics like area, gender, age wise distribution of a skin disease, cases per million and whether the disease is common or rare.

4.7. Recommendation Engine

This module will provide recommendations to the user based on the diagnosis results as well as the users' location. It will provide information about nearby dermatologists, specialists as well home remedies and preventive measures

V. Advantages

1. Non-invasive
2. Allows remote diagnosis reducing the need to visit professionals
3. Ease of accessibility
4. Provides immediate relief measures and precautions
5. Solves the issue regarding small number of dermatologists catering to a larger population
6. Can provide assistance for professionals
7. Can be made available free of cost to users
8. If the system is implemented using cloud, it also incorporates all advantages of cloud
9. Users do not need additional hardware or software.

VI. Limitations

1. Requires an internet connection
2. Only symptoms affecting skin will be considered (Rashes, warts, acne, etc.)
3. Any AI application is only as good as the data.
4. Will only provide diagnosis for commonly occurring diseases (Will recommend a professional for possible rare diseases)

7. Expected Result

1. Easily accessible to most people through the website or through a Whatsapp chatbot.
2. Detect the disease based on the image of the infected area.
3. Can perform a quick remote non-invasive self-diagnosis.
4. Provides immediate relief measures and precautions.

VII. CONCLUSION

1. The project has high feasibility due to factors like supporting research and literature, available datasets, low user-end requirements, well documented tools and technologies.
2. It also has a lot of future scope and extendibility.
3. It is very suitable for the current pandemic situation where people hesitate to go to doctors as well as the general mindset where people hesitate to seek professional help for dermatology related issues.

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Cite this article as :

Prof. Sandeep Manohar Chaware, Apurv Deshpande, Archita Palkar, Durvesh Bahire, Riya Singh, "Proposed System for Remote Detection of Skin Diseases Using Artificial Intelligence", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 7 Issue 2, pp. 263-267, March-April 2021. Available at doi : https://doi.org/10.32628/CSEIT217244
Journal URL : https://ijsrcseit.com/CSEIT217244