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Dermasentia

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***Abstract*—In the present age, everyone desires to have beautiful and clear skin. While the obsession for flawless skin is on the rise, beauty products and the industries producing them are equally in demand. Makeup industries attract crowds in large numbers. However, below all these lies the sole reason of worry - skin diseases. Beauty and makeup industries do help in achieving flawless skin by masking the real issue that is the skin diseases and unknowingly aggravating it by not diagnosing and treating it. While visiting the dermatologist is an apt solution, people shy away and the long procedures of appointments at the clinics, often tires them out. The covid situation doesn't help and discourages people even more to get an appointment at a hospital.**

It was of utmost importance to develop a system to detect skin disease easily at the comfort of one's own home. The proposed system will tackle this issue which helps in detecting diseases that are common and at an early stage by using the classification method. It will also successfully eradicate the long waiting hours at a clinic and the long procedures following it. Not only does it save the users time, but also saves money by cutting down the doctor's fee. On detection of diseases, users will be suggested detailed information about the detected skin disease and further tips such as do's and don'ts to avoid further aggravation of the disease. If the user still feels the need to visit a specialized doctor, he will also be shown the nearest doctors/clinics in his locality

***Index Terms*— Skin Disease, Dermatology, artificial neural network, computer vision, clustering.**

I. Introduction

Skin diseases are the most common Non-Fatal Diseases around the world. Around 64.5% of the population is affected by some kind of skin disease out of which diseases like Acne, Eczema and Rosacea are most common. The skin diseases are normally prevalent in the resource-poor regions with low cleanliness and hygiene. Providing diagnosis and treatments often become a hassle in such areas. Moreover, even in urban cities, people often don't find time to make an appointment and go down to the doctor's clinic on a regular basis. Our system focuses on solving these underlying issues and provides an easy and efficient solution to it.

II. Literature Survey

Yash Kumar Arora, Amish Tandon ,Rahul Nijhawan [1] have discussed the approach of detecting Eczema using a Deep Learning framework approach employing a pretrained network integrated with AdaBoost algorithm for Eczema detection. M. N. Alam, T. T. K. Munia, K. Tavakolian, F. Vasefi, N. MacKinnon and R. Fazel-Rezai [2] created an automatic eczema detection and severity measurement model presented using modern image

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processing and computer algorithms. The system by V. Pugazhenthi, Sagar Naik, Amruta Joshi, Shreya Manerkar, Vinita Nagvekar [3], via input images from a camera, detects if the skin captured is healthy or not. Leelavathy S, Jaichandran R, Shobana R, Vasudevan, Sreejith S Prasad and Nihad [4] propose a lightweight and hybrid system that takes microscopic images as input and combines image processing and machine learning. Nawal Soliman ALKolifi ALEnezi [5] describe in paper, scales images to a size of 227X227 px in the pre-processing stage in order to obtain the same number of features from all images and also to reduce the processing time and increase performance. Li-sheng Wei,, Quan Gan, and Tao Ji [6] are detecting three types of skin diseases such as herpes, dermatitis, and psoriasis by a new recognition method.

III. Existing Systems

Medgic - Scan, Analyse and Detect Skin Problems allows the user to click a picture or also upload a picture and the system will detect common skin diseases like pigmentation and lumps. However, the application takes a minimum of fifteen minutes and can take up to 15 hours to display the result. The application states that they are still in the developing phase and are trying to improve the accuracy.[1]Dermatology Atlas & Skin Infections has a large database of a variety of skin diseases. It provides various details of varied skin diseases. The skin diseases include acantholysis, acanthosis, acne, impetigo, jungle rot, melanosis, psoriasis, eczema, etc. The information is legitimate and accurate however it would differ from patient to patient. The application, however, lacks the functionality of detecting skin diseases.[2] CureSkin aims at detecting various skin abnormalities like pigmentation, dark spots and dark circles. It offers the functionality of having conversations with dermatologists on the portal. Along with their products, they also provide regimens that are dermatologically approved. They mainly try to tackle skin diseases that are caused by hormonal imbalance.[3]
First Derm is an online solution that provides skin disease diagnosis via two images: one close-up and one of the whole affected area. The organization also produces dedicated scanners integrating with the application for higher accuracy, with prices ranging from 100USD to upwards of 1000USD.

IV. Motivation

Skin diseases affect majority of the population and is often neglected which leads worsens it over time. It was a need to make basic skin treatment necessary to the general people which will save both cost as well as money leading people to the right measures, precautions and treatments to be taken to take care of their skin diseases.

V. Problem Statement

Skin diseases affect a majority of our population and very often goes untreated and overlooked. We propose a system that provides easy and accessible diagnosis to everyone along with steps and resources for further care and treatment.

VI. Architecture and Methodology

Our Input is the image of the affected skin which would be then analysed and detects the disease affecting the patient. Our frontend allows the user to upload the image of the affected area and get an overview of the disease detected along with doctor's recommendation and over-the-counter product recommendations.
The user can simply input a picture and our models will detect if the user is suffering from eczema, pigmentation, acne or has healthy skin. The models after processing will detect and display the result. Based on this, the user will be first shown basic information or description of the detected disease.
The user can also find medical regimens to treat the disease and the user will be displayed over the counter medications to tackle the detected disease. If the user still feels the need to visit a dermatologist, the application will display a list of doctors specializing in this domain, in the nearby vicinity.

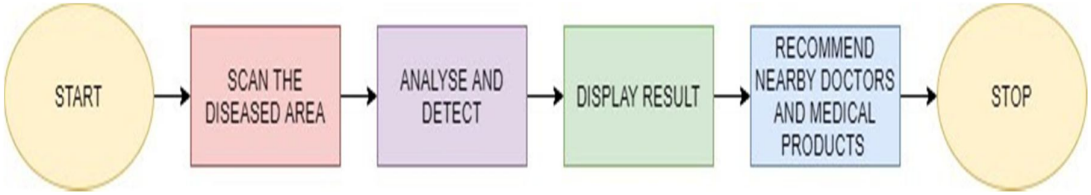

Figure 1. Flow Chart

A. Architecture Diagram

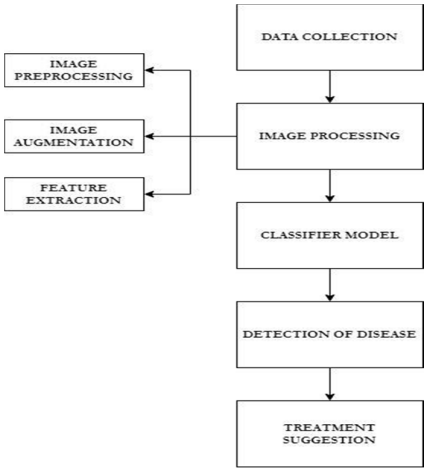

Figure 2. Architecture Diagram

B. Disease

Around 64.5% of the population is affected by some kind of skin disease out of which diseases like Acne, Eczema and Rosacea are most common. It is most prevalent in the areas of low hygiene and rural areas. Especially in the slums of India.

The three diseases considered for creating the dataset are: Pigmentation, Eczema and Acne. Fig.1, 2 and 3 depict the above mentioned three diseases respectively.

80 percent of people have had acne at some point in their life. Eczema being a long-term skin disease needs early diagnosis and constant care. Global warming, pollution and ultraviolet rays contribute to the increase of skin diseases.

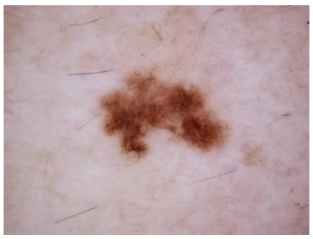

Figure 3. Pigmentation

Figure 4. Eczema

Figure 5. Acne

C. Preprocessing

To achieve high accuracy the images have to be pre-processed to be compatible with the used model and to get the accurate classification .Here we subtract the mean RGB value from each pixel computed on the training set and this is the only pre-processing required. This can be observed from the below image which shows the image after pre-processing.

Figure 6. Pre-processing the images

D. Image Resizing

To resolve the problem of different image sizes in the dataset an input image is either increased or decreased in size in order to make the image compatible with the model and gain consistency in the datasets. Unifying the image size will get the same number of features from all images. Moreover, resizing the image reduces processing time and thus increases system performance. Here the images are resized to 224 x 224 pixels.

E. Model

VGG16 is a convolutional neural network model proposed by K. Simonyan and A. Zisserman from the University of Oxford in the paper "Very Deep Convolutional Networks for Large-Scale Image Recognition". The model achieves 92.7% top-5 test accuracy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. It was one of the famous models submitted to ILSVRC-2014. It makes the improvement over AlexNet by replacing large kernel-sized filters (11 and 5 in the first and second convolutional layer, respectively) with multiple 3×3 kernel-sized filters one after another.

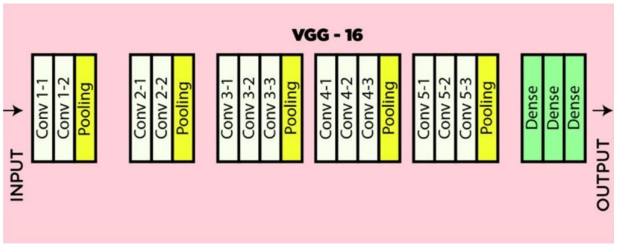

Figure 7. VGG-16 architecture map

F. Classification

We proposed feature extraction and classification from a pretrained convolutional neural network. Because it is the easiest and robust approach to use the power of pretrained deep learning networks giving us high accuracy and efficiency.

G. Flask

Flask is a lightweight and minimalistic framework for rapidly and conveniently developing web applications using Python. Flask originated as a wrapper around Werkzeug, a comprehensive web application library and Jinja, a fast, flexible and extensible templating engine. In many ways it serves as an alternative to Django, another high level Python web framework. Flask is also WSGI (Web Server Gateway Interface, a specification that describes how a web server communicates with web applications, and how web applications can be chained together to process one request) compliant.

H. Doctor Recommendation

Once the disease is detected and classified by the model it will direct you to the next page having which would recommend the most suitable doctors for the patient and disease according to the location of the patient.
For this we would be using the google location API embedded in the website which would detect the users location and recommend suitable doctors according his location.

I. Google Maps and Web Services

Google Map's Web Services can be used to find nearby locations of hospitals / dermatology centres and Chemists. The Places API allows us to lookup by using centres containing specific keywords such as 'Hospital' or 'Dermatology' or chemist. These results can then be mapped to the Doctor's and Medical Products tables and matched based on user location. Google's Web Services provide scalable and efficient solutions for any given volume of requests.
Using Google Loader of Google Maps, we can get the user's IP address. The IP address can be used to obtain an estimate of the user's location. This obtained location can be matched to the location of nearby hospitals and chemists which have the relevant doctors or products respectively available.

J. Reccomendation Process

Additional databases will be created consisting of disease specific descriptions, their Dos and Don'ts, dermatologist information such as their specialization, reviews, user satisfaction, affiliations, hospitals, location,

etc and of medical products information such as the ailments that can be treated by it, side-effects, chemists that provide it as well as its pricing, etc. All these services will work in unison to provide the end user with descriptions of their ailments, Dos and Don'ts, a good doctor specializing in the ailment affecting them who can provide the exact services they need and is located within a preferable distance as well as details of over the counter medication that will provide relief, its availability, the nearest place to source it and its pricing.

K. Connecting Via Flask

Here the VGG16 model we use in our back end is merged to the HTML/CSS web pages created for the front end of our website. The image input is sent from the website's HTML frontend to the VGG16 model in the backend. The VGG16 model classifies the input image and sends back its output and it is displayed for the end user to see on the front end along with the disease descriptions, DOs and Don'ts, doctor's information and medical products information. All this orchestration is made possible via the Flask framework.

L. Result

The model is implemented and trained using python .Initially, the input images are pre-processed, then features are extracted and classified using pretrained model VGG16 which gives the output accuracy of about 98%.

```
Epoch 1/5
206/206 - 382s - loss: 0.4354 - accuracy: 0.8279 - val_loss: 2.4608 - val_accuracy: 0.6562
Epoch 2/5
206/206 - 381s - loss: 0.0875 - accuracy: 0.9737 - val_loss: 2.8052 - val_accuracy: 0.6719
Epoch 3/5
206/206 - 387s - loss: 0.0547 - accuracy: 0.9878 - val_loss: 3.1152 - val_accuracy: 0.6719
Epoch 4/5
206/206 - 1009s - loss: 0.0394 - accuracy: 0.9908 - val_loss: 3.2547 - val_accuracy: 0.6719
Epoch 5/5
206/206 - 561s - loss: 0.0299 - accuracy: 0.9932 - val_loss: 3.5852 - val_accuracy: 0.6719

<tensorflow.python.keras.callbacks.History at 0x1cc0a351be0>
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Figure 8. Accuracy

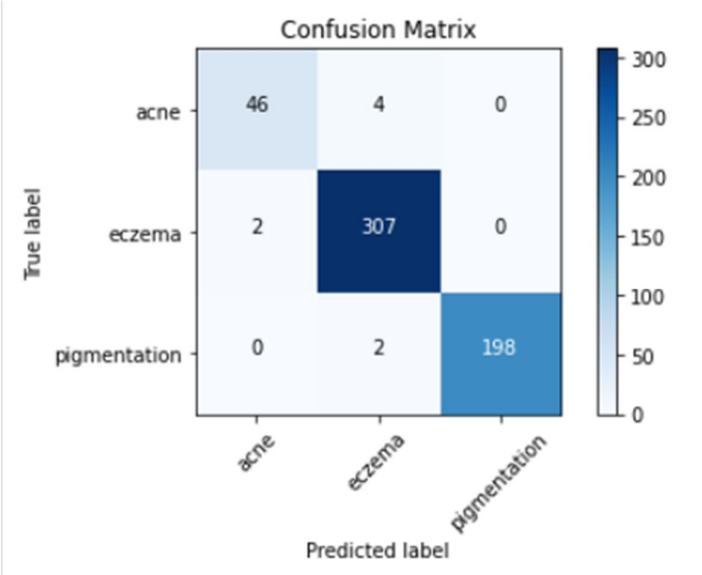

Figure 9. Confusion Matrix

The GUI is made using HTML and CSS consisting of the 3 main pages with the first page to upload the image, the second page giving the output of what the disease is and the third page recommending suitable dermatologists according to the area.

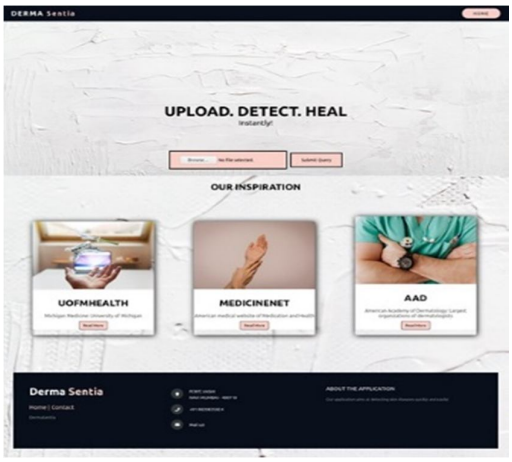

Figure 10. Home Page

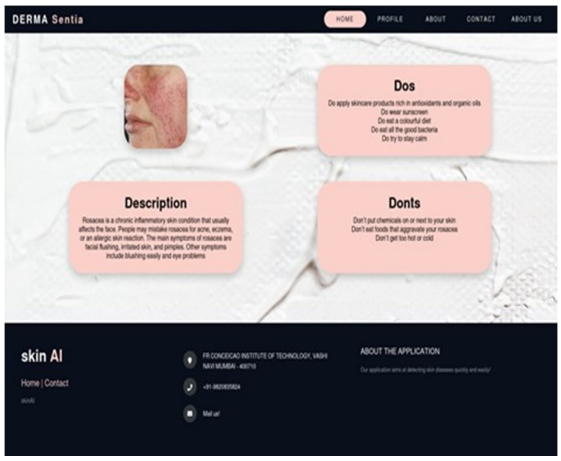

Figure 11. Dos and Don'ts Page

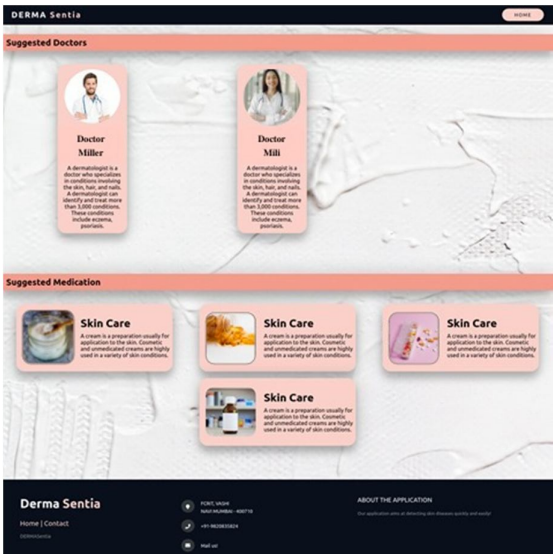

Figure 12. Doctors and Medication Recommendation Page

VII. Justification of the Results

Thus the system implemented here detects multiple ailments in contrast to the reference [1] and [2], which only concentrates on a single disease. Dermasentia also detects more common skin diseases which affects a much wider population which is an advantage in comparison to the references [3], [4] and [6]. The implemented system also has a very good accuracy of the skin disease detection of up to 98% in comparison to [5]. Also, the system is completely developed with a working interface which is an enhanced and user-friendly version of the other systems.

VIII. Conclusion

A system has thus been implemented that allows diagnosis of common widespread skin ailments with very high accuracy. In addition to diagnosis the system also provides information about the disease, its dos and don'ts. The system also contains a recommendation system wherein doctors and over the counter medication suited for the particular ailments are recommended. This system is completely web based without the need of fancy equipment or even a mobile phone, keeping in line with its philosophies of being cheap and accessible to as many people as possible.

FUTURE SCOPE

Integrating the system with hospital medical equipment to allow medical procedures to become faster, more convenient, cheaper and accessible. Provide technical reports specifically for doctors which would help better assess patients and save time and resources . Add support for a wider range of ailments in addition to the ones already present. A developer API for easier integration into third party services or other healthcare software. Tracking of an individual's disease progression and /or recovery and providing even more tailored personalized diagnosis and remedies.

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