Skin Disease Analysis and Image Detection

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Abstract. Skin disorders vary greatly in symptoms and severity. They can be temporary or permanent, may be painless or painful. Some have situational causes, while other may be genetic. For identifying the type of disease, we are creating a website for representing a skin care clinic. This site helps people to clarify their concerns whether they have a skin disease or not. And not only it does display the problem, it also provides information about the cause and preventions. This method takes the digital image of affected skin area of the disease, then use image analysis to identify the type of disease. Our proposed approach is simple, fast and does not require expensive equipment. The approach works on the inputs of a colour image. Then resize of the image to extract features using Convolutional Neural Network. Finally, the type of disease is shown to the user.

1. Introduction

Deep learning is a part of the broader family of machine learning wherein the learning can be supervised, unsupervised or semi supervised. Deep learning unlike machine learning uses a large dataset for the learning process and the number of classifiers used gets reduced substantially. The training time for the deep learning algorithm increases because of the usage of the large dataset. Deep learning algorithm chooses its own features unlike the machine leaning making the prediction process easier for the end user as it does not use much of pre-processing.

1.1. Relevance of Domain

The whole project will be built on Jupyter Notebook using Python language and Machine Learning + Deep learning. The data set will be collected from various relevant medical websites. An interactive web portal will be designed using programming languages such as HTML, CSS and Java Script. Front end of web page will be designed using HTML and decoration will be done using CSS. A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning Algorithm which can take an input image, assign importance (learnable weights and biases) to various aspects / objects in the image and be able to differentiate one from the other.

1.2. Relevance of Application

It helps in reducing workload of hospitals and improves the operational efficiency of the Doctors also. If the ailment is found to be minor, the patients themselves can find alternative cure without physical visits to the Hospitals. This is more relevant in the current era of stress on hospitals due to COVID-19 pandemic situation. This portal is not limited to only single disease prediction, it works for multiple skin diseases. It provides faster, correct output with high accuracy. This portal enables the patient to detect the skin disease which he is suffering without consulting doctor just by uploading an image.

2. Literature Survey

2.1. Skin Diseases Analysis

Wei, Gan, and Tao Ji et al. had their system work on three different steps. The first step includes clearance of noise and disturbances from the image to make it clearer. Then the efficient method of grey-level co-occurrence matrix (GLCM)was brought into the work to segment images of various skin diseases. The positive texture and colour features of different skin disease images could be obtained accurately. In the end, the system uses the support vector machine to accurately find out about skin

disease. SVM helps the system to perfectly classify every disease in their respective order. The initial testing of the system was done for three different skin diseases namely eczema, herpes, and rubella. In the test, it was found that 16 out of 20 findings provided approximately accurate results. In the first step, the image clearance is done using image rotation and segmentation, the representation of an image into something more meaningful and easier to analyze.

2.2. Skin Disease Detection using Image Processing Technique

Authors: Prem J Patil, Sagar J Buchkule, Varsha S More, Sanket G Abhale. The goal of their application is to develop a system which recognizes skin diseases and displays user the results as detected disease, remedies recommended and for that user have to upload an image then, Image dispensation starts with the digitized colour image of the diseased part. Finally, by smearing the KNN algorithm skin disease can be forecast. The dataset covers types of diseased skin images and also Healthy skin images. The training dataset trains the data whereas testing dataset match the images. The accuracy of training is 80% whereas the accuracy of testing is 89%.

2.3. Vision-Based Skin Disease Identification Using Deep Learning

Authors: R Bhavani, V Prakash, R V Kumaresh, R Sundra Srinivasan. Using the latest advanced technologies like deep learning & machine learning algorithms skin disease types can be predicted. Various type of predictions and analysis are being carried out. The accuracy of the results is improvised. Using Machine Learning Algorithms Support Vector Machine, Random Forest, the skin diseases are predicted. The accuracy of the prediction is biased. The accuracy sometimes may be accurate while sometimes may not. For feature extraction and classification these models are used. For training and testing data, Logistic Regression is used. This ensemble model is 80% accurate and can classify up to 15 disease classes.

2.4. Skin Disease Detection Using SVM & KNN

Authors: Y Sumithra Ra, Mahamad Suhilb, D S Guruc a novel approach for automatic segmentation and classification of skin lesions is proposed. Initially, skin images are filtered to remove unwanted hairs and noise and then the segmentation process is carried out to extract lesion areas. For segmentation, a region growing method is applied by automatic initialization of seed points. The segmentation performance is measured with different well-known measures and the results are appreciable. Subsequently, the extracted lesion areas are represented by colour and texture features. SVM and k-NN classifiers are used along with their fusion for the classification using the extracted features. The performance of the system is tested on our own dataset of 726 samples from 141 images consisting of 5 different classes of diseases. The results are very promising with 46.71% and 34% of F-measure using SVM and k-NN classifier respectively and with 61% of F-measure for fusion of SVM and KNN.

2.5. Skin Cancer Prediction Using Feature Extraction Technique

Ekta Singhal: Skin Cancer is most prevalent cancer in the light-Skinned population, and it is generally caused by exposure to ultraviolet light. In this paper, an automatically skin cancer classification system is developed & the relationship of skin cancer image across the neural network are studied with different type of preprocessing. The collected image is feed into the system and image pre-processing is used for noise removal. Images are segment using Thresholding. There is certain feature unique in skin cancer region these features are extract using feature extraction technique. Multilevel 2-D wavelet decomposition is used for feature extraction technique. These features are given to the input nodes of neural network. Back propagation neural network and radial basic neural network are used for classification purpose, which categories the given images into cancerous or noncancerous.

Table 1. Comparative Study of Literature Survey.

Sl. No.	Title of the Paper	Authors	Algorithms	Accuracy
1	Skin Disease Analysis	Wei, Gan, and Tao	GLCM & SVM	80%
2	Skin Disease Detection Using Image Processing	Prem J. Patil, Sagar J. Buchkule, Varsha S. More, Sanket G.Abhale	KNN	Training set- 80% Testing set- 89%
3	Vision-based Skin Disease Detection Using Deep Learning	R.Bhavani, V.Prakash, R.V Kumaresh, R.Sundra Srinivasan	Deep Learning, Machine Learning, Random Forest, SVM.	80%
4	Skin Disease Detection Using SVM & KNN	Y Sumithra Rao, Mahamad Suhilb, D. S. Guruc	SVM & KNN.	61%
5	Skin Cancer Prediction Using Feature Extraction Technique	Ekta Singhal	Image pre-processing, Back Propagation Neural Network, Radial Basic Neural Network.	80%

3. Methodology and Experimental investigation:

The Proposed Methodology consists of following steps:

- Collection of data and fit it in test and train folders.
- Here we collected a dataset of nearly 800 images. 80% of them are filtered to train folder and remaining to test folder.
- Data pre-processing
- Here we removed duplicate images, irrelevant images and made data worthy.
- Importing libraries
- Importing Keras library and sequential to initialize layers and dense to build layers.
- Building and saving of model
- Here we performed n epochs with n batches to obtain good accuracy.
- Hosting using html/CSS and python.

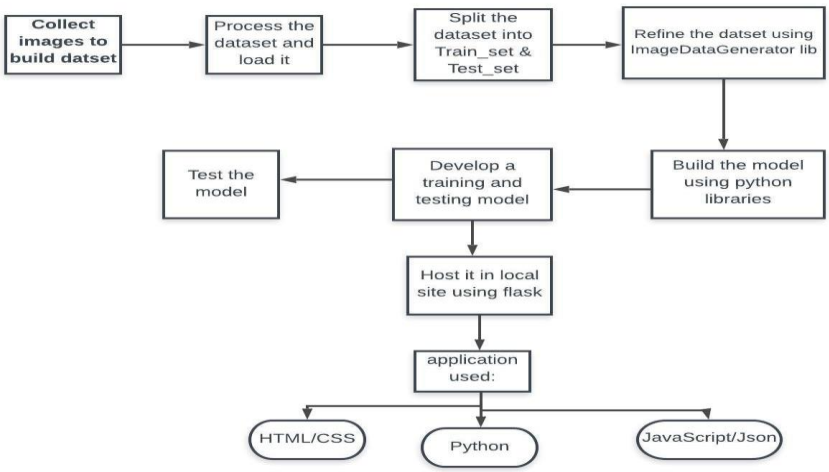

Figure 1. Flow chart

3.1. Data collection
We have collected 5 types of skin diseases and have kept 80% the of images in the train set and 20% of the images in test set.

3.1.1. Acne It is the skin condition that occurs when your hair follicles become plugged with oil and dead skin cells. It causes whiteheads, blackheads, or pimples. Acne is most common among teenagers, though it affects people of all ages. Effective acne treatments are available, but acne can be persistent.

3.1.2. Hair loss It can affect just your scalp or your entire body, and it can be temporary or permanent. It can be the result of heredity, hormonal changes, medical conditions, or a normal part of aging. Anyone can lose hair on their head, but its more common in men. Baldness typically refers to excessive hair loss from your scalp.

3.1.3. Nail Fungus A nail fungus causing thickened, brittle, crumbly or ragged nails. Usually, the problems caused by this condition are cosmetic. The main symptoms are changes in the appearance of nails. Rarely, the condition causes pain or a slightly foul odor. Treatments include oral anti-fungal drugs, medicated nail polish or cream or nail removal.

3.1.4. Melanoma The most serious type of skin cancer. Melanoma occurs when the pigment-producing cells that gives color to the skin become cancerous. Symptoms might include a new, unusual growth or a change in an existing mole. Melanomas can occur anywhere on the body. Treatment may involve surgery, radiation, medication or in some cases, chemotherapy.

3.1.5. Vitiligo A disease that causes the loss of skin color in batches. Vitiligo occurs when pigment-producing cells die or stop functioning. Loss of skin color can affect any part of the body, including the mouth, hair and eyes. It may be more noticeable in people with darker skin. Treatment may improve the appearance of the skin but does not cure the disease.

3.2. Libraries used.

3.2.1. DataGenerator The imageDataGenerator is an easy way to load and augment images in batches for image classification tasks.

3.2.2. Tensorflow To add layers as well as compare the loss and Adam curve our result data or obtained log.

3.3. Layers

A convnets is a sequence of layers, and every layer transform one volume to another through differentiable functions.

3.3.1. Input Layer This layer holds the raw input of the image.

3.3.2. Convolution Layer This layer computes the output volume by computing dot product between all filters and image patches.

3.3.3. Activation Function Layer This layer will apply element wise activation function to the output of the convolution layer. Some common activation functions are RELU, sigmoid, tanh, Leaky RELU. We have used RELU for our model as this is a multi-classification problem.

3.3.4. Pool Layer This layer is periodically inserted in the convNets and its main function is to reduce the size of the volume which makes the computation fast, reduces memory and also prevents from overfitting. Two common types of pooling layers are max pooling and average pooling.

3.3.5. Dense Layer It is regular deeply connected neural network layer.

3.4. Model Building

Lastly, we have created a User-Friendly Application Such that normal people/naïve users can understand our model. We created a Flask app. Basically, Flask is a small and lightweight Python web framework that provides useful tools and features that make creating web applications in Python easier. It gives developers flexibility and is a more accessible framework for new developers since you can build a web application quickly using only a single Python file. We Used HTML&CSS to create a website.

3.4.1. HTML/CSS The Hyper-Text Markup Language, or HTML is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as Java Script. Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.HTML elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page. Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language such as HTML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript. CSS is designed to enable the separation of presentation and content, including layout, colours, and fonts.

3.5. Experimental Investigation

In this project, we have downloaded the dataset available on Kaggle. It contains subfolders namely trainset and trainset. Each set consists of five classes of diseases namely A77cne, Hair loss, Nail fungus, Melanoma, Vitiligo.

Table 2. Prediction Success Ratio of the Module.

Sl. No.	Type of Disease	Sample Size	No. of images detected	Success Rate
1	Acne	30	20	70%
2	Hair loss	30	25	80%
3	Nail Fungus	30	16	54%
4	Melanoma	30	26	86%
5	Vitiligo	30	26	86%

3.6. Algorithm

We have used CNN algorithm. convolutional neural network (CNN) is slightly in variance with the multilayer perceptron. A CNN can have a single convolution layer or it can contain multiple convolution layers. These layers can be interconnected or pooled together. A convolution operation is performed on the input and then the results are passed to the further layers. Thus, due to this, the network can be deep but will contain only a few parameters. Due to this property, a convolutional neural network shows effective results in image and video recognition, natural language processing, and recommender systems. Convolutional neural networks give accurate results in semantic parsing and paraphrase detection. This is the reason to use CNN for skin disease detection. CNN classifier is implemented to train and test skin disease images. CNN classifier is a layered architecture where multiple layers perform various operations to train and test the image data.

3.6.1. Model building

Step1: Importing the libraries
Step2: Loading dataset
Step3: Data Processing
Step4: Initializing the model
Step5: Adding the Hidden layers
Step6: Here we perform epochs with ‘n’ batches to obtain good accuracy
Step7: Saving the (.h5 file)

3.6.2. Pseudo Code

```
#Model initializing
  model=Sequential()
#Convolution Layer
  model.add(Convolution2D(32,(3,3),input_shape=(64,64,3),activation="relu"))
#Pooling Layer
  model.add(MaxPooling2D(pool_size=(2,2)))
#Hidden Layer
  model.add(Dense(units=500,init="uniform",activation="relu"))
#Accuracy
  model.compile(optimizer="adam",loss="categorical_crossentropy",metrics=["accuracy"])
#Saving Model
  model.save("sd.h5")
```

3.6.3. Flow chart

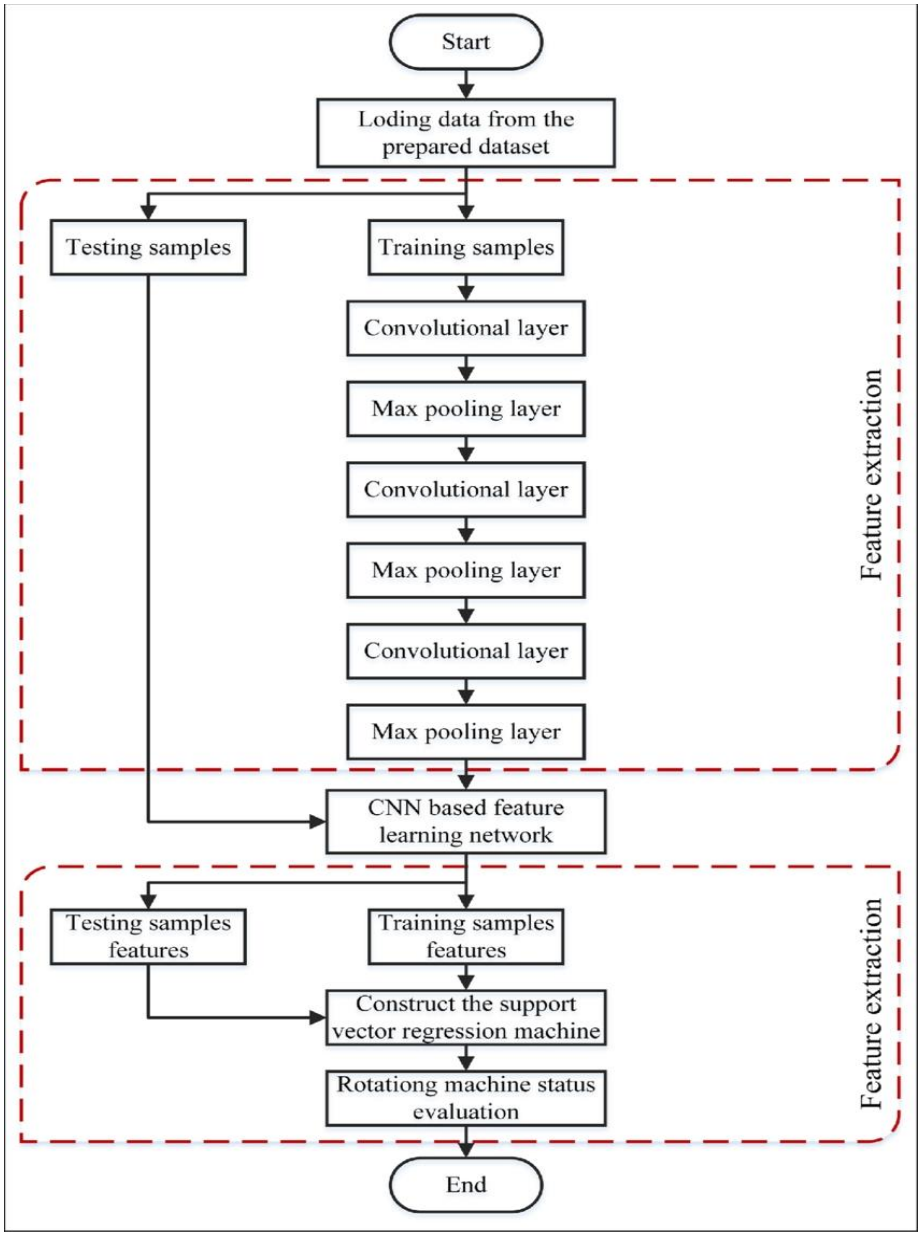

Figure 2. Implementation flow

4. Result

This study is carried to detect the type of skin disease. This Prediction model is created in Python programming language. We have used CNN algorithm, and this algorithm is applied on the data set which we collected from Kaggle. We have used all 5 types of diseases for predicting the disease. We acquired 81% Of accuracy and Lastly, we created a User-Friendly application to make our project understandable even for naive users.

Figure 3. Homepage

The above picture is the homepage of our project. And in this page we have briefly given explanation of skin disease. If we click on prediction it directs to next page.

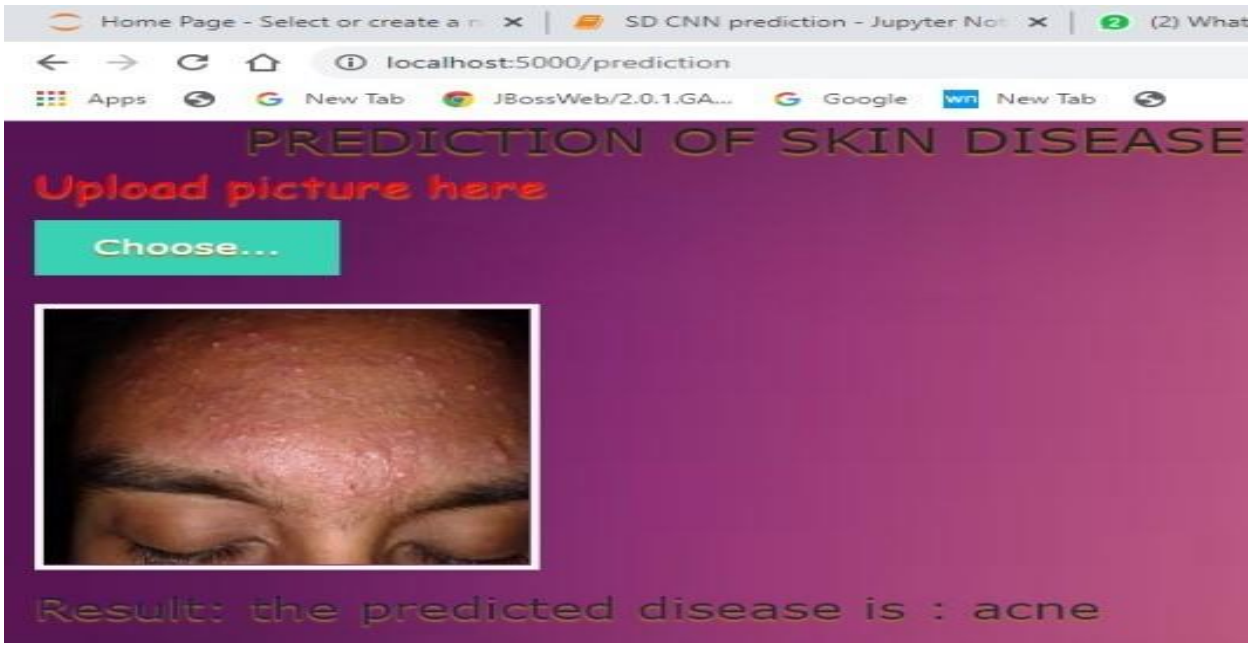

Figure 3(a). Predicted Acne image

This the directed page from home page. If we click on choose button we can select image from our system. After uploading the image the algorithm processes the image and detects and what type of disease it is and output will be name of the predicted disease. In the above picture we have uploaded the image and the output predicted is acne.

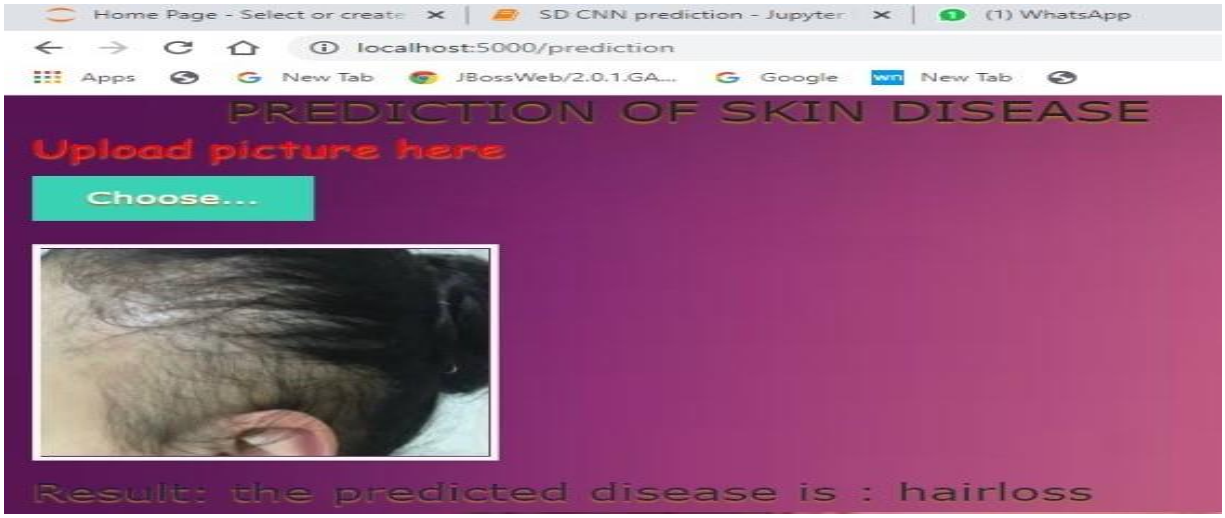

Figure 3(b). Predicted Hair Loss Image

After the prediction of the previous image we can click on choose and upload another image. After uploading the image the algorithm processes the image and detects and what type of disease it is and output will be name of the predicted disease. In the above picture we have uploaded the image and the output predicted is Hair loss.

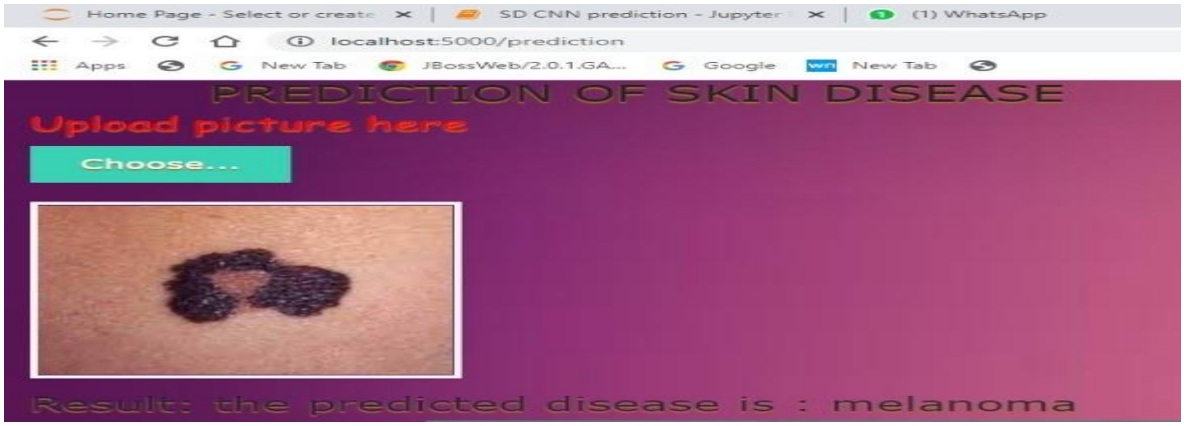

Figure 3(c). Predicted Melanoma image

After the prediction of the previous image we can click on choose and upload another image. After uploading the image the algorithm processes the image and detects and what type of disease it is and output will be name of the predicted disease. In the above picture we have uploaded the image and the output predicted is Melanoma.

Figure 3(d). Predicted Nail fungus image

After the prediction of the previous image we can click on choose and upload another image. After uploading the image the algorithm processes the image and detects and what type of disease it is and output will be name of the predicted disease. In the above picture we have uploaded the image and the output predicted is nail fungus.

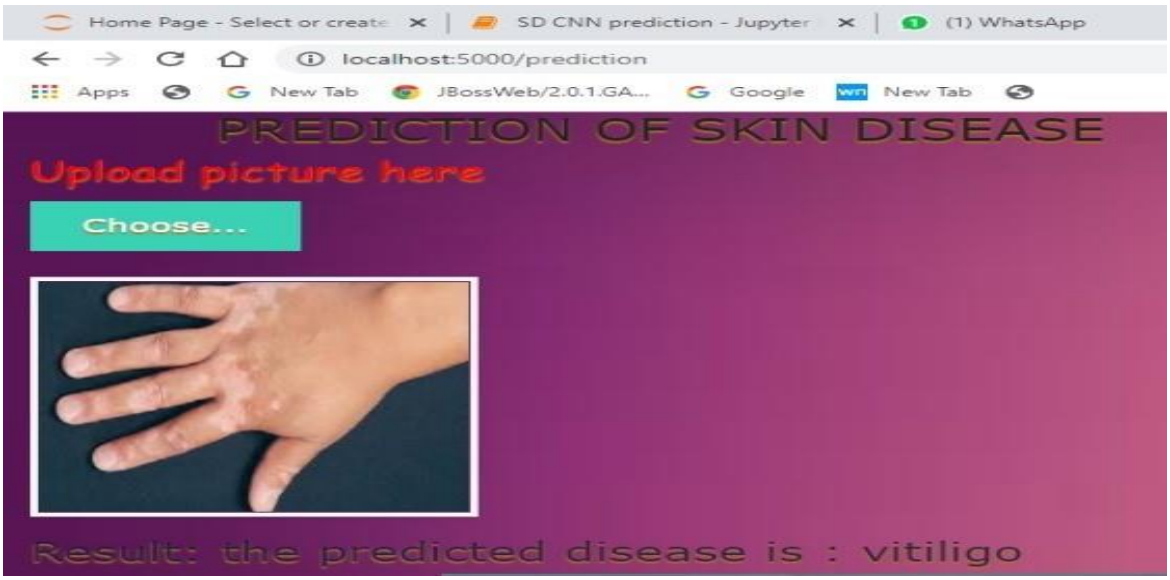

Figure 3(e). Predicted vitiligo image

After the prediction of the previous image we can click on choose and upload another image. After uploading the image the algorithm processes the image and detects and what type of disease it is and output will be name of the predicted disease. In the above picture we have uploaded the image and the output predicted is vitiligo.

5. Conclusion

In the given study, it has been demonstrated that how the CNN model can be used to predict five different categories of skin diseases i.e., Acne, Nail fungus, Hair loss, Melanoma, Vitiligo. The proposed system is able to successfully detect the disease present in the image. It can be used to help people from all over the world and can be used in doing some productive work. The tools used are free to use and are available for the user, hence, the system can be deployed free of cost. The application developed is light-weight and can be used in machines with low system specifications. It has also a simple user interface for the convenience of the user. The image processing and deep learning algorithm is successfully implemented.

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