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Skin Disease Identification and Diagnosis using Deep Learning

Prof. Bharati Kale[#1], Sangeeta Udapudi[#2], Madhavi Surpur[#3] , Rashmi Musale[#4]

Department of Computer Science, Visvesvaraya Technological University Belagavi. Angadi Institute of Technology & Management Belagavi, India. [#]

ABSTRACT: Dermatological disorders are one of the most widespread diseases in the world. Despite being common its diagnosis is extremely difficult because of its complexities of skin tone, color, presence of hair. Our project provides an approach to use computer vision based techniques (deep learning) to automatically predict the various kinds of skin diseases. The system uses publicly available image recognition architectures namely Inception V3 or Inception Resnet V2 or Mobile Net with modifications for skin disease application and successfully predicts the skin disease based on maximum voting from the three networks. These models are pretrained to recognize images several classes like panda, parrot etc which we will modify to predict skin diseases. The architectures are published by image recognition giants for public usage for various applications. The system consists of three phases- The feature extraction phase, the training phase and the testing /validation phase. The system makes use of deep learning technology to train itself with the various skin images. The main objective of this system is to achieve maximum accuracy of skin disease.

KEYWORDS: Computer Vision, Deeplearning, CNN, object detection, Inception V3, TensorFlow.

I. INTRODUCTION

The Dermatology remains the most uncertain and complicated branch of science because of it complicacy in the procedures involved in diagnosis of diseases related to hair, skin, nails. The variation in these diseases can be seen because of many environmental, geographical factor variations. Human skin is considered the most uncertain and troublesome terrains due to the existence of hair, its deviations in tone and other mitigating factors. The skin disease diagnosis includes series of pathological laboratory tests for the identification of the correct disease. For the past ten years these diseases have been the matter of concern as their sudden arrival and their complexities have increased the life risks. These Skin abnormalities are very infectious and need to be treated at earlier stages to avoid it from spreading. Total wellbeing including physical and mental health is also affected adversely. Many of these skin abnormalities are very fatal particularly if not treated at an initial stage. Human mindset tends to presume that most skin abnormalities are not as fatal as described thereby applying their own curing methods. However if these remedies are not apt for that selective skin problem then it makes it even worse. The available diagnosis procedure consists of long laboratory procedures but this paper proposes a system which will enable users to predict the skin disease using computer vision. This work is able to predict 7 skin diseases Melanocytic nevus, Melanoma, Benign keratosis-like lesions, Basal cell carcinoma, Actinic keratoses, Vascular lesions, Dermatofibroma.

II. RELATED WORK

Mariam A.Sheha Cairo University Mai S.Mabrouk ,Amr Sharawy et al[1] This paper presents an automated method for melanoma diagnosis practical on a set of dermoscopy images. Topographies quarried are based on gray level Co-occurrence matrix (GLCM) and Using Multilayer perceptron classifier (MLP) to classify among Melanocytic Nevi and Malignant melanoma. The first practise, Automatic iteration counter is faster but the second one, Default iteration counter gives a better precision, which is 100 % for the training set and 92 % for the test set.

Subrat Kumar Rath, Siddharth Swarup Rautaray et al[2] This paper presents the Performance Comparison of Min-Max Normalisation on Frontal Face Detection Using Haar Classifiers. They focus on evaluating the ability of Haar classifier in detecting faces from three paired Min-Max values used on histogram stretching. Min-Max histogram stretching was the selected method for implementation given that it appears to be the appropriate technique from the observation carried out. Experimental results show that, 60-240 MinMax values, Haar classifier can accurately detect faces compared to the two values

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Shivajirao M. Jadhav Sanjay L. Nalbalwar Ashok A. Ghatol et al[3] Artificial Neural Network Models based Cardiac Arrhythmia Disease Diagnosis from ECG Signal Data. In this paper we planned an Artificial Neural Network (ANN) based cardiac arrhythmia disease judgement system using standard 12 lead ECG signal recordings data. In this study, we are mainly interested in categorizing illness in normal and abnormal classes. ANN models are skilled by static back propagation algorithm with momentum learning rule to examine cardiac arrhythmia.
Vinayshekhar Bannihatti Kumar, S. Selvin Prem Kumar, Varun Saboo et al[4] Dermatological disease detection using image processing and machine learning. They have provided an approach to detect various kinds of these diseases. We use a dual stage approach which effectively combines Computer Vision and Machine Learning on clinically evaluated histopathological attributes to accurately identify the disease.

Shaoqing Ren, Kaiming He, Ross Girshick, and Jian Sun et al [5] In this work Fast R-CNN have reduced the running time of these detection in which hold up region proposal computation work . Here it offer a Region Proposal Network that exchange convolutional features of full image with the detection network thus permitting costless region proposals. In this RPN is trained from beginning to end to produce region proposal with high quality which are further used by Fast RCNN for detection. Then they combine Fast R-CNN and RPN into a single network by using their convolutional feature.

C. Lee, K. Won oh and H. Kim et al [6]. In this the contrast changed over models and few picture edit predict as far as calculation time and location accuracy. Examination information will be used for deciding an appropriate identification demonstration that a robot needs to play out a question local assignment.

Nguyen, D. Kanoulas, G. Caldwell, and N. Tsagarakis et al [7] A novel and real time method is shown to distinguish object affordances from RGBD pictures. This technique trains the Deep Convolution Neural Network (CNN) to learn wise features from the input data in an end-to-end aspect. The CNN has an encoder-decoder pattern so as to get even label prediction. The information is represented as various methods to give the system a chance to take in component all more eminently. This technique sets another standard basis on identifying order of object possibly enhancing the precision by 20% in association with cutting edges that utilize

III. PROPOSED SYSTEM

Convolution Neural Network

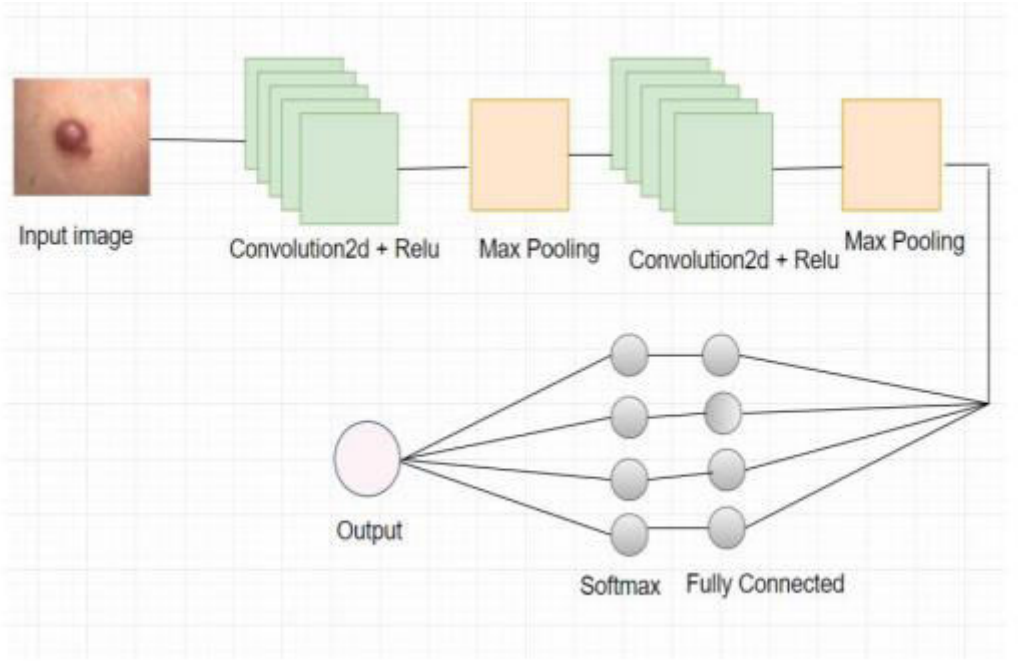

Fig 1.Convolutional Neural Network

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The above [Fig.1] shows the flow of convolutional neural network. A 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 main reason to use CNN for skin disease detection. After experimenting with SVM classifier, CNN classifier is implemented to train and test skin disease images. Unlike SVM classifier, there is no need to perform processing steps on image. In SVM classifier, an image needs to be processed using image processing unit and then given for the classification to SVM classifier. CNN classifier is implemented in such a way where there is no need of image processing module. CNN classifier is a layered architecture where multiple layers perform various operations to train and test the image data. In this proposed solution, 408 images are given to CNN classifier for training where images for training are given to Convolution2dLayer. This is the first layer to extract the features from the input image. This layer applies a convolution operation and gives the result to the next layer and applies convolutional filters to the input. It computes the dot product of the input and weights and then adds a bias term. Then ReluLayer is introduced which is Rectified linear Unit Layer for handling nonlinearity in the network.

MaxPooling Layer reduces the dimensionality of image and is used to divide the input into rectangular regions and computes the maxima of each region. After this operation, Fully Connected Layer multiplies an input with weight matrix, adds bias vector and it is responsible for creating a model for classification layer by applying Softmax Layer. Softmax Layer is a logistic activation function which is used for multiclass classification. Finally Classification Layer will detect the affected area of image and gives the output.

Dataset Used

In this project, a sample data from the complete dataset employed to train the system model is presented in [Fig. 2]. The database is split into; training set, validating/testing set. A training set is adopted for learning to fit the parameters and is specifically applied to alter the varying weights and errors of the system in each training run. Validation/testing set tune the parameters and is used only to assess the effectiveness and efficiency of the system.

Fig 2. Training dataset

Fig 3. Testing dataset

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In [Fig 3] The divide mode is set to 90% for the training of the data, 10% for the validating/testing of the data.

IV. METHEDOLOGY

Development of a widespread plan to test the special features and general functionality on a range of platform combination is firstly initiated by the test process. The procedures used are strictly quality controlled. The method involves use of pre-trained image recognizers with modifications to identify skin images.
The process verifies that the application is bug free and it meets the requirements stated in the requirements document of system. The following are the considerations used to develop the framework from developing the testing methodologies.

Module Design Are

- *Feature extraction module.*
- *Training module.*
- *Validation/ Testing phase.*

Mobile Net is considered to have light weight architecture and fast model, more preferred for mobiles and embedded application. With small size (17MB), they are based on streamlined architecture that uses deep-wise separate convolutions. Though these process same as inception these have light weights. The other two networks used are Inception V3 .

Inception V3 involves two fragments

[1] Feature extraction part with a convolutional neural network.
[2] Classification part with fully-connected layer.

The pre-trained Inception V3 model attains advanced accuracy in recognition of general materials with 1000 classes, like Zebra, Dalmatian and Dishwasher etc. The model extracts several features from the input images in the feature extraction part and then classifies them established on those obtained features. In transfer learning, when a new model is built to categorize an original dataset, the feature extraction and classification parts are reused and retrained respectively with the dataset. In transfer learning the last layer of the model is trained again with the new dataset so that the model can learn about the application. In transfer learning, when a new model is built to categorize an original dataset, the feature extraction and classification parts are reused and . learning the last layer of the model is trained againwith the new dataset so that the model can learn about the application.

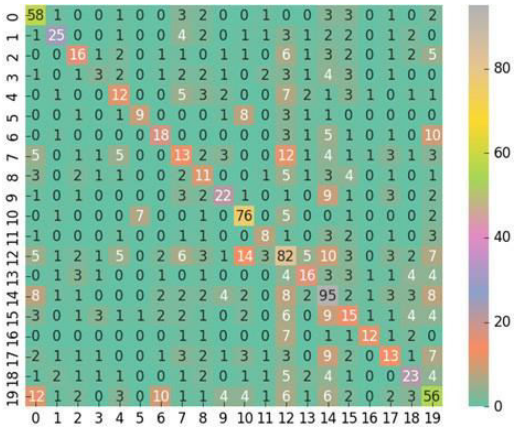

Fig 4. Confusion Matrix of Inception V3.

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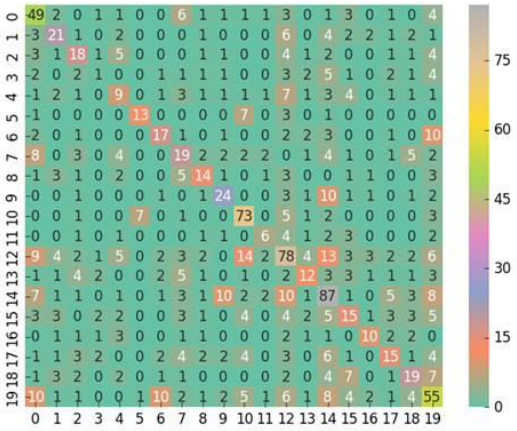

Fig 5. Confusion Matrix of MobileNet.

SYSTEM ARCHITECTURE

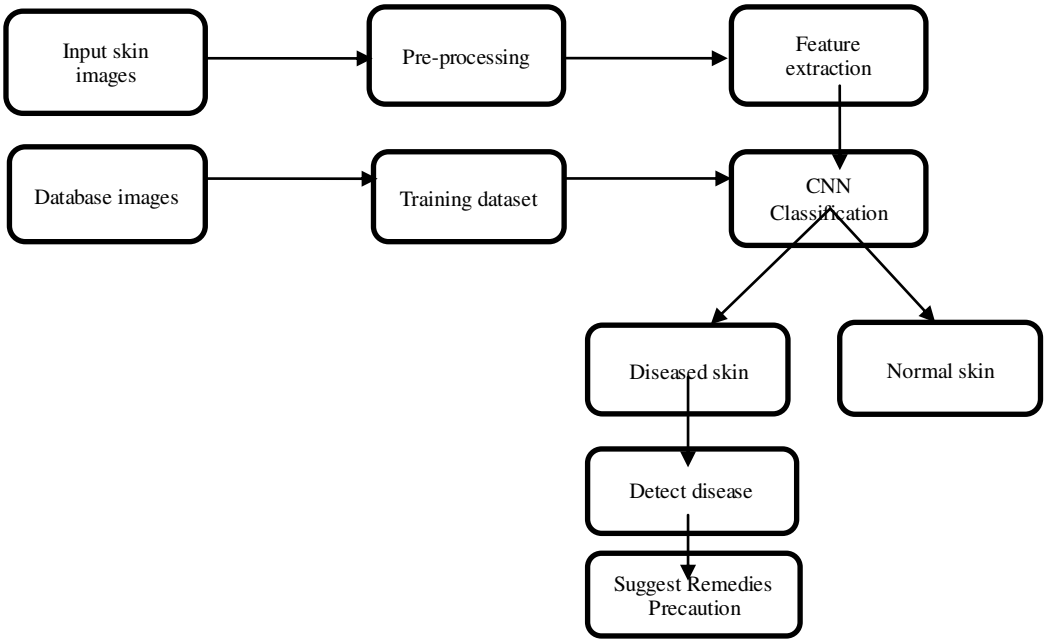

Fig 6. System Architecture

The above[Fig 6] shows the entire artchitecture of the work. The user will upload the skin image. After uploading the skin image is preprocessed. The features are extracted from the image and then the CNN algprithm is applied on the image for classification. The database contains types of diseased skin images and normal skin images. The training data trains the data and CNN classified image is matched with this trained dataset. If the image is normal skin image then the system will display 'Normal skin' and then get terminate. If the image is diseased skin then the disease is detected and suggestion of remedies and precautions to be taken for that disease is displayed

V. RESULT AND DISCUSSION

This study projects a method that uses techniques related to computer vision to distinguish different kinds of dermatological skin abnormalities. We have employed various types of Deep learning algorithms (Inception_ v3,MobileNet) for feature extraction and CNN algorithm for training and testing purpose. Using the state of the art

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architecture considerably increases the efficiency up to 88 percentage. And further more by using ensemble features mapping, combing the models trained using Inception V3, MobileNet a voting based model will be ensembled and thereby increasing the efficiency. For enhanced performance and selecting the optimum architecture for the application, we have used CNN technique. In this method, the divide mode is set to 90% for the training of the data, 10% for the validating/testing of the data. To characterize the efficiency of a classification model (or "classifier") on a set of test data for which the true values, a table of confusion matrix is used.

Result of Inception V3 Confusion Matrix for Inception V3 is displayed in [Fig. 4.]and the diagonal in the matrix describes the accuracy from the algorithm.

Results of MobileNet Confusion Matrix for MobileNet is displayed in [Fig. 6] and the diagonal in the matrix describes about the accuracy of the algorithm.

VI. CONCLUSION

In this work a model for prediction of skin diseases is done using deep learning algorithms. It is found that by using the assembling features and deep learning we can achieve a higher accuracy rate and also we can go for the prediction of many more diseases than with any other previous models done before. As the previous models done in this field of application were able to report a maximum of six skin diseases with a maximum accuracy level of 75%. By implementing deep learning algorithm we are able to predict as many as 20 diseases with a higher accuracy level of 88%. This proves that deep learning algorithms have a huge potential in the real world skin disease diagnosis. If even a better system with high end system hardware and software with a very large dataset is used the accuracy can be increased considerably and the model can be used for clinical experimentation as it does have any invasive measures. Future work can be extended to make this model a standard procedure for preliminary skin disease diagnosis method as it will reduce the treatment and diagnosis time.

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