Detection of Skin Diseases and Classification using Deep Learning Algorithm

Evani Sai Krishna Karthik[1]; Potu Teja[2]; Vaggu Sridhar[3] and B. Priyanka[4]

[1, 2, 3]Student, Department of ECE, Sreenidhi Institute of Science and Technology, Hyderabad, Telangana, India.
[4]Assistant Professor, Department of ECE, Sreenidhi Institute of Science and Technology, Hyderabad, Telangana, India.

Abstract: Bacteria, Viruses and many such are the reasons for most of the Skin diseases and allergies. With the evolution and development in Science and Technology, we find numerous laser and equivalent photonic techniques employed to detect a skin disease. This sort of equipment and setup is authorized by a referred dermatologist and is also very expensive. Especially, Dermatology is one of the most unprecedented Branch of Medicine when it comes to its diagnosis aspect. And for such reasons, alternatives are being created using Deep Learning Techniques where you don't need heavy investments on hardware or equipments. Using such algorithms has also lessened the human labour requirement. Nowadays, Deep Learning Techniques are been rightly used even in predicting different types of Cancers in the very early stages itself. Extracting required characteristic features from an Image forms the basis in classifying skin lesions. Constraints like extensive number of tests for a particular detection, differences in time taken by a practitioner and his or her experience can be removed as we propose a standardized automatic image-based system which utilizes a computational Convolutional Neural Network to detect, classify and present the type of tumor as the result. We have utilized 80:20 training to testing ratio dataset that includes various types of skin diseases' images to create an utmost accurate Deep Learning model using Convolutional Neural Network and AlexNet CNN architecture which can further hike the accuracy appropriately. The main motive of the project is to bring out a reliable and utmost accurate DL model that can become a significant helpful technique in Dermatology diagnosis. If successfully accomplished, this can become a standard handy tool for Dermatology students to learn in their curriculum.

KEYWORDS: Social Distancing, Arduino Uno, Pulse Rate Sensor, PIR Sensor, OLED, Smart Band

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INTRODUCTION

Due to the increased prevalence of skin malignancies, the computer based diagnostic tools will become highly useful tools for the dermatologists to diagnose the skin diseases. The anomalies in skin are first diagnosed by visual evidence, through some tests and then by dermoscopic analysis, biopsy, and histological study in some situations. Because of the changes in the visual appearance of lesions, automatic classification of dermoscopic pictures is difficult.Traditional methods were outperformed by the deep learning like CNN (Convolutional Neural Network). These networks could be used for area recognition and medical picture classification since they allow for the extraction of discriminatory information from images while preserving the spatial structure.

In this report, we present a way to automatically recognize the presence of skin cancer using a deep learning classification technique. The deep learning model will use the computational power of the machine to create feature of images for analyzing, processing and regulating the data predicted using image pixels through the path of the image uploaded and its diagnosis labels as inputs in an interactive interface that displays the classified results.

Related Work

In paper [1], they have captured the images using some high-definition camera and processed those images for better results. By using miniscule squares of images they obtained a feature matrix and using ReLU feature matrix is smoothened by making the negative feature into zero value by using the function $f(x)= \ln(1+e^x)$. Spatial pooling is used to reduce the 3D feature set to 2D feature matrix and finally with the help of features obtained from ReLU and sample pooling, Classification is done using fully connected network which is softmax classifier.

In paper [2], they developed a system that detects the type of skin disease using the features like skin color, size, area, color of fluid, type of fluid, age, gender etc. Here they have used feed forward and back propagation neural network technique to classify the images, about 100 neurons are used in the hidden layer. Here they used a different approach by using the artificial neural networks for their classification unlike others where they used predefined CNN architectures to classify the images. The drawback of this approach is it is very difficult collect the data and they have used limited dataset for their approach which decreases the accuracy of the model.

In paper [3], a system is proposed to detect 3 types of skin diseases with higher accuracy using predefined convolutional neural network known as multiclass Support Vector Machine (SVM), which can classify images at higher speed and accuracy. Here they have implemented with the help of MATLAB software, which will show the accuracy and type of the disease. As MATLAB is used only for preliminary purpose,which is easy but not an efficient way to implement a Machine Learning model and deployment will be tedious in this case.

In paper [4], they have used convolutional neural network to generate feature matrix from digital images and using soft max architecture to classify 5 different type of skin diseases. By using this they have achieved an accuracy of 73% by classifying over 2400 images. Here they have used some systems to introduce noise into the images in-order to make the model not to over fit the data.

In paper [5], which was published by Alex Krizhevsky and his colleagues during ImageNet challenge 2012 which they won by creating AlexNet, which is a pre trained neural network which we are using for our project. During this they are able to train 1.2 million images and classify them into 1000 classes with the help of 60 million parameters and 650,000 neurons. Here they have discussed about how they created a neural network that can handle millions of images and able to find a solution for the over fitting problem. They have discussed detail implementation of each layer and how they are able handle such a large data.

Organization

The rest of the paper is organized in the following order. Working of the system is described in Section 2. Required Software and Hardware is elaborated in Section 3. We have Results following in Section 4 followed by Future Work in Section 5. Finally, Section 6 is the conclusion for the paper.

WORKING

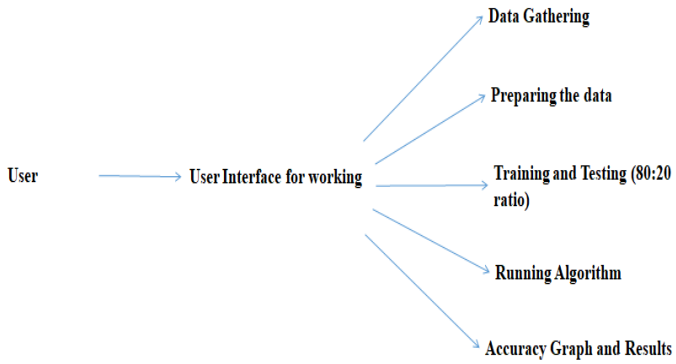

Fig. 1 Block Diagram

1. Data Gathering

There are many different strategies for collecting various sorts of quantitative data, but no matter which method you use, there is a basic process that you will typically follow. The following five steps make up this procedure.

- Decide what information you require.
- Set a deadline for collecting data.
- Decide on a data collection approach.
- Collect the information.
- Analyze the data and put your findings into practice.

2. Preparing the data

Preparing the data is a crucial step in machine learning that facilitates the improvement in quality and data and is helpful in gaining useful features. Processing of data is a crucial part which refers to cleaning the data and organizing the raw data to get important insights for creating a deep learning model.

3. Training and Testing

By using the training data we provide to model, all algorithms uses the data to learn the features and find important relationships, developing understanding, making decisions, and increasing their confidence. It is necessary to how an application will perform based on training info we provide to it. The more data we supply for training, the better the model will perform. Following data utilized to make the model learn, the model is tested on a test data. The test data gives us a fantastic opportunity to examine the model. The test set is used only when ourmodel is trained properly using the training set.

4. Modeling or Running the Algorithm

After training and testing the data we use the model to run the algorithm for any desired input and thus we observe the output. This can be repeated over and over for numerous desired inputs as well.

5. Speculating the results and Accuracy Graph

The estimation of the outcome of a given result, for example whether a patient have benign or malignant skin cancer, "prediction" is a part of finding the output of the application in which the model learnt from the train data and the training is applied to new data. The model will generate probable output values for the new data with the help of the algorithm that has been trained from previous data.Also the accuracy graphs can appropriately be captured to notice the output trends.

Convolution Neural Networks-They are multilayer neural networks that are primarily used for object detection and image processing. First CNN was created by Yann LeCun in 1988, which he called LeNet. It could recognize characters such as ZIP codes and numerals. CNNs are commonly used to detect abnormalities, identify satellite photos, interpret medical pictures, forecast time series, and identify anomalies. Most popular for analyzing images, has a lot of scope beyond Image Analysis if properly exploited. It has Convolutional Layers, which are hidden layers.

They can have layers that aren't convolutional but these layers make a CNN basically. Just like any other layer they receive input and transform into some form of output that is sent to the next layer and the operation involved is titled as Convolution. More precisely the convolutional layers are able to detect specific patterns through convolution that make them unique from other artificial neural network patterns.CNNs have many layers that analyze and extract information from data:

Convolution Layer - CNN consists of a convolution layer that performs the convolution operation using several filters like filters detecting shape (geometrical filters).

ReLU (Rectified Linear Unit) – CNNs use the ReLU for conducting operations on items. The result is a rectified feature map.

Pooling Layer - Following that, the pooling layer receives the rectified feature map. the feature map's dimensions are reduced in pooling using downsampling. By flattening the 2D arrays from the

pooled feature map, The pooling layer combines them into a single linear vector that is lengthy and continuous.

Fully Connected Layer - When the pooling layer's flattened matrix is supplied as an input, a fully linked layer emerges, classifying and labelling the pictures.Here's a CNN-processed image example.

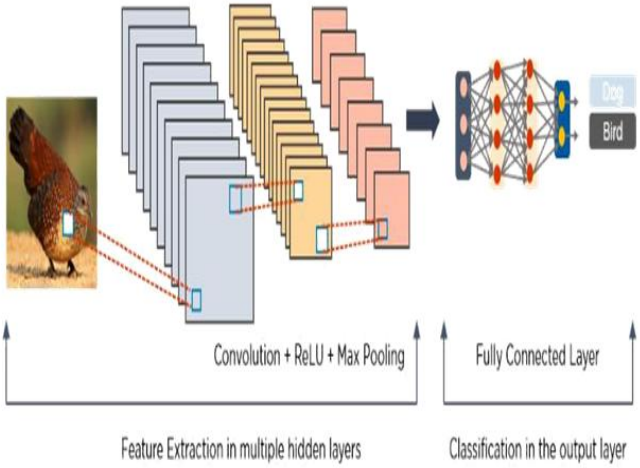

Fig.2 CNN Model Image

AlexNet Architecture

- The AlexNet is one of the best neural network model of the CNN, it uses Graphical Processing unit to improve the efficiency.
- It has 5 layers of convolution from the CNN 3 are maximum pooling layers, 2 normalization layers, 2 layers which are connected fully and one layer is soft max.
- Each convolutional layer has a number of filters of convolution and a function to activate non-linear activities.
- Layers or filters in the convolution perform the maximum pooling operation.
- The input which is given to the model in AlexNet is of fixed size.
- The input size is mentioned at most of the places as 224x224x3 but due to some padding which happens it works out to be 227x227x3
- There are a huge number of parameters in the Alexnet model. The count leads all the way to nearly 6 crore.

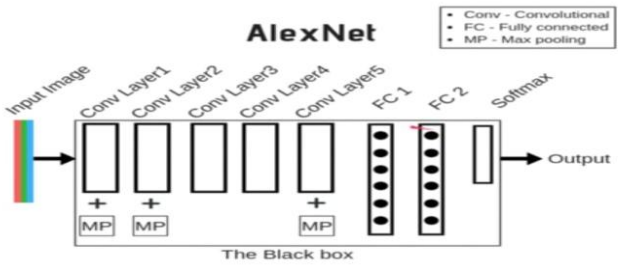

Fig. 3 AlexNet Architecture

Also there are several existing Python Libraries, Modules, Frameworks and many such which are used in programming the model. Few of them are: Tensor Flow, Matplotlib ,Keras , Pandas, Sklearn, Seaborn and Numpy etc.

SOFTWARE AND HARDWARE REQUIREMENTS

Software requirements include choosing the operating system, features, graphics requirement, and design constrains. We have different options to work with this project and all the options we have are mentioned below. And for our convenience we chose Anaconda.

[1] Anaconda version 3.7
[2] Python ide version 3.7
[3] Google colab
[4] Jupiter

PC/ Laptop with processor Intel core i3 or above & RAM of 4GB or above. These are the Hardware requirements.

RESULTS

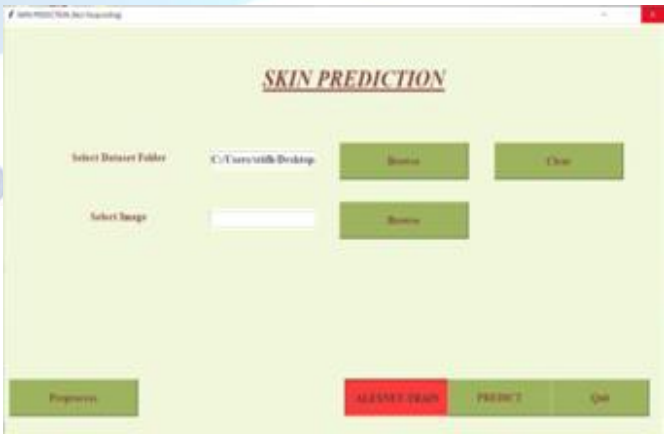

Fig. 8 Skin Prediction User Interface

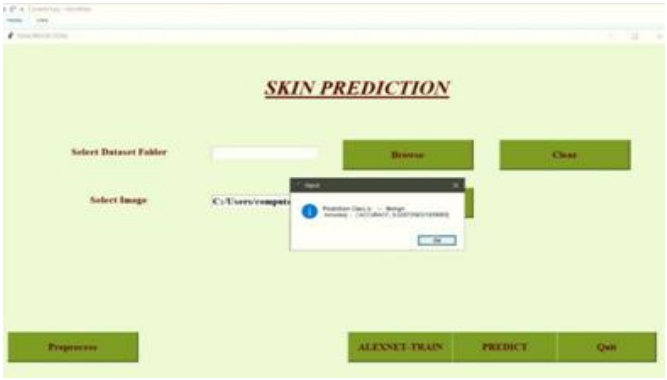

Fig. 9 Result as Output Dialog Box

It is evident from both the images above that after browsing for the desired input image and its folder path, we can predict the output as either benign or malignant tumor which appears on the popped up dialog box along with its accuracy value. We also have preprocess, AlexNet Train, Quit and Clear buttons or options available on the interface. When an option is selected the appropriate assigned action is performed. For suppose if we select AlexNet Train we get its accuracy, loss, metrics value and such parameter graphs get displayed.

FUTURE SCOPE

In our project, we gave an outline of deep learning achievements in the field of skin disease diagnosis. Initially, we will provide a quick overview of the subject and terms related to the skin cancer. Moreover, techniques for acquiring skin images and freely available datasets are discussed. Furthermore, the idea and advanced deep learning architectures, as well as widely used machine learning methodology, are presented. Next, we offer performance assessment measures and discuss deep learning applications to skin cancer detection based on various activities such as classification, categorization, multi-task learning, and random.

Following that, we explore the remaining issues associated. Detection of cancers on skin using deep learning: an overview of two prominent approaches to detect the skin diseases(cancer) and suggestions for future research paths Eventually, we provide a summary of the entire paper. This article, in comparison to previous relevant literature reviews, follows a comprehensive examination of the subject of skin cancer diagnostics. In reading the essay, one may have an innate understanding of the basic principles in the subject of skin cancer detection, as well as the obstacles encountered in this subject.

Furthermore, those who are interested in working in this sector around the world might investigate a variety of approaches to addressing these issues. The possible advantages of using deep learning to automatically diagnose skin disorders are enormous. Nevertheless, correct detection raises the necessity for dependable detection processes that may be used in the disease detection by professional doctors. One could also see that several deep learning methods are being presented and have demonstrated equivalent or higher diagnostic performance on skin disorder images. Therefore, we must be mindful that only an automated skin-cancer detection model, should be thoroughly evaluated prior being used in real-world clinical detection activities.

CONCLUSION

This paper is mainly about the model built with the help of CNN and ALEXNET structure for the skin image diagnosis of two common diseases on the skin majorly and built over a dataset that includes images of benign and malignant skin diseased persons. The outcomes show that CNNs are capable of recognizing and classifying skin disorders. The work done by our team gave significant results of accurate detection of the skin cancer and we also learnt that the internal modifications can improve the efficiency of the system. Our current model is able to detect to main types of skin diseases, one of them being a deadly cancer. By far, the system has a better accuracyand it can still be improved by increasing the dataset sizes. This model can directly be a part of the real-life diagnosis by making minor improvements. Convolution Neural Networks could be the future of prediction software applications because of its robustness and accuracy. By using ALEXNET, the efficiency and performance of the applications can be improved in the algorithms. Apart from CNN, other architecture may also be implemented to improve the accuracy of classification.

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