



Convolutional Neural Network Model for Predicting Skin Based Diseases and Evaluation of Risk Assessment

S.A.K. Jainulabudeen, S. Murugavalli, H. Shalma

Abstract: In today's dynamic lifestyle, with people not prioritizing hygiene as an essential entity, they tend to get more easily prone to skin diseases. As a result, it has become highly significant to devise an automated mechanism which helps users to predict a disease using simple methodologies such as input in the form of images. In our case we have used Convolutional Neural Networks to diagnose the same. The disease prediction system uses simple methodologies including taking user input in the form of images, which aids in providing more accurate results. As the concept used is Convolutional Neural Network (CNN), the system not just analyses the input and predicts the disease based on it, but also guesses the nearest possible result based on its feature and adds that record to that class of disease for future predictions. Over a longer period of time, this majorly helps in preventing hazardous skin diseases from causing widespread damage, as spreading of skin diseases is highly rapid and difficult to control, the ultimate aim through this project is to overcome the above limitations and help create awareness amongst people on skin diseases, which happens to be a growing concern in the near future.

Index Terms: Skin diseases, Convolutional Neural Networks, Datasets, Prediction, Geo location.

I. INTRODUCTION

Day by day, despite the growth of technologies and advancements in the fields of medicine, the rate of people being affected by diseases [1] has seen no decline. What makes things worse is that most of these diseases are left unknown till their last stages, leaving them with lesser chances of survival. Lack of systems to create awareness amongst public has claimed many lives, the reasons for the same being many. Some of them are financially infeasible in consulting a doctor, while some other doesn't have the time to do so, and some others do not have adequate realization on the extents of their impact.

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Thus, at this stage to maintain the balance between growth in the medical field; care should also be simultaneously taken that the people are well aware of what comes ahead of them. The Location based disease control system [2] mainly solves this concern.

The project is implemented in the form of an application, designed for web and mobile interfaces where the users (residents of a particular area) can register themselves, and make an entry of any minor medical complaints they face, which are likely to be symptoms of a much major skin disease. For eg. If person is having lot pimples in face persisting for a longer period then it may be Acne or Scabies. The system detects the disease based on the symptoms, analyses it and stores the record in a database. It further evaluates other records having similar symptoms and finally generates a report, with necessary statistics and consultations. Another added feature in this project is that the system itself maintains a record of the diseases in a particular area, and if it is seen to exceed a particular number in that area, an alert is sent to the nearest public health care center of that region, which could declare the region epidemic to that disease and issue necessary health advisories, vaccines and intimate the doctors and public..

II. EXISTING SYSTEM

Feed forward back propagation artificial neural network is used in most of the existing systems, where the nonlinear data may not be evenly distributed. The data gets transformed by the Hidden layer (middle layer) of the multilayer network [3] and learns the data transformation [4] to make it linearly separable. This is an approach which gives comparatively less accurate results

A. Feed Forward Neural Network (FFNN)

These FFNN systems make use of single perception, multiple perception or Hidden layer network. The inputs are fed in such a way that no cycle is formed. Thus only the forward nodes make use of the given input and thus, reuse cannot be possible in this case leading to lesser accuracy [5]. In single perception FFNN, the inputs are fed directly to the output node using few weights. Other networks used are hidden layer etc..

B. Hidden Layer Neural Network (HLNN)

The hidden layer neural networks uses concept of abstraction.



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In these networks the input is fed to output nodes [6] as a result of a function. The estimation of output is based on the provided input. This results in a slightly more [7] accurate result, however as the input is used only once, the possibility of cycle being formed is limited, thus achieving high accuracy is impossible [9]. Thus an alternate solution is formed which is using convolutional neural networks [8] [12] which will increase the accuracy and performance of the system to a larger extent.

III. PROPOSED SYSTEM

Uses convolutional neural network which is more accurate and datasets are faster to train. Convolutional neural network is a type of neural network which has some or all convolutional layers, it performs better in terms of large scale data and real time usage.

The main contribution of our approach is as follows:

1. A skin disease detection approach is proposed, which is based on convolution neural network using Gradient Descent Algorithm [10]. Besides some scalable applications are proposed, for example, we explore how the system is identifying the diseases based on deep learning [11] [12]. This showed significant improvement in accuracy of skin disease detection.
2. Datasets and KERAS are used

Features of Proposed System

- Based on the application the user can easily and clearly understand about the disease
- User will consult a doctor after knowing about the disease

The convolutional models are prototyped and build using KERAS. The python web framework called flask is used to interact with the firebase and host web API.

IV. ARCHITECTURE OF DISEASE PREDICTION SYSTEM

The disease prediction consists of the following modules such as user interface module, convolutional deep neural network, database and python web framework. The user interface is developed for both web and mobile applications.

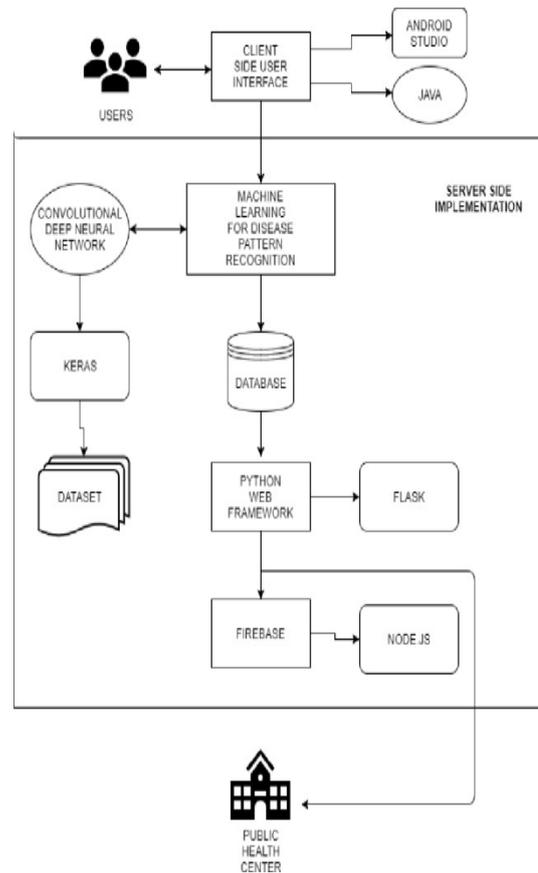


Fig.1 Architecture of Disease Prediction System

V. MODULES

A. Front End Technologies

Android application for android based mobile phones. Provides Front end User Interface for Android based mobile phones like Samsung, Mi, etc. As it is a mobile application it uses cocoa controls in the front end. The language used here Java. For that we have used Android studio IDE for Development.

B. Convolutional Neural Networks Model

Uses deep neural networks technology, a technology where networks are composed of several layers. Each layer is being made of a number of nodes. The networks interpret sensory data through a kind of machine perception, labeling or clustering raw input. The library used for this purpose is KERAS

A a) KERAS

Do not. KERAS is an open source neural network library which has various classes and packages which are helpful in designing the neural networks. It provides prototyping for both convolutional networks, as well as combinations of the Runs seamlessly on CPU and GPU. It is written in python which makes it more users friendly, modular and extensible. It is capable of running on the top of CNTK, TensorFlow or theano

A b) Why KERAS

The input to our system is in the form images, which in turn taken by the computer as the pixels and its related color model, so the data set is very large. Hence we are in need of a fast prototyping and this can be achieved easily by the Keras. Also Keras contains the most commonly used neural network building blocks such as layers, models, optimizers, objectives etc. It also provides host of tools to work with image and text data. This makes our job easier and simpler. As it is a open source software available in GitHub we need not to pay to use this API. Thus Keras is the in this thesis. Though it is a open source it has the maximum number of features next to Google framework TensorFlow.

c) Using KERAS

In this system the different libraries of keras such as Models and Layers are used. From the Models package classes like Sequential is used. From the Layers library various classes like Dense Flatten, Maxpooling2D, Conv2D, Averagepooling2D, LeakyReLU are used to build the convolutional neural networks.

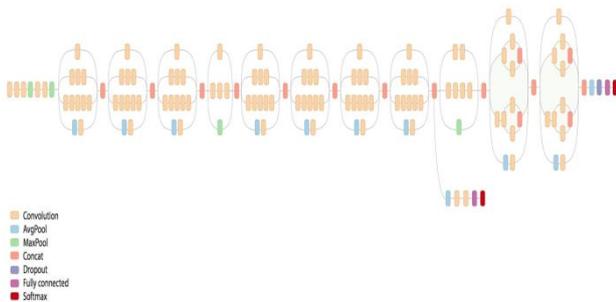


Fig. 2 Convolutional Model Build Using KERAS [7]

d) Kaggle Datasets

Along with these, we also make use of Kaggle Datasets which has collection of thousands of diseases. The datasets available for the same in Kaggle has been verified. The result from the machine learning model dataset is sent in JSON format to the Client’s UI application.

e) Python Web Framework

As the application is developed to support both web and mobile interfaces we are in need of an web Framework or a web application framework. Since our application is developed in python we make use of a python web framework for the development of web applications like web services, web resources and web APIs. The Web framework [9] [11] used here is Python Web Framework using Flask. There various python web frameworks available like Django, which is the most common framework, but in our system we use Flask. Flask is used instead of Django because flask is a microframework, which means it does not require a particular tool or a library, has DAL(Data Abstraction Layer), form validation, etc which need functions from third party applications. The data being collected is processed and any updates made are done through the server connected to this

framework. Node.js is an opensource, cross-platform. JavaScript run time is used for executing server side. The part of the Node.js code analyses the data results and if seen to exceed the prescribed number, it returns message stating an epidemic having occurred.

C. Back End Technologies

The backend uses the following technologies and the database used here is SQL server 2015 and also we use firebase database framework to collect and analyze datasets.

a) Firebase

The mobile counterpart of the same is done using Firebase. Firebase uses analytics, which sends a push notification to the user in case of an epidemic. Firebase and Node.js is used to analyze the data and provide a realization to the user on the current statistics. The system has been designed in the form as an alert system which intimates the users on whether the disease is spreading.

b) MYSQL Server

The MYSQL Server is used for the following functions. It is used to maintain patients records; area wise, district wise, state wise and across the nation. Must be able to gather data from all users and segregate accordingly. Perform analysis on data in the backend for providing Disease Analysis, Statistics, Prediction, Awareness, Prescription and Suggestions.

VI. PERFORMANCE ANALYSIS

To analyze the performance of the system two factors are considered here such as Accuracy and Loss.

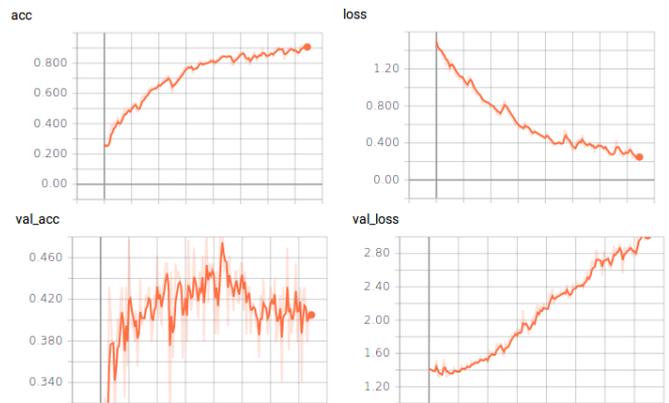


Fig. 3 Accuracy and Loss

The above graphs show accuracy, loss, Validation accuracy and Validation loss of the system in predicting the skin diseases and analysis respectively

VII. SURVEY ANALYSIS

Survey analysis is the rate of analyzing over a scale of people as compared to the total number of cases affected with that particular disease.



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The image classes used in datasets included about 300-500 images taken as survey input per disease.

Table 1. Performance Report

Disease	Analysis	Reading	Accuracy
Psoriasis	10 to 30 %	1.25	94.06 %
Impetigo	140 million people (approximately 2 %)	3.34	93.42 %
Tineacorp oris	10 to 20 % of people in the world	4.24	95.22 %
Vitiligo	50 million people (Approximately 2%)	7.33	98.81 %

VIII. BENEFITS

Acute prediction of diseases available first on hand to every citizen who uses this application, Disease Analysis [9] possible right from home, sparing the need to visit Hospitals, Nursing homes or health centers. Statistics on intensity, severity of the disease, past records and present records of others affected by similar disease presented in user interactive formats. The system also makes use of geo-location access, through which it becomes easy to identify whether a particular disease has become epidemic with respect to that particular location Awareness, Suggestions and first aid tips for every disease for quick user reference. Diseases, when identified quicker can be averted or cured much easier. Eases the jobs for Government Healthcare bodies, Corporation Health officials etc.

IX. CONCLUSION AND FUTURE WORKS

Thus the proposed new system of location based disease prediction system for predicting skin diseases has been developed and tested by applying a variety of transformations on the images. The results obtained displayed better accuracy as compared to the Feed Forward Back Neural Network mechanism [13], exhibiting an average accuracy of 91%. Also a report gets generated in the end which displays details relevant to the disease bound to that corresponding geo-location. This helps in educating the user by providing a user friendly report regarding the diseases. The system may increase the exact location tracking method [14] [15] and fine clear location also can increase the performance of identifying the system easily. Here we made a few example disease and few example images [16] [17] in a data sets to identify, In future many skin diseases and not only disease based on skin every type of disease and wound can be implemented in the system for future enhancement

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