IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

EPIDERMAL EXAMINATION FOR CLASSIFICATION OF SKIN ANOMALIES USING CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT

This project addresses the demand for an intelligent and rapid classification system of skin diseases - Acne, Melanoma, Psoriasis, Rosacea, Vitiligo using highly-efficient convolutional neural network. Diseases like Melanoma can be prove to be fatal if not identified early. Thus, identifying the diseases at early stages is critical to save lives. Towards this goal we propose a system that uses recent deep Convolutional Neural Network learning methods that are capable of classification of skin disease. The model is trained with labelled data of the skin diseases. Using feature extraction, the features of the diseases like the diameter, color and border are identified. The features are then summarized while retaining the important information. Then, the image of the skin lesion is loaded into the model along with various factors like the patient's history, drinking or smoking habits and results of the tissue testing. These factors help provide additional information about the patient to produce more accurate results. The system then classifies the type of skin disease along with the severity of the diseases based on the trained data. Automated systems capable of detecting diseases could save lives, costs and reduce needless interference.

Keywords- Anomalies, Convolutional Neural Networks, Feature Extraction, Classification

I.INTRODUCTION

Skin diseases are is primarily diagnosed visually, beginning with an initial clinical screening and followed potentially by dermoscopic analysis, a biopsy and histopathological examination. Automated classification of skin lesions using images is a challenging task owing to the fine-grained variability in the appearance of skin lesions.

Deep convolutional neural networks (CNNs) show potential for general and highly variable tasks across many fine-grained object categories. Here we demonstrate classification of skin lesions using a single CNN, trained end-to-end from images directly, using only pixels and disease labels as inputs. The deep learning CNN exhibits reliable cancer classification when tested on a larger dataset. We tested the CNN on more images to demonstrate robust and reliable cancer classification.

II.RELATED WORKS

The authors “R. Rastghalam, H. Danyali, M. S. Helfroush, M. Emre Celebi and M. Mokhtari”, proposed an automatic method for detecting melanoma in skin microscopic pictures. The suggested method collects texture and statistical histogram information from the microscopic sub-image, then uses asymmetric analysis and the retrieved data to estimate tumour location. The final choice is made using a fusion-based HMM classifier that is trained for each sub-image using the EM approach. The classifier's parameters are optimised using EM, which merges the retrieved features and makes an optimal judgement for each sub-image at the same time. Melanoma may be recognised in each pathology sample utilising textural characteristics and a fusion-based HMM classifier, according to our findings. A modest number of examples were used to calculate the Gray level parameters.[1]

The authors "Vimal K. Shrivastava, Narendra D. Londhe, R.S. Sonawane and Jasjit S. Suri", presented a computer-aided diagnosis (CADx) method for automatically classifying psoriasis skin pictures into psoriatic lesion and healthy skin The complete feature extraction and feature selection technique in the support vector machine paradigm is one of the proposed system's primary merits. The main contributions of this work are summarized as follows: (1) use of three novel redness features; (2) comprehensive feature space with 46 features such as grayscale, color space, redness and chaoticness;(3) feature selection process to obtain the optimal features which provides a reliable and an accurate system for classification; (4)relationship between classification accuracy and data size is successfully demonstrated leading to system generalization.[2]

The authors "Amir Mirbeik-Sabzevari and Negar Tavassolian" devised a system which uses skin-like semisolid phantoms to simulate the interaction of millimetre waves with the human skin and the tumour. Deionized water, oil, gelatin powder, formaldehyde, TX-150, and detergent are mixed together to create normal and malignant skin tissues. Over the frequency range of 0.5–50 GHz, the dielectric characteristics of the phantoms were measured using a slim-form open-ended coaxial probe in conjunction with a millimeter-wave vector network analyzer.[3]

The authors "Nasim Alamdari, Kouhyar Tavakolian, Minhal Alhashim and Reza Fazel-Rezai" presented various picture segmentation approaches for detecting acne lesions, as well as machine learning methods for distinguishing different acne lesions. The purpose of segmentation is to divide the image into portions with reasonably similar visual appearances or that match items or parts of objects. For classification fuzzy c-means method (FCM) and Support Vector Machine (SVM) was used.[4]

The authors "Jyotsna Anthal, Anand Upadhyay and Ashish Gupta" propose a system to classify Vitiligo using learning vector quantization model. The number of input layer neurons, number of output neurons based on the class vector, learning rate, and types of LVQ neural network learning were all necessary when designing the LVQ neural network method in Matlab. The LVQ neural network is tested using testing datasheets, and the accuracy of classifiers is calculated using the testing dataset. The impacted area is also detected by feeding the complete image to the LVQ neural network, with the affected area represented by a pseudo colour in the image.[5]

III.PROPOSED SYSTEM

A model-driven architecture, that uses deep Convolutional Neural Network Machine learning algorithms in its core implementations, is used to construct models that assist in predicting skin cancer with improved accuracy. The study illustrates the method of building models and applying them to classify the skin anomalies

The data set of the skin lesions like Acne, Rosacea, Melanoma, Vitiligo and Psoriasis is fed into the model. In data preprocessing, the data is cleaned by removing irrelevant and noisy data. Feature extraction is the next step of the process in which the features like border, color and type of each skin disease is identified in order to classify the different types of skin disease. Using these above parameters, the model is trained using the appropriate Convolutional Neural Network Algorithm. When an input is received the features of the image is identified and the model classifies the image as either Acne, Rosacea, Melanoma, Vitiligo or Psoriasis

A. Dataflow Diagram

A data flow diagram (DFD) depicts a system's overall data inputs, processes, and outputs. Lines and arrows are commonly used to represent flows, whereas rectangles and ovals are used to represent distinct outcomes. In order to keep the data orderly and logical, the real results are printed along the lines and in the shapes.

The following data flow diagram show how the dataset is processes starting with feature extraction and finally how the prediction is made.

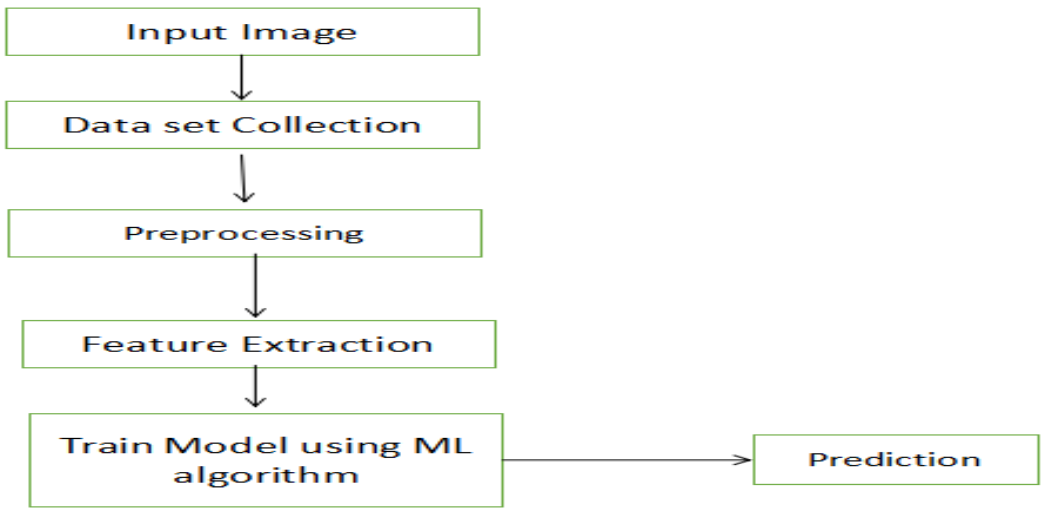

Fig. 1. Data Flow Diagram

B. USE CASE DIAGRAM

A use case diagram is a form of behavioral diagram specified by and derived from a Use-case analysis in the Unified Modeling Language (UML). Its goal is to offer a graphical representation of a system's functionality in terms of actors, goals (expressed as use cases), and any dependencies between those use cases. A use case diagram's principal aim is to indicate which system functions are performed for which actor. The actors here are the user and the system. The user feeds the dataset of different skin diseases to the system and instructs the system of how to classify these images by defining the suitable Machine Learning algorithm. The system then classifies the skin images accordingly.

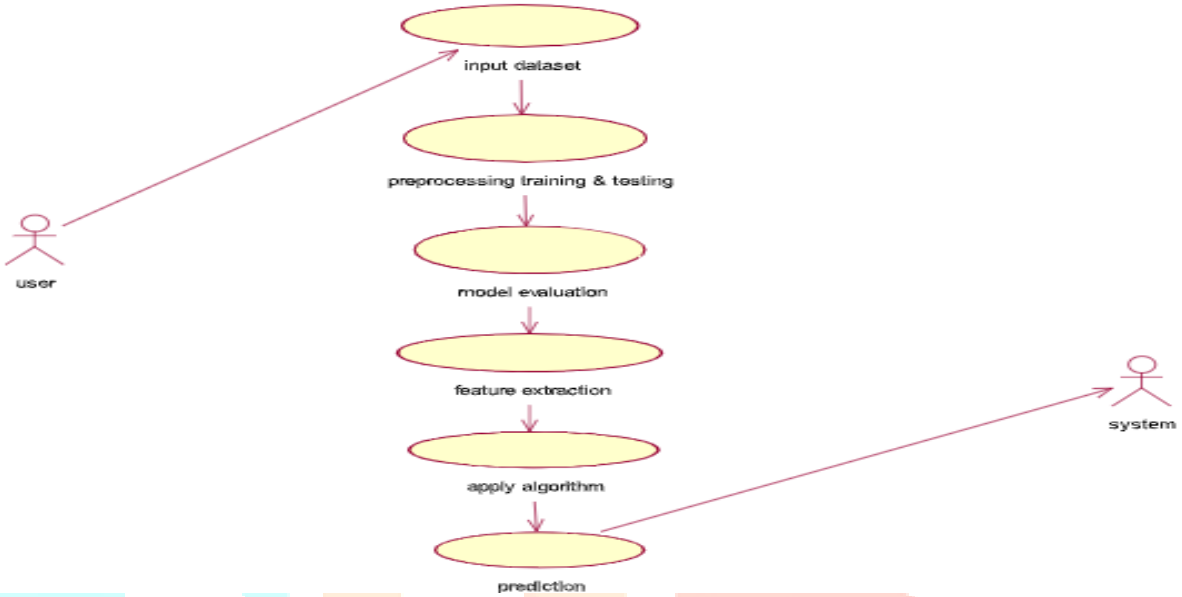

Fig. 2. Use Case Diagram

C. MODULE DESCRIPTION

Data Preprocessing

It is a technique for converting unclean data into a clean data set. In other words, anytime data is received from various sources, it is collected in raw format, which makes analysis impossible.

During preprocessing, data goes through a sequence of steps:

a) **Data Cleaning**: Filling in missing values, smoothing noisy data, and addressing data discrepancies are all examples of data cleansing operations.

b) **Data Integration**: Data from several representations is combined, and internal conflicts are handled

c) **Data Transformation**: The process of converting data from one format to another is known as data transformation.

d) **Data Reduction**: In a data warehouse, this phase seeks to give a condensed version of the data

Feature Extraction:

Feature extraction is a dimensionality reduction procedure that reduces a large set of raw data into smaller groupings for processing. The enormous number of variables in these large data sets necessitates a lot of computational resources to process. Feature extraction refers to strategies for selecting and/or combining variables into features in order to reduce the amount of data that needs to be processed while still accurately and thoroughly characterizing the original data set.

Model evaluation: We apply the machine learning algorithm for testing part and get the accuracy of this model.

Classification: Classification is a well-known machine-learning-based data mining technique. Essentially, classification is the process of categorizing each item in a set of data into one of a number of specified classes or groupings.

TensorFlow

TensorFlow is a open source and cost-free machine learning framework. It's a symbolic math toolkit that performs many tasks including deep neural network training and inference using dataflow and differentiable programming. It enables programmers to design machine learning applications by utilizing a variety of tools, frameworks, and community resources. TensorFlow is a Google project. TensorFlow is written in the Python programming language, making it a simple framework to grasp. By receiving inputs as a multi-dimensional array called Tensor, TensorFlow allows you to create dataflow graphs and structures to define how data goes through a graph. It lets you to create a flowchart of operations that may be performed on these inputs, which travel in one direction and out the other.

Keras

Keras is a Python-based Open-Source Neural Network framework that operates on Theano or TensorFlow. It's built to be modular, quick, and simple to use. Low-level computation is not handled by Keras. Instead, it makes use of a library called the "Backend". Keras is a high-level API wrapper for low-level APIs that can be used with TensorFlow, CNTK, or Theano. The Keras High-Level API is responsible for how we create models, define layers, and set up numerous input-output models. Keras also compiles our model with loss

and optimizer functions, as well as the training process with the fit function, at this level. Keras in Python doesn't handle low-level API like creating a computational graph, tensors, or other variables because the "backend" takes care of that.

OpenCV

OpenCV (Open-Source Computer Vision Library) is a computer vision and machine learning software library that is free to use. OpenCV was established to provide a common foundation for computer vision applications and to accelerate the use of machine perception in consumer products. The library contains over 2500 optimised algorithms, including a large collection of classic and cutting-edge computer vision and machine learning methods. Complex tasks such as identifying and recognizing faces, identifying objects, classifying human actions in videos, tracking camera movements, tracking moving objects, extracting 3D object models, generating 3D point clouds from stereo cameras, stitching images together to generate an entire scene with a high-resolution image, and many others are made simple with OpenCV.

Matplotlib

Matplotlib is a data visualization and graphical charting package for Python and its numerical extension NumPy that works across platforms. As a result, it offers an open source alternative to MATLAB. Matplotlib's APIs (Application Programming Interfaces) can also be used to integrate charts in GUI programmes. The pyplot API includes a stateful interface similar to MATLAB. In reality, matplotlib was created as an open source replacement for MATLAB. a) matplotlib.pyplot.figure: The top-level container is Figure. Everything visualised in a plot, including one or more Axes, is included. b) matplotlib.pyplot.axes: Axes set the coordinates and contain the majority of the elements in a plot: Axis, Tick, Line2D, Text, and so forth. It's the place where data is shown. The X-Axis, Y-Axis, and perhaps a Z-Axis are examples of axes

NumPy

NumPy is a Python library for computing and processing multidimensional and single-dimensional array elements. It's a Python extension module that's primarily built in C. It has a number of routines that can execute numeric operations quickly. NumPy implements multi-dimensional arrays and matrices, among other powerful data structures. These data structures are used to compute arrays and matrices in the most efficient way possible. NumPy makes it simple and efficient to deal with large amounts of data. NumPy also makes matrix multiplication and data rearrangement easy. NumPy is quick, making it possible to work with enormous amounts of data.

OS

In Python, the OS module contains functions for communicating with the operating system. Python's standard utility modules include OS. This module allows you to use operating system-dependent functions on the go. Python's built-in operating system dependent modules are designed to use the same interface as long as the same functionality is accessible. The os module also provides extensions specific to a given operating system, although utilizing them ultimately compromises portability.

IV.RESULTS

In this page, the file which contains the image of the skin is chosen and added into the module. The additional factors like family history, smoking and drinking habits of the patient, exposure to UV rays, skin allergy etc., is selected. These factors provide additional information and can be used to produce accurate results.

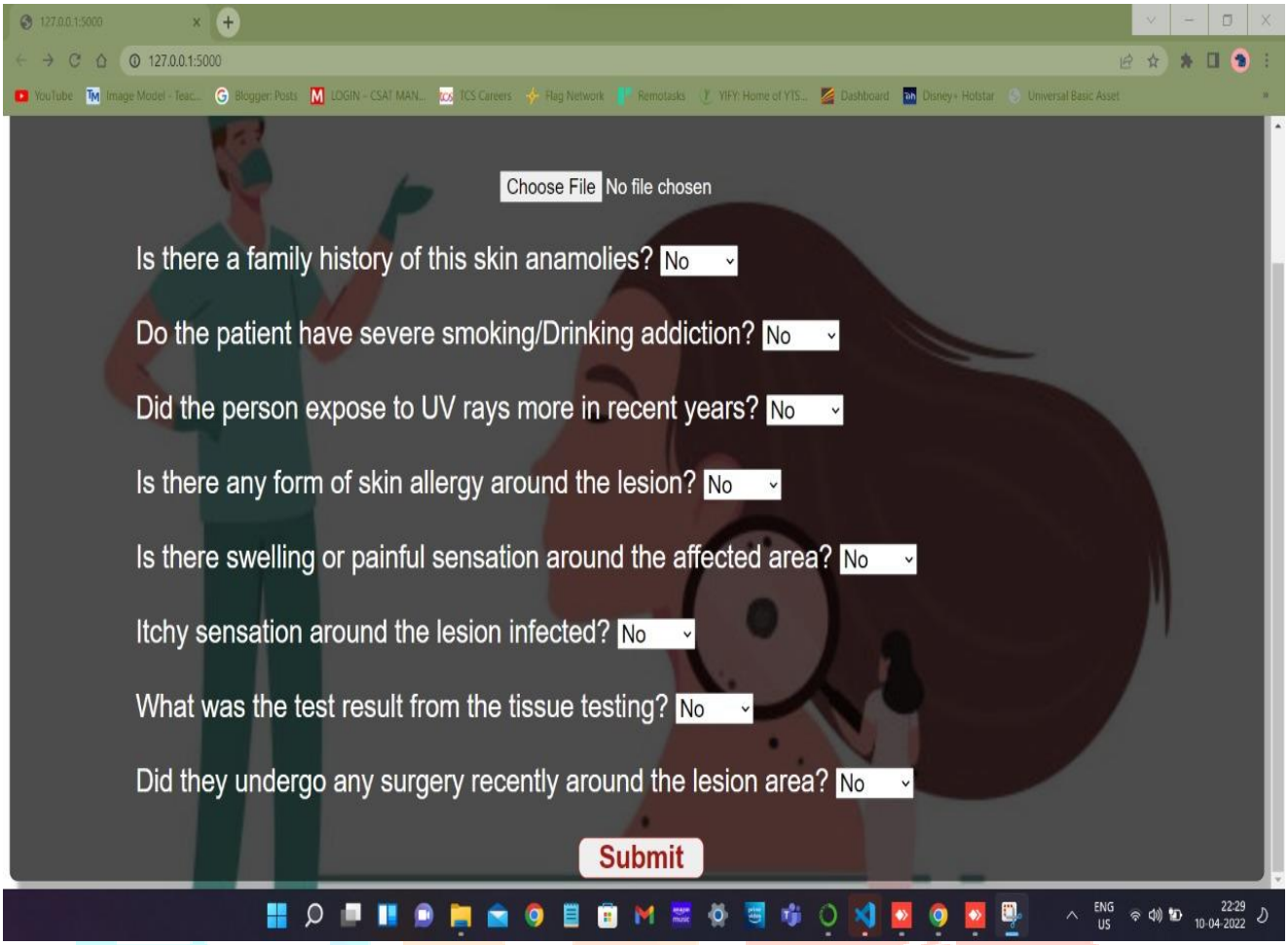

Fig. 3. Image and Parameter Selection

In the next page, the system classifies the image as either Acne, Rosacea, Vitiligo, Melanoma or Psoriasis. The factors which are provided earlier is useful in determining the severity of the disease

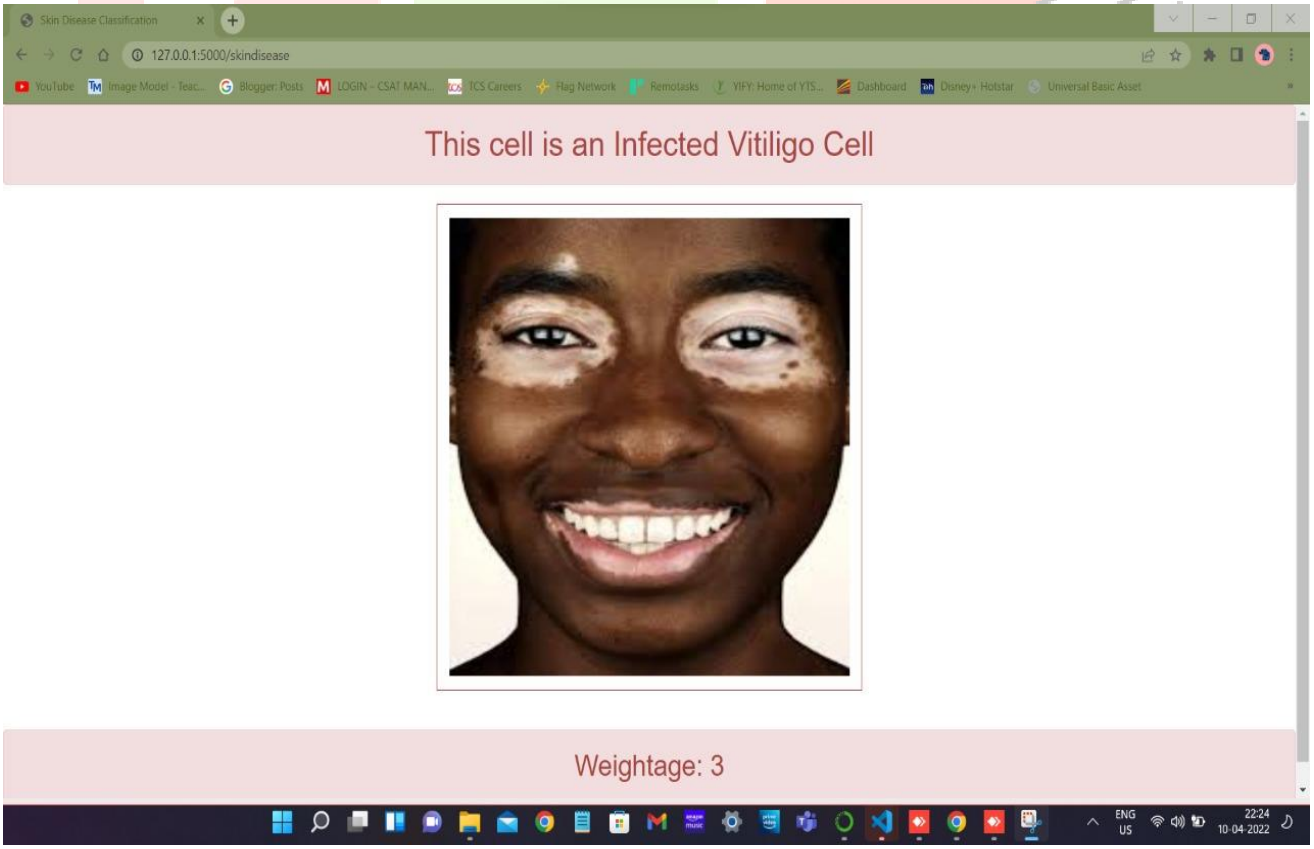

Fig. 4. Output with Weightage

The below graph depicts the accuracy of the system

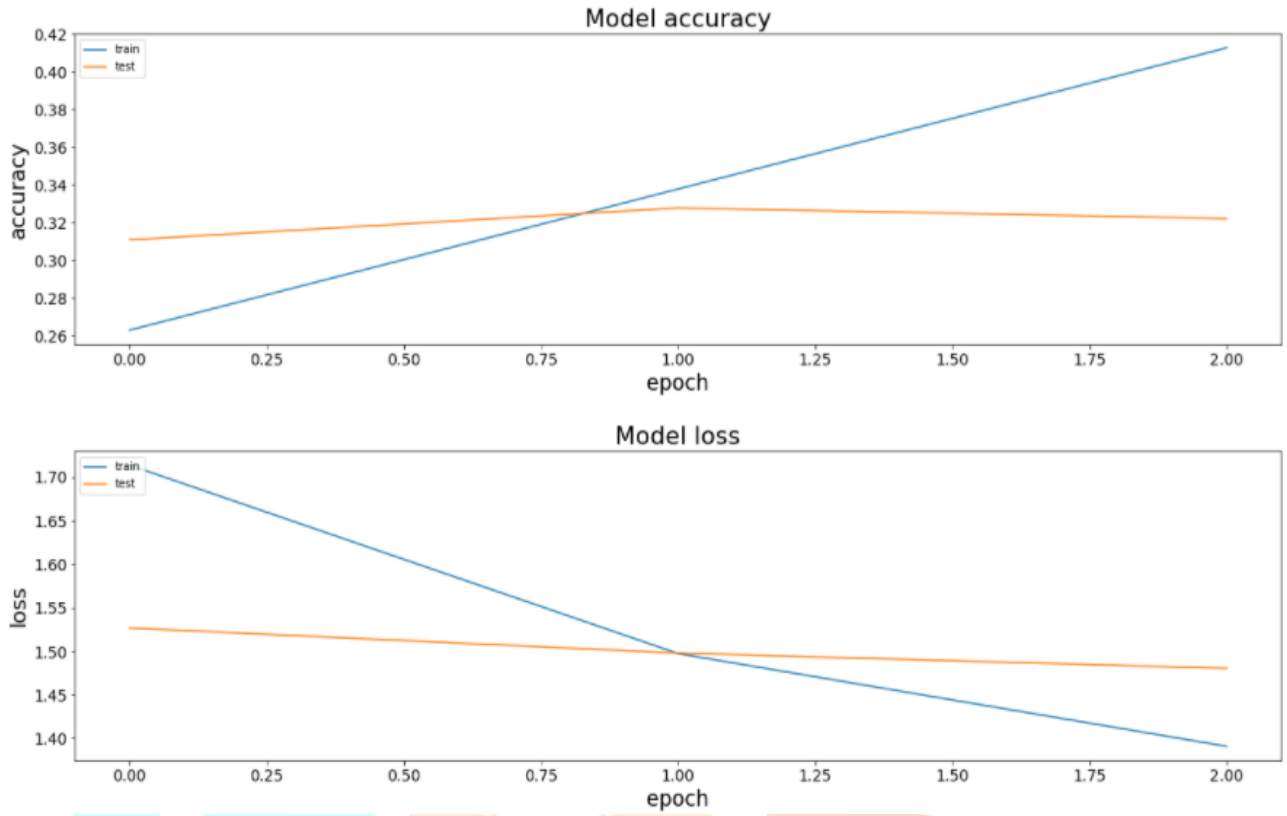

Fig. 5. Accuracy Graph

V.CONCLUSION AND FUTURE WORK

The skin is the crucial part of the human body. Different factors influence the skin, including lifetime sun exposure (UV radiation), sunlamps and tanning salons, and medications (a few anti-toxins, hormones, or antidepressants that make skin more sensitive to the sun), all of which increase the risk of skin diseases. Convolutional Neural Network classifiers are used in the proposed framework to examine and identify whether the supplied input image has been altered by any skin anomalies or not. This increases overall productivity while simultaneously reducing computational time.

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