Acne Detection and Care System

PROJECT SYNOPSIS

OF MAJOR PROJECT

BACHELOR OF TECHNOLOGY

Computer Science and Engineering

SUBMITTED BY

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(August 2022)

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Project Synopsis

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DECLARATION

We hereby declare that this submission is our work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degreeor diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

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ACKNOWLEDGEMENT

It gives us a great sense of pleasure to present the synopsis of the project "*Acne Detection and Care System*" undertaken during B.Tech. Third Year. We owe a special debt of gratitude to Our guide **Dr. Sanjeev Sharma (Assistant Professor & Addl. Head, CSE)**, KIET Group of Institutions, Delhi- NCR, Ghaziabad, for his constant support and guidance throughout the course of our work. His sincerity, thoroughness and perseverance have been a constant source of inspiration for us. It is only his cognizant efforts that our endeavours have seen the light of the day.

We also take the opportunity to acknowledge the contribution of **Dr. Vineet Sharma, Head of the Department of Computer Science and Engineering** , KIET Group of Institutions, Delhi- NCR, Ghaziabad, for his full support and assistance during the development of the project. We also do not like to miss the opportunity to acknowledge the contribution of allthe faculty members of the department for their kind assistance and cooperation during the development of our project.

Last but not the least, we acknowledge our friends for their contribution to the completionof the project.

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Introduction to Acne Detection and Care System

The "Acne Detection and Care System" has been developed to override prevailing acne and pimples problems faced by the teenagers and young adults. This is developed to assit the acne patients for treatment on the basis of their demographic information such as skin type, gender, age.

Because these acne and pimples are so common, demand from the acne patients who would like to have their acne severity assessed professionally on a regular basis outstrips the availability of dermatologists to assess the acne severity. It is estimated that acne patients must wait for an average of over 32 days for an appointment with their dermatologist. This presents a big challenge and frustration for acne patients since it delays guidance on diet, life style and skin care products. And in some cases even dermatologists are not available for patients in a particular area or they are not even affordable by everyone.

Psychological issues such as dissatisfaction with appearance, embarrassment, self-consciousness, lack of self-confidence, and social dysfunction such as reduced/avoidance of social interactions with peers and opposite gender, reduced employment opportunities have been documented. For these reasons, timely diagnosis and treatment are important and desirable.

This system can lead to fast, accurate detection of the acne of users at a very initial stage based on the uploaded selfie images and will recommend medicines, creams and treatment plans including diet and skin care routines appropriate to the user acne severity.

Deep learning algorithms are introduced in acne detection to improve detection precision. However, it remains challenging to diagnose acne based on the facial images of patients due to the complex context and special application scenarios. Here, we provide an ensemble neural network composed of two modules: (1) a classification module aiming to calculate the acne severity and number; (2) a localization module aiming to calculate the detection boxes. This ensemble model could precisely predict the acne severity, number, and position simultaneously, and could be an effective tool to help the patient self-test and assist the

doctor in the diagnosis.

Hence, We described a practical approach to develop a CNN-based transfer learning regression model to assess the severity level of acne lesions from selfie images.

Rationale

Acne, medically known as acne vulgaris, occurs when pores become clogged with dead skin cells and oil. This creates blackheads, whiteheads and, as inflammation worsens, red pimples. Traditionally, acne severity assessment is made by the dermatologists in a clinical environment. Prescribed treatments are carried out by dermatologists, or over-the-counter skin care products are recommended based on the severity.

Because the disease is so common, demand from the acne patients who would like to have their acne severity assessed professionally on a regular basis outstrips the availability of dermatologists to assess the acne severity. It is estimated that acne patients must wait for an average of over 32 days for an appointment with their dermatologist. This presents a big challenge and frustration for acne patients since it delays guidance on diet, life style and skin care products.

This system can lead to fast, accurate detection of the acne of users at a very initial stage based on the uploaded selfie images and will recommend medicines, creams and treatment plans including diet and skin care routines appropriate to the user acne severity.

This will lead to an ease to the teenagers and the young adults in curing and treating their acne according to their skin type and other demographics. This will help those users where the dermatologists are not available or are available at a high fee which cannot be afforded by everyone.

Objective of Acne Detection and Care System

The main objective of the Project on Acne Detection and Care System is to detect the severity and nature of acne and pimples of the user and to recommend medicines, creams and treatment plans including diet and skin care routines appropriate to the user acne severity. This will lead to an ease to the teenagers and the young adults in curing and treating their acne according to their skin type and other demographics. This will help those users where the dermatologists are not available or are available at a high fee which cannot be afforded by everyone. The purpose of the project is to build an application program through with the acne patients can cure and treat their skin problems

on their own.

The main objectives are:

1. To build an acne detection and care system
2. To detect the skin type of the patient
3. To classify the acne and pimples type of the patient
4. To suggest remedies, skin care routines and medicines to the users on the basis of their skin type
5. To help the user to find dermatologist available for the treatment

Functionalities provided by the Acne Detection and Care System

1. It deals with daily monitoring of the acne severity and skin conditions

2. It shows the skin care routines to be followed by the patient during the treatment.

3. It suggests the diet and hygiene to be followed by the patient.

4. It shows the medicines and creams along with their prescribed dosage for acnes.

5. It suggests the appointment to the respective dermatologists.

Scope of Acne Detection and Care System

This project can be further extended by integrating with E-Commerce as the user can order the prescribed medicines and creams from the web application as well and can get them delivered at their doorstep. It can be also used for booking appointment to the nearby dermatologists and to take online prescription from the specialized doctors in case of major severity. This will make an easy, fast and reliable treatment of the patient's acne and thereby the acnes can be cured at a very initial stage of severity. Due to lack of dermatologists and the negligence due to delays in appointments, the severity of acne and pimples increases and reached at a stage where even after the cure and treatment they are left with noticeable facial marks and scars. This project can eliminate this negligence and helps the patient to be free from every type of facial problems and scars.

Hence, this project in future can solve a huge persisting problem of acne and pimples among the teenagers and young adults.

Features of Acne Detection and Care System

1. It satisfy the user requirement.

2. Easy to operate

3. Have a good user interface

4. Easy to understand by the user

5. Accuracy in work

6. Treatment becomes very speedy

7. Access to any medicinal information

Literature Review

Acne, medically known as acne vulgaris, occurs when pores become clogged with dead skin cells and oil. This creates blackheads, whiteheads and, as inflammation worsens, red pimples. Traditionally, acne severity assessment is made by the dermatologists in a clinical environment. Prescribed treatments are carried out by dermatologists, or over-the-counter skin care products are recommended based on the severity.

Because the disease is so common, demand from the acne patients who would like to have their acne severity assessed professionally on a regular basis outstrips the availability of dermatologists to assess the acne severity. It is estimated that acne patients must wait for an average of over 32 days for an appointment with their dermatologist. This presents a big challenge and frustration for acne patients since it delays guidance on diet, life style and skin care products. To fill this gap, NSH collaborated with Microsoft to develop a consumer mobile app for acne assessment. There are two main functions of the mobile app: 1) accurately assess the acne severity of users based on uploaded selfie images, and 2) recommend treatment plans appropriate to the specific level of severity, factoring in demographic information such as gender, age, skin type, etc.

The main contributions of this work are summarized as follows:

(1) We describe the first mobile application for acne assessment that has accuracy on the level of a dermatologist using just cell phone selfie images instead of clinical high-resolution images. (

2) We propose a novel image augmentation approach for facial images which addresses the spatial sensitivity problem of CNN models on small training data. It significantly improves the generalization of the model on test images.

(3) We build a real-world skin management mobile application facilitating the whole treatment cycle comprising dermatologists, users, and skin care products.

Here they propose a coupling method for skin patch extraction for both frontal face images and side view images. The facial landmark model is the first step. If no face was detected in the first step, we employed the OpenCV One Eye model to detect the location of the single eye. The OpenCV model is an object detection model using a Haar feature-based cascade classifier. Based on the eye location, we inferred the regions of the forehead, cheeks and chin skin patches. So, from each face image we extracted 2-4 skin patches depending on the image view angle. The same overall acne severity label assigned by the dermatologists was assigned to all skin patches from the same image.

CNN models are spatially sensitive. It means that if a feature on a test image appears on a new location where the same feature had never been seen before on the training images, the CNN model cannot recognize it. This brings a significant challenge. First, the severity of acne does not depend on where the acne lesion is. Instead, it is mostly determined by the severity of each acne lesion, and how many there are. Second, the number of training images is small, and the acne lesions only appear in a limited number of locations. Therefore, the locations of acne lesion on the testing images are very likely to be new compared to the training images.

A key requirement of this real-world project was to deploy the system as a practical consumer mobile app. We operationalized the trained CNN model, together with the image augmentation steps as a Python Flask web service API using Azure Container Service (ACS) and Azure Kubernetes Service (AKS). This exposed a web service API which could be invoked from the mobile app, sending the selfie image as payload and returning an acne severity score.

They described a practical approach to develop a CNN-based transfer learning regression model to assess the severity level of acne lesions from selfie images.

The model was able to perform at the level of a trained dermatologist, allowing NSH to deploy a consumer app to assist in the treatment of this disease. The author proposed the coupling approach of facial landmark model and the OneEye OpenCV model to extract skin patches from different sectors of the face to eliminate background noise. Image rolling as an innovative data augmentation approach was critical to address the limited availability of labelled training data. Our results demonstrate that transfer learning regression with appropriate data augmentation is an effective method to train a domain-specific model despite a small sample training set.

NSH and Microsoft are working together to make this application globally available to the millions of people who are affected by acne. The app will enable an individualized experience for each customer with instantaneous analysis of selfie images and personalized guidance for treatment and management using interactive coaching.

TECHNOLOGY USED

NumPY: It is a python library which is used to work in domains of linear algebra and provides efficient results on multi-dimensional array.

Pandas: It is one of the crucial tool of Machine Learning which is mainly used for analysis and has various other features also such as cleaning, transforming and visualizing data.

Matplotlib: It is a comprehensive library for creating static, animated, and interactive visualizations in Python. Matplotlib makes easy things easy and hard things possible.

Tensorflow: It is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML-powered applications.

CNN : In deep learning, a **convolutional neural network (CNN/ConvNet)** is a class of deep neural networks, most commonly applied to analyze visual imagery. Now when we think of a neural network we think about matrix multiplications but that is not the case with ConvNet. It uses a special technique called Convolution

Reactjs: ReactJS is a **declarative**, **efficient**, and flexible **JavaScript library** for building reusable UI components. It is an open-source, component-based front end library which is responsible only for the view layer of the application. It was initially developed and maintained by Facebook and later used in its products like WhatsApp & Instagram.

METHODOLOGY

- The project starts with importing **NumPY**, **Pandas**, **Matplotlib**, **Pylot, Tensorflow** and other libraries

- Then we have to download the dataset of various images of infected leaves from **kaggle website** by the help of which we can train our model

- The data is than visualized using "imshow" which is used to show different types of leaves which are present in our dataset

- Then we apply Train-Test split to split our dataset according to test ratio.

- Then we apply Data augmentation to increase the number of labeled images. The classic data augmentation methods include vertical flipping, horizontal flipping, 90° counterclockwise rotation, 180° rotation, 90° clockwise rotation, random brightness decrease, random brightness increase.

- Then we Build and Train a **CNN** model using various layers and kernel size.

- Then we have to plot a training history graph.

- Then we have to Export model to a file on disk.

- Then we have to write fast API server around that model , which will help to generate working http server which we will be used in deployment in production.

- At last we have to build a website using **Reactjs** where we can drag and drop the image of various plant leaf and predict it's output whether it is healthy or not

DIAGRAMS

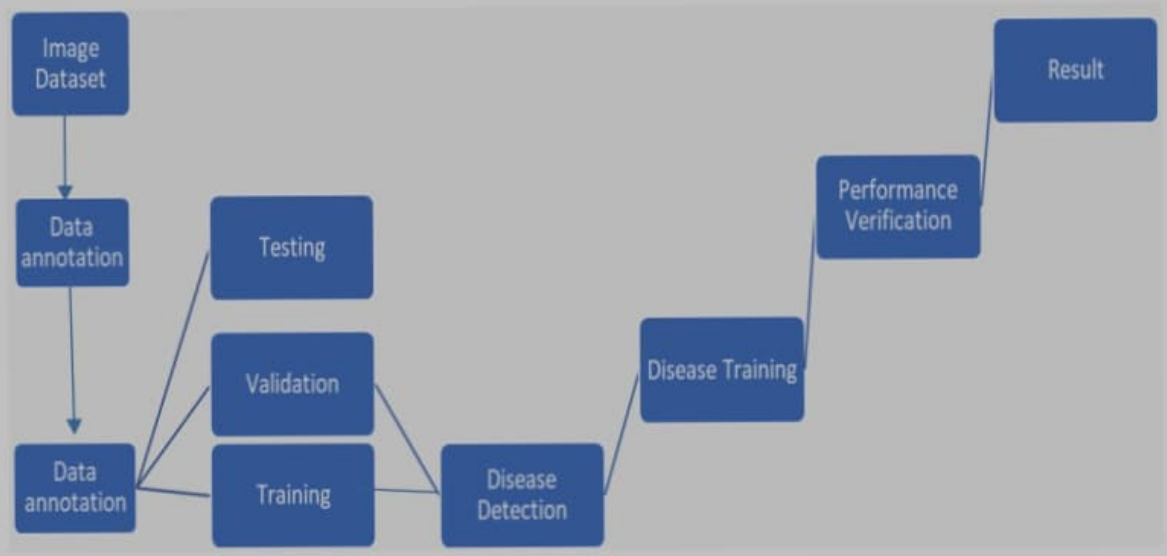

Fig.1 Flow Diagram of working Model

ARCHITECTURE DIAGRAM:

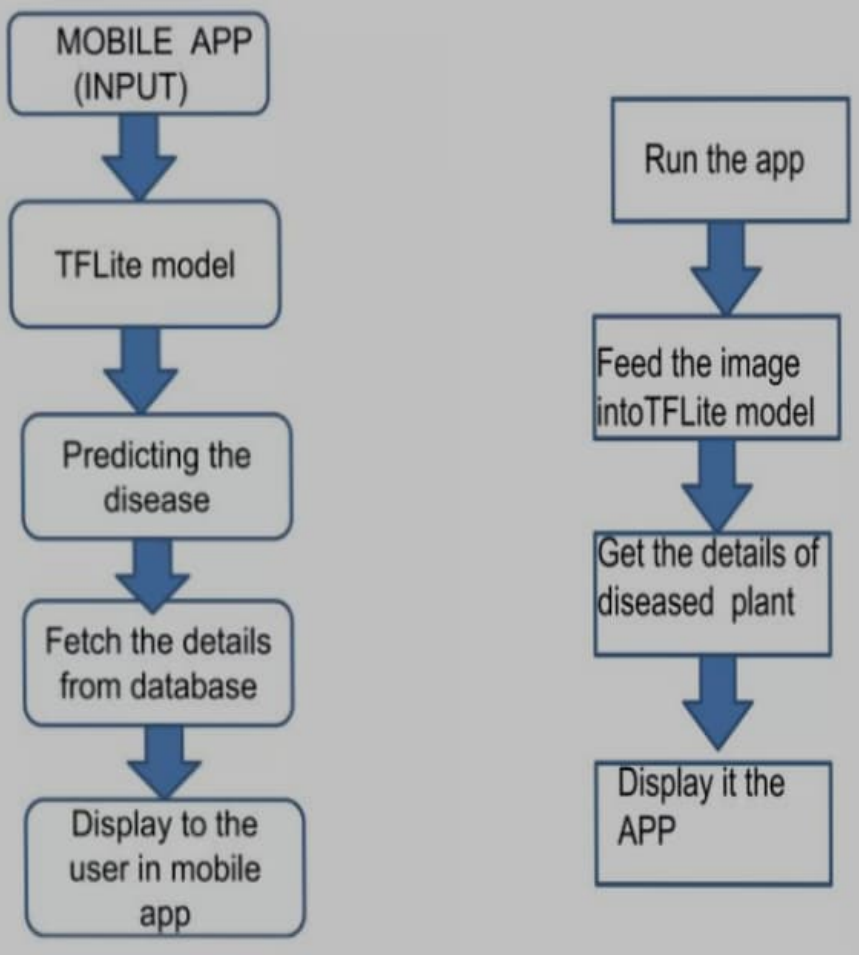

Fig.2 Architecture Diagram of Application working