A

Major Project

On

DEEP TRANSFER LEARNING FROM FACE RECOGNITION FOR FACIAL DIAGNOSIS APPLICATIONS

(Submitted in partial fulfilment of the requirements for the award of Degree)

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CMR TECHNICAL CAMPUS

UGC AUTONOMOUS

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2019-2023

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the project entitled **“Deep Transfer Learning From Face Recognition For Facial Diagnosis Application ”** being submitted by **A.RAHUL (197R1A05C6), B.L.V.PRASAD (197R1A05D1) & J.SHIVAPRANAV (197R1A05E1)** in partial fulfillment of the requirements for the award of the degree of B.Tech in Computer Science and Engineering to the Jawaharlal Nehru Technological University Hyderabad, is a record of bonafide work carried out by them under our guidance and supervision during the year 2022-23.

The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

Dr. K. MAHESWARI
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Submitted for viva voice Examination held on ___________________

ACKNOWLEDGEMENT

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ABSTRACT

The relationship between face and disease has been discussed from thousands years ago, which leads to the occurrence of facial diagnosis. The objective here is to explore the possibility of identifying diseases from uncontrolled 2D face images by deep learning techniques. In this paper, we propose using deep transfer learning from face recognition to perform the computer-aided facial diagnosis on various diseases. In the experiments, we perform the computer-aided facial diagnosis on single (beta-thalassemia) and multiple diseases (beta-thalassemia, hyperthyroidism, Down syndrome, and leprosy) with a relatively small dataset. The overall top-1 accuracy by deep transfer learning from face recognition can reach over 90% which outperforms the performance of both traditional machine learning methods and clinicians in the experiments. In practical, collecting disease-specific face images is complex, expensive and time consuming, and imposes ethical limitations due to personal data treatment. Therefore, the datasets of facial diagnosis related researches are private and generally small comparing with the ones of other machine learning application areas.

The success of deep transfer learning applications in the facial diagnosis with a small dataset could provide a low-cost and noninvasive way for disease screening and detection.

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1.INTRODUCTION

1. INTRODUCTION

1.1 PROJECT SCOPE

This project is titled “Deep Facial Diagnosis Deep Transfer Learning From Face Recognition To Facial Diagnosis”. The medical examination in many rural and underdeveloped areas because of the limited medical resources, which leads to delays in treatment in many cases. Even in metropolises, limitations including the high cost, long queuing time in hospital and the doctor-patient contradiction which leads to medical disputes still exist. Computer-aided facial diagnosis enables us to carry out non-invasive screening and detection of diseases quickly and easily. Therefore, if facial diagnosis can be proved effective with an acceptable error rate, it will be with great potential. With the help of artificial intelligence, we could explore the relationship between face and disease with a quantitative approach.

1.2 PROJECT PURPOSE

This project has been developed to perform the computer-aided facial diagnosis on single (beta-thalassemia) and multiple diseases (beta-thalassemia, hyperthyroidism, Down syndrome, and leprosy) with a relatively small dataset. The overall top-1 accuracy by deep transfer learning from face recognition can reach over 90% which outperforms the performance of both traditional machine learning methods and clinicians .

1.3 PROJECT FEATURES

The main features of this project is using deep transfer learning from face recognition to perform the computer-aided facial diagnosis on various diseases. In the experiments, we perform the computer-aided facial diagnosis on single like beta-thalassemia and multiple diseases like beta-thalassemia, hyperthyroidism, Down syndrome, and leprosy with a relatively small dataset. Therefore,the success of deep transfer learning applications in the facial diagnosis with a small dataset could provide a low-cost and noninvasive way for disease screening and detection.

2. SYSTEM ANALYSIS

2. SYSTEM ANALYSIS

2.1 PROBLEM DEFINITION:

It is still difficult for people to take a medical examination in many rural and underdeveloped areas because of the limited medical resources, which leads to delays in treatment in many cases. Even in metropolises, limitations including the high cost, long queuing time in hospital and the doctor-patient contradiction which leads to medical disputes still exist. Computer-aided facial diagnosis enables us to carry out non-invasive screening and detection of diseases quickly and easily. Therefore, if facial diagnosis can be proved effective with an acceptable error rate, it will be with great potential. With the help of artificial intelligence, we could explore the relationship between face and disease with a quantitative approach.

2.2 EXISTING SYSTEM:

Due to the scarcity of medical resources, it is still challenging for people to get a medical exam today in many rural and undeveloped areas, which frequently causes treatment to be delayed. Limitations still exist, such as high costs, lengthy hospital wait times, and doctor- patient conflicts that result in medical disputes, even in major cities. We can rapidly and easily do non-invasive screening and disease detection thanks to computer-aided face diagnostics. Therefore, facial diagnosis will have significant promise if it can be demonstrated to be effective with a tolerable error rate. We could use artificial intelligence to study the correlation between sickness and face using a quantitative method.

2.2.1 DISADVANTAGES OF EXISTING SYSTEM:

- High costs
- Lengthy hospital wait times
- Doctor-patient conflicts that result in medical disputes

2.3 PROPOSED SYSTEM:

In this using deep learning algorithm to detect disease from facial diagnosis as nowa-days due to so many diseases all hospitals are full which will not permit to see doctor sooner and this result into late diagnosis and to avoid such problem author is building neural network to predict disease from computer. Author is saying to train algorithm with small dataset will not give better prediction result so author is performing transfer learning with prebuilt VGG16 neural network.

In this transfer learning we can use any prebuilt neural network and then embed our own dataset training in the last layer of that prebuilt CNN algorithm. This algorithm is already trained with huge dataset so I embedding our small dataset in that prebuilt algorithm model can give better prediction result.

2.3.1 ADVANTAGES OF PROPOSED SYSTEM:

1. The success of deep transfer learning applications in the facial diagnosis with a small dataset could provide a low-cost and noninvasive way for disease screening and detection.
2. We hope that more and more diseases can be detected efficiently by face photographs.

2.4 FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY
- SOCIAL FEASIBILITY

2.4.1 ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

2.4.2 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.4.3 SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

2.5 HARDWARE & SYSTEM REQUIREMENTS:

2.5.1 HARDWARE REQUIREMENTS

Minimum hardware requirements are very dependent on the particular software being developed by a given Enthought Python / Canopy / VS Code user. Applications that need to store large arrays/objects in memory will require more RAM, whereas applications that need to perform numerous calculations or tasks more quickly will require a faster processor.

- **Operating System : Windows, Linux**
- **Processor : Minimum Intel i3**
- **Ram : Minimum 4 GB**
- **Hard Disk : Minimum 250 GB**

2.5.2 SOFTWARE REQUIREMENTS

The functional requirements or the overall description documents include the product perspective and features, operating system and operating environment, graphics requirements, design constraints and user documentation.

The appropriation of requirements and implementation constraints gives the general overview of the project in regards to what the areas of strength and deficit are and how to tackle them.

- **Python idel 3.7 version (or)**
- **Anaconda 3.7 (or)**
- **Jupiter (or)**
- **Google colab**

2.6 FUNCTIONAL REQUIREMENTS

1.Data Collection

2.Data Preprocessing

3. Training And Testing

4.Modiling

5.Predicting

2.7 NON FUNCTIONAL REQUIREMENTS

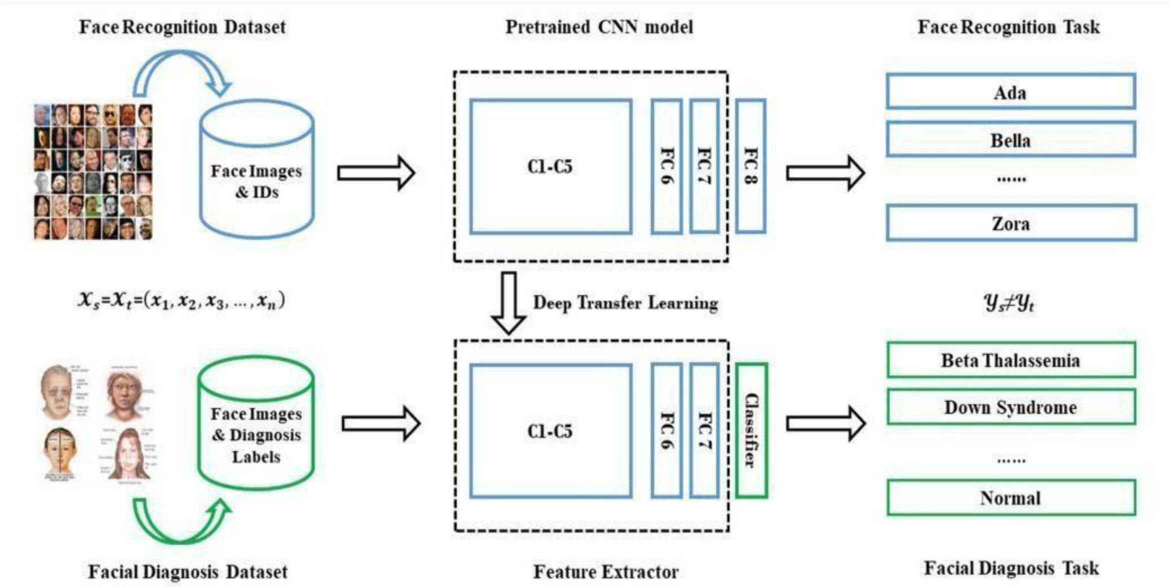
NON-FUNCTIONAL REQUIREMENT (NFR) specifies the quality attribute of a software system. They judge the software system based on Responsiveness, Usability, Security, Portability and other non-functional standards that are critical to the success of the software system. Example of nonfunctional requirement, “how fast does the website load?” Failing to meet non-functional requirements can result in systems that fail to satisfy user needs. Non- functional Requirements allows you to impose constraints or restrictions on the design of the system across the various agile backlogs. Example, the site should load in 3 seconds when the number of simultaneous users are > 10000. Description of non-functional requirements is just as critical as a functional requirement.

- Usability requirement
- Serviceability requirement
- Manageability requirement
- Recoverability requirement
- Security requirement
- Data Integrity requirement
- Capacity requirement
- Availability requirement
- Scalability requirement
- Interoperability requirement
- Reliability requirement
- Maintainability requirement
- Regulatory requirement
- Environmental requirement

3. ARCHITECTURE

3.ARCHITECTURE

3.1 SYSTEM ARCHITECTURE



3.2 DATA FLOW DIAGRAM

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

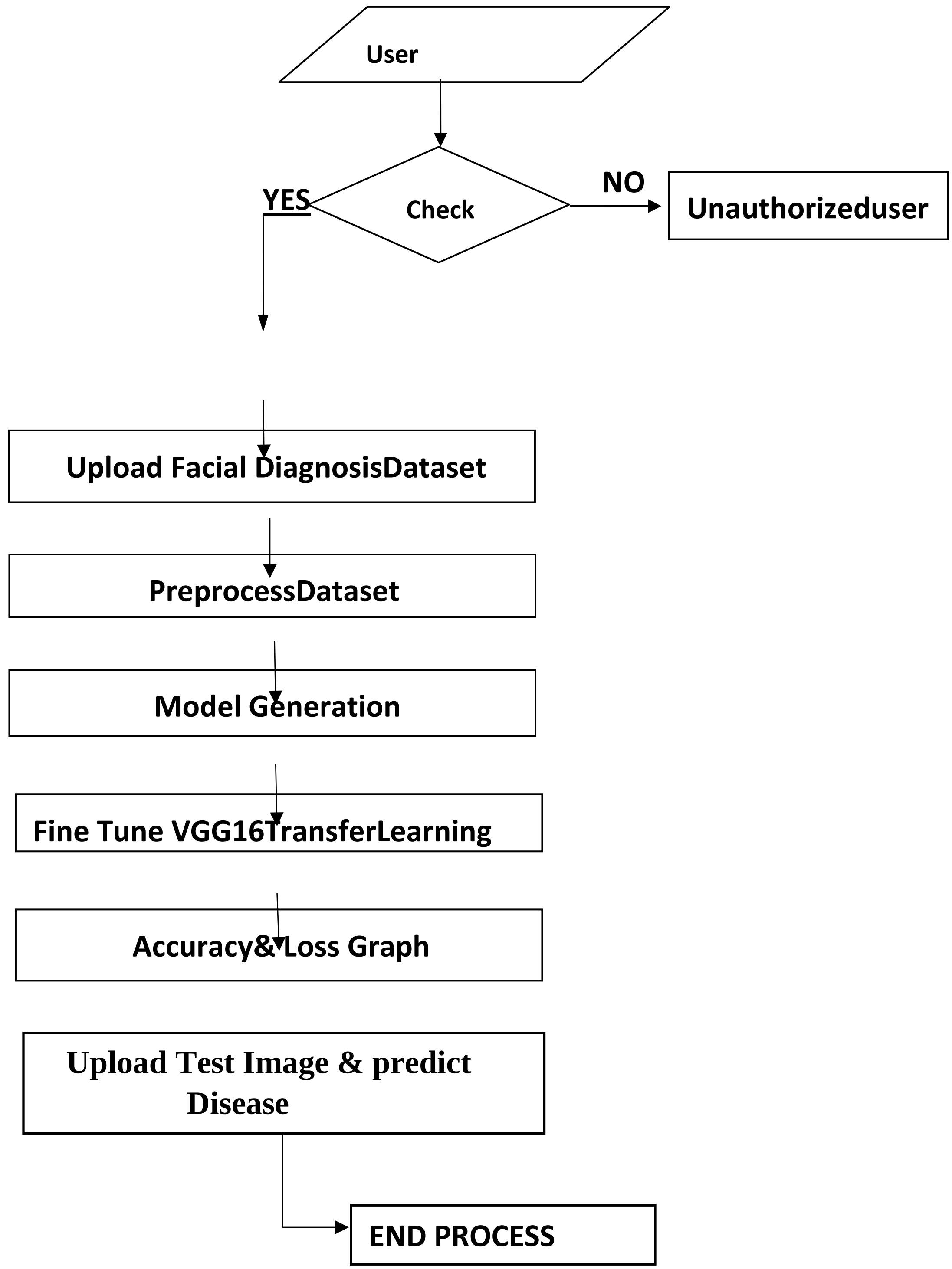


FIGURE 3.2 DATA FLOW DIAGRAM

3.3 USE CASE DIAGRAM

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

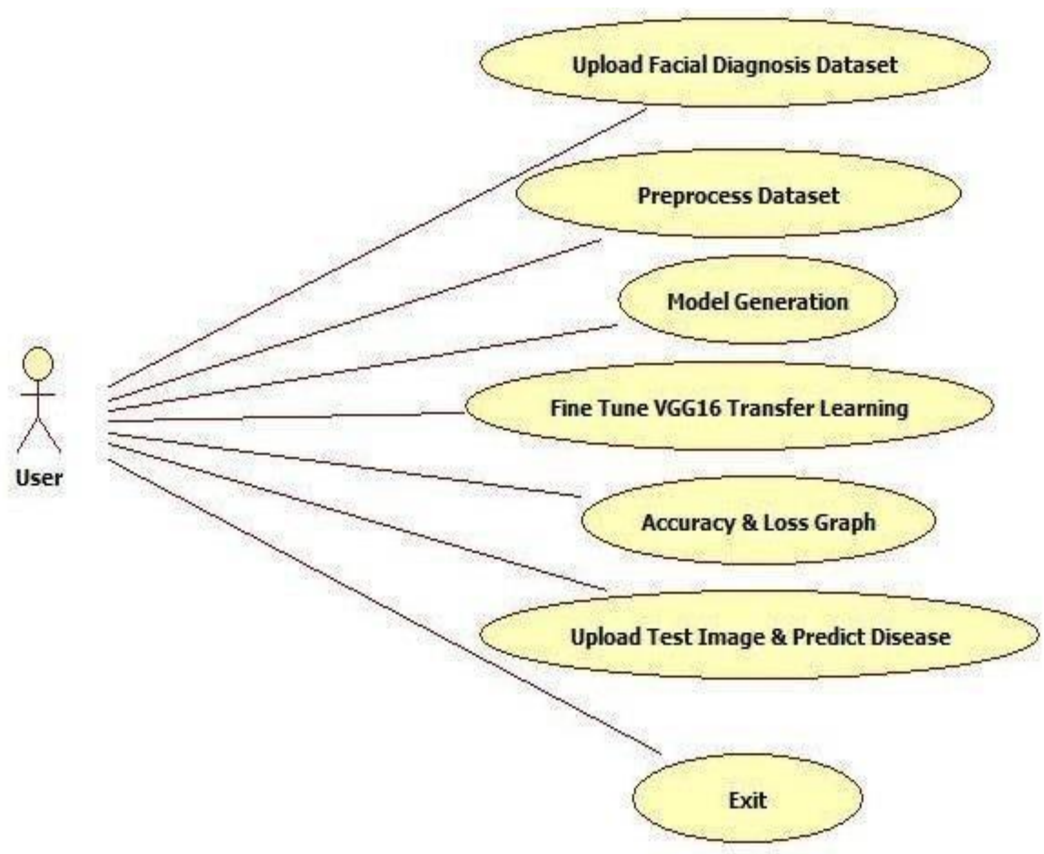


FIGURE 3.3 USE CASE DIAGRAM

3.4 CLASS DIAGRAM

The class diagram is used to refine the use case diagram and define a detailed design of the system. The class diagram classifies the actors defined in the use case diagram into a set of interrelated classes. The relationship or association between the classes can be either an "is-a" or "has-a" relationship. Each class in the class diagram may be capable of providing certain functionalities. These functionalities provided by the class are termed "methods" of the class. Apart from this, each class may have certain "attributes" that uniquely identify the class.

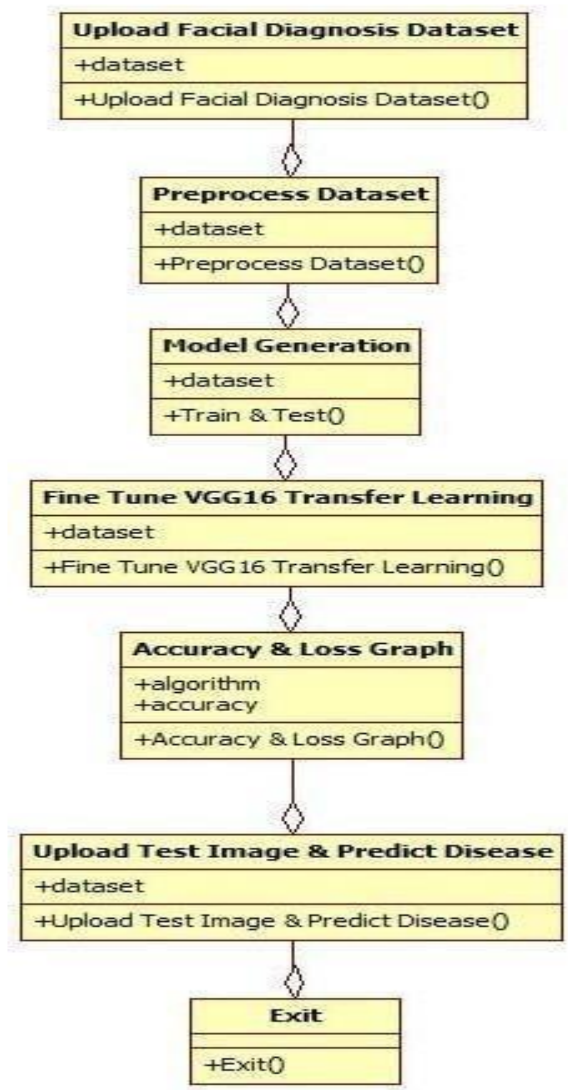


FIGURE 3.4 CLASS DIAGRAM

3.5 ACTIVITY DIAGRAM

The process flows in the system are captured in the activity diagram. Similar to a state diagram, an activity diagram also consists of activities, actions, transitions, initial and final states, and guard conditions.

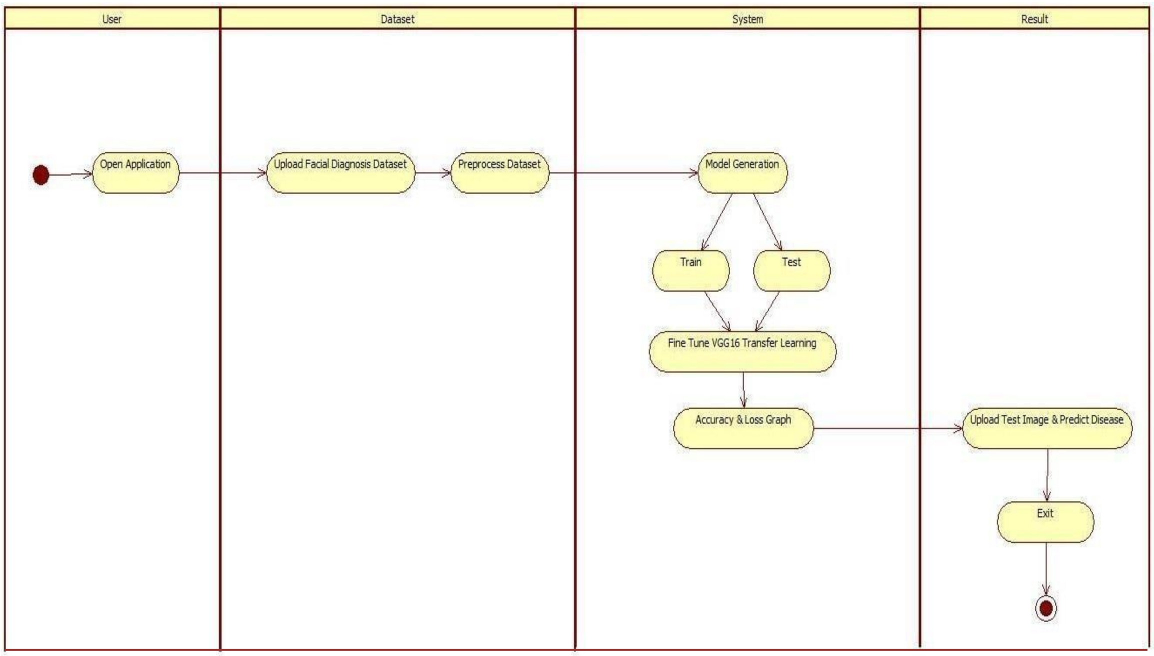


FIGURE 3.5 ACTIVITY DIAGRAM

3.6 SEQUENCE DIAGRAM

A sequence diagram represents the interaction between different objects in the system. The important aspect of a sequence diagram is that it is time-ordered. This means that the exact sequence of the interactions between the objects is represented step by step. Different objects in the sequence diagram interact with each other by passing "messages".

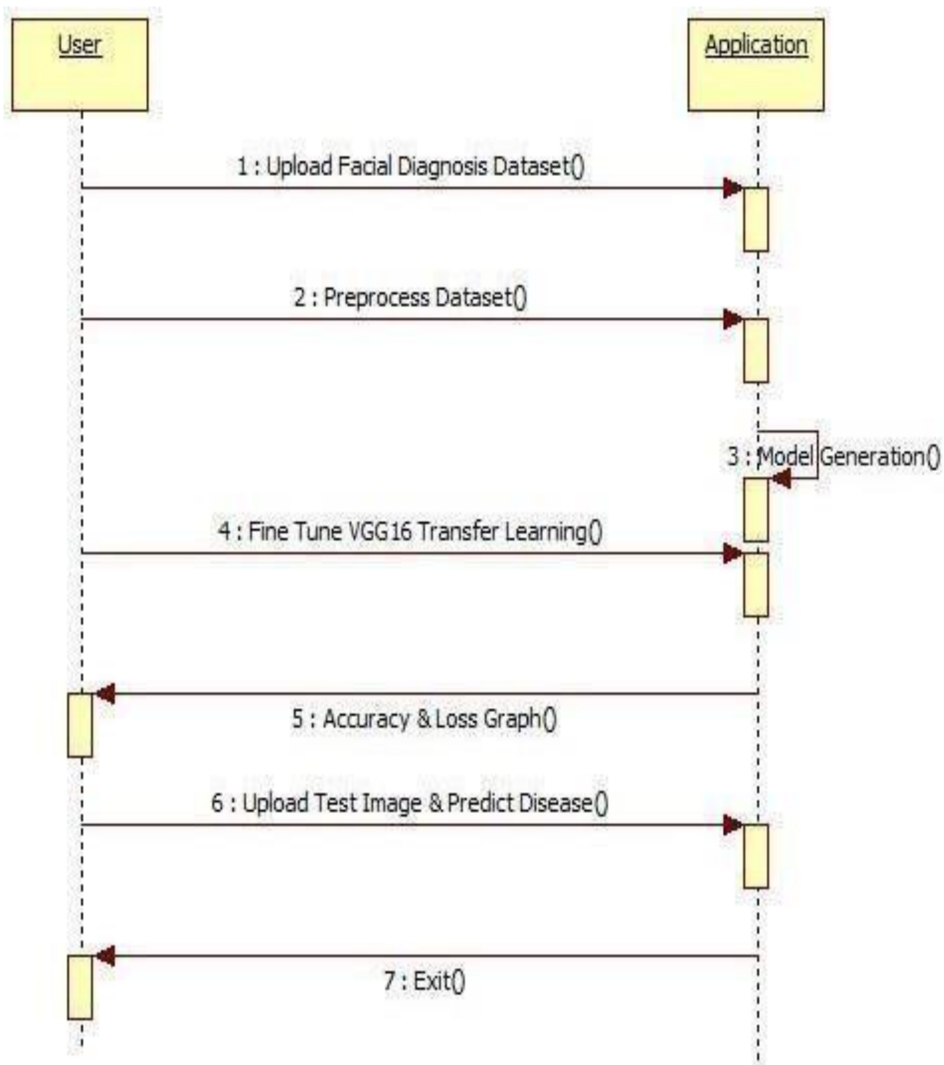


FIGURE 3.6 SEQUENCE DIAGRAM

4.IMPLEMENTATION

4. SAMPLE CODE

```
from matplotlib import pyplot as plt
from tkinter import messagebox
from tkinter import
from tkinter.filedialog import askopenfilename
from tkinter import simpledialog
import tkinter
from tkinter import filedialog
from keras import applications
from keras.layers import Input
from keras.models import Model
from keras.layers import Conv2D, MaxPooling2D
from keras.layers import Dense, Dropout, Activation, Flatten
from keras.preprocessing.image import ImageDataGenerator
from keras.models import model_from_json
import os
from keras.preprocessing import image
import numpy as np
from keras.layers import Convolution2D
import cv2
import imutils
import pickle

root = tkinter.Tk()

root.title("Deep Facial Diagnosis: Deep Transfer Learning From Face Recognition to Facial
Diagnosis")
root.geometry("1200x850")

global filename
global vgg_classifier
global training_set
global test_set

classes = ['Beta-Thalassemia','Down syndrome','Hyperthyroidism','Leprosy']

def upload():
    global filename
    filename = filedialog.askdirectory(initialdir=".")
    text.delete('1.0', END)
    text.insert(END,filename+" loaded\n");
```

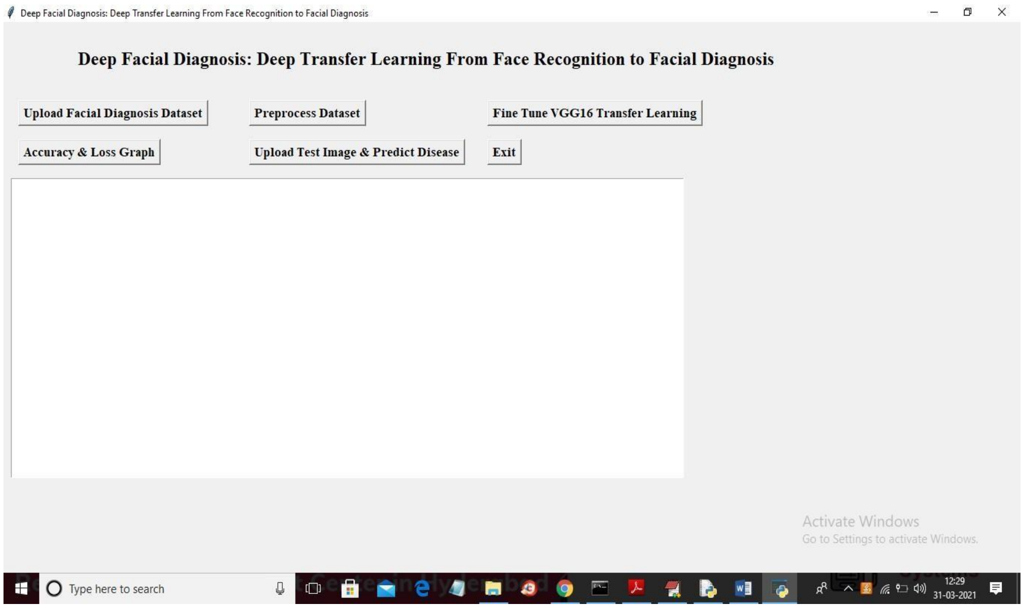
```
def preprocess():
    text.delete('1.0', END)
    global training_set
    global test_set
    train_datagen = ImageDataGenerator()
    test_datagen = ImageDataGenerator()
        training_set = train_datagen.flow_from_directory('Dataset/train',target_size = (224, 224),
batch_size = 2, class_mode = 'categorical', shuffle=True)
    test_set = test_datagen.flow_from_directory('Dataset/test',target_size = (224, 224), batch_size = 2,
class_mode = 'categorical', shuffle=False)
    text.insert(END,"Dataset preprocessing completed\n")
    text.insert(END,"Total classes found in dataset : "+str(training_set.class_indices)+"\n")


def buildCNNModel():
    text.delete('1.0', END)
    global training_set
    global test_set
    global vgg_classifier
    if os.path.exists('model/model.json'):
        with open('model/model.json', "r") as json_file:
            type_model_json = json_file.read()
            vgg_classifier = model_from_json(type_model_json)

        vgg_classifier.load_weights("model/model_weights.h5")
        vgg_classifier._make_predict_function()
        vgg_classifier.summary()
        f = open('model/history.pckl', 'rb')
        data = pickle.load(f)
        f.close()
        acc = data['accuracy']
        accuracy = acc[9] * 100
            text.insert(END,"Fine Tuning VGG16 Transfer Learning Prediction Accuracy :
"+str(accuracy)+"\n\n")
    else:
        input_tensor = Input(shape=(224, 224, 3))
         vgg_model = applications.VGG16(weights='imagenet', include_top=False, input_shape=(224,
224, 3)) #VGG16 transfer learning code here
        vgg_model.summary()
        layer_dict = dict([(layer.name, layer) for layer in vgg_model.layers])
        x = layer_dict['block2_pool'].output
```

```
    x = Conv2D(filters=64, kernel_size=(3, 3), activation='relu')(x)
    x = MaxPooling2D(pool_size=(2, 2))(x)
    x = Flatten()(x)
    x = Dense(256, activation='relu')(x)
    x = Dropout(0.5)(x)
    x = Dense(4, activation='softmax')(x)
    vgg_classifier = Model(input=vgg_model.input, output=x)
    for layer in vgg_classifier.layers[:7]:
      layer.trainable = False
    vgg_classifier.compile(loss='categorical_crossentropy', optimizer='rmsprop', metrics=['accuracy'])
    hist = vgg_classifier.fit_generator(training_set,samples_per_epoch = 8000,nb_epoch = 10,validation_data = test_set,nb_val_samples = 2000)
    vgg_classifier.save_weights('model/model_weights.h5')
    model_json = vgg_classifier.to_json()
    with open("model/model.json", "w") as json_file:
      json_file.write(model_json)
    print(training_set.class_indices)
    print(custom_model.summary)
    f = open('model/history.pckl', 'wb')
    pickle.dump(hist.history, f)
    f.close()
    f = open('model/history.pckl', 'rb')
    data = pickle.load(f)
    f.close()
    acc = data['accuracy']
    accuracy = acc[9] * 100
    text.insert(END,"Fine Tuning VGG16 Transfer Learning Prediction Accuracy : "+str(accuracy)+"\n\n")


def predict():
  filename = filedialog.askopenfilename(initialdir="testImages")
  image = cv2.imread(filename)
  img = cv2.resize(image, (64,64))
  im2arr = np.array(img)
  im2arr = im2arr.reshape(1,64,64,3)
  img = np.asarray(im2arr)
  img = img.astype('float32')
  img = img/255
  preds = vgg_classifier.predict(img)
  predict = np.argmax(preds)
```

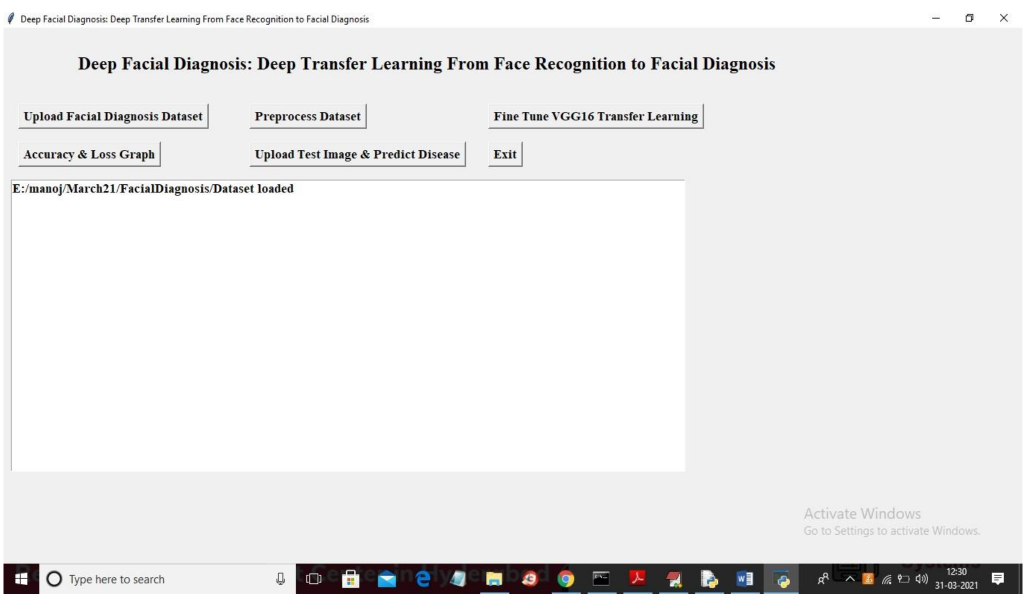
```
    print(predict)
    img = cv2.imread(filename)
    img = cv2.resize(img, (600,400))
        cv2.putText(img, "Disease Predicted as : "+classes[predict], (10, 25), cv2.FONT_HERSHEY_SIMPLEX,0.7, (0, 255, 0), 2)
    cv2.imshow("Disease Predicted as : "+classes[predict], img)
    cv2.waitKey(0)



def graph():
    f = open('model/history.pckl', 'rb')
    data = pickle.load(f)
    f.close()

    accuracy = data['accuracy']
    loss = data['loss']
    plt.figure(figsize=(10,6))
    plt.grid(True)
    plt.xlabel('Epoch')
    plt.ylabel('Accuracy/Loss')
    plt.plot(loss, 'ro-', color = 'red')
    plt.plot(accuracy, 'ro-', color = 'green')
    plt.legend(['Loss', 'Accuracy'], loc='upper left')
    #plt.xticks(wordloss.index)
    plt.title('VGG16 Transfer Learning Accuracy & Loss Graph')
    plt.show()

def exit():
    root.destroy()


font = ('times', 18, 'bold')
title = Label(root, text='Deep Facial Diagnosis: Deep Transfer Learning From Face Recognition to Facial Diagnosis')
title.config(font=font)
title.config(height=3, width=80)
title.place(x=5,y=5)

font1 = ('times', 13, 'bold')

upload = Button(root, text="Upload Facial Diagnosis Dataset", command=upload)
```

```
upload.place(x=20,y=100)
upload.config(font=font1)

processButton = Button(root, text="Preprocess Dataset", command=preprocess)
processButton.place(x=330,y=100)
processButton.config(font=font1)

vggbutton = Button(root, text="Fine Tune VGG16 Transfer Learning", command=buildCNNModel)
vggbutton.place(x=650,y=100)
vggbutton.config(font=font1)

graphbutton = Button(root, text="Accuracy & Loss Graph", command=graph)
graphbutton.place(x=20,y=150)
graphbutton.config(font=font1)

predictbutton = Button(root, text="Upload Test Image & Predict Disease", command=predict)
predictbutton.place(x=330,y=150)
predictbutton.config(font=font1)

exitbutton = Button(root, text="Exit", command=exit)
exitbutton.place(x=650,y=150)
exitbutton.config(font=font1)

text=Text(root,height=20,width=100)
scroll=Scrollbar(text)
text.configure(yscrollcommand=scroll.set)
text.place(x=10,y=200)
text.config(font=font1)

root.mainloop()
```

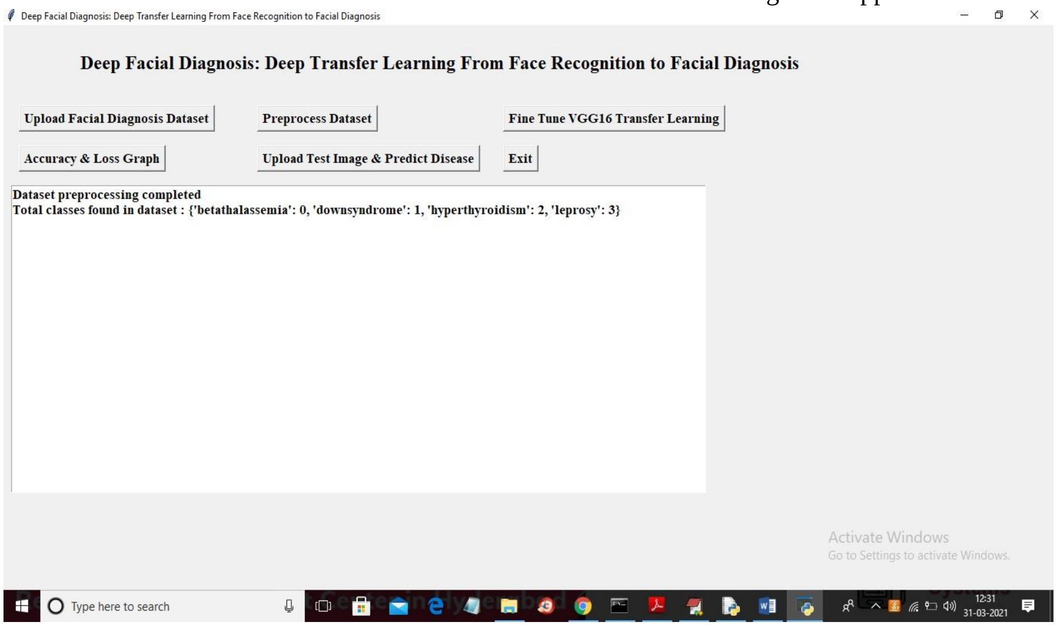
5. SCREENSHOTS



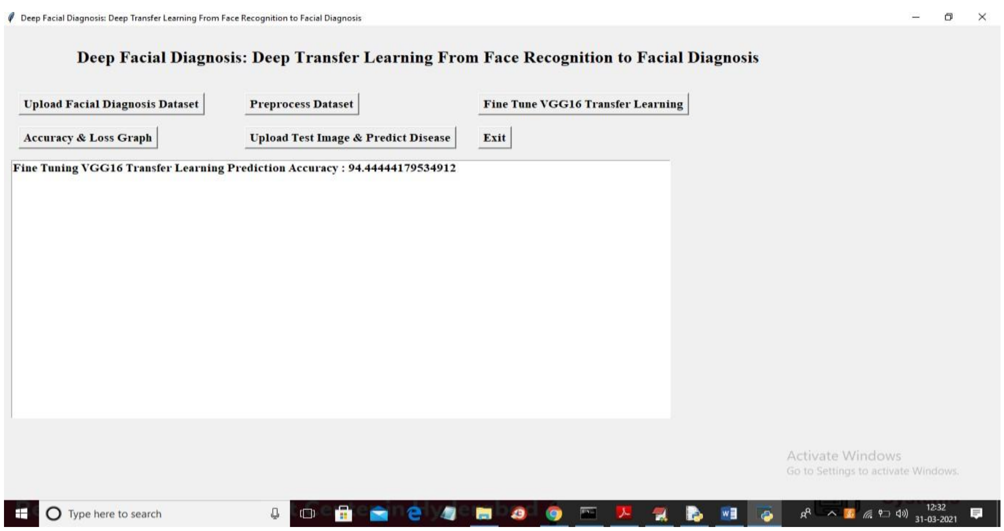
Screenshot 5.1 Home screen



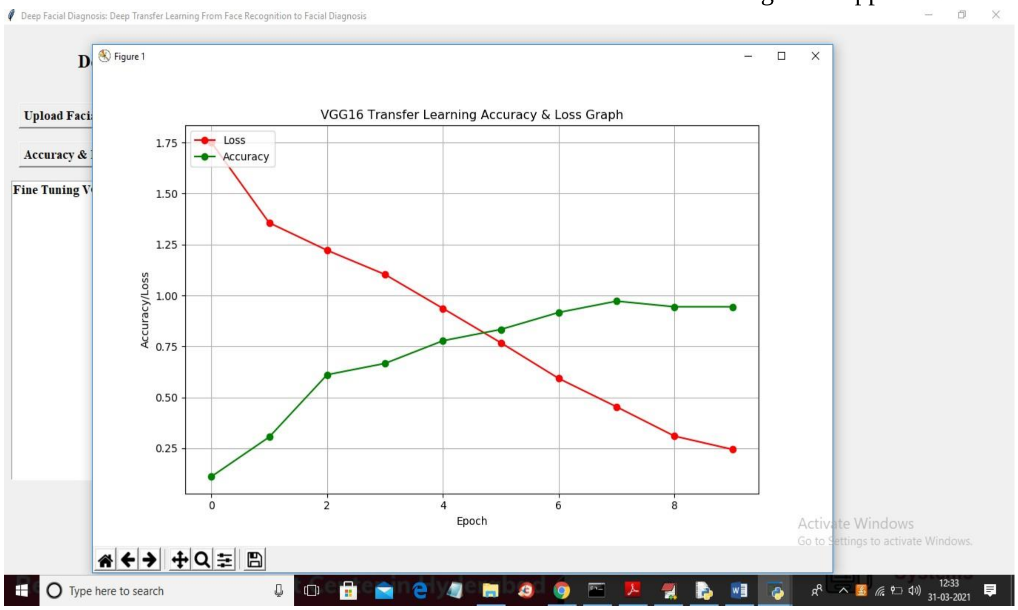
Screenshot 5.2 Upload Facial Diagnosis Dataset



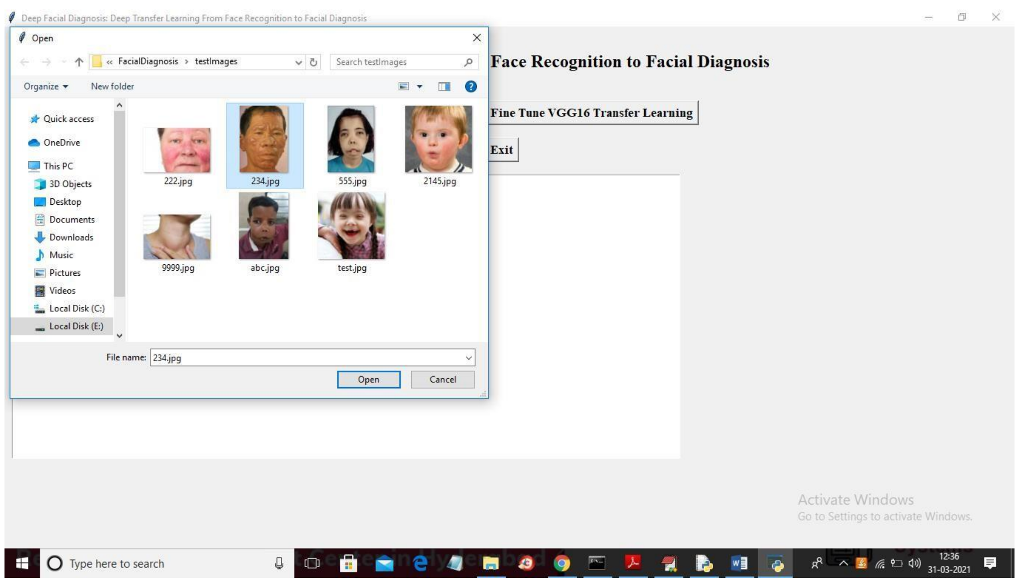
Screenshot 5.3 Preprocess Dataset



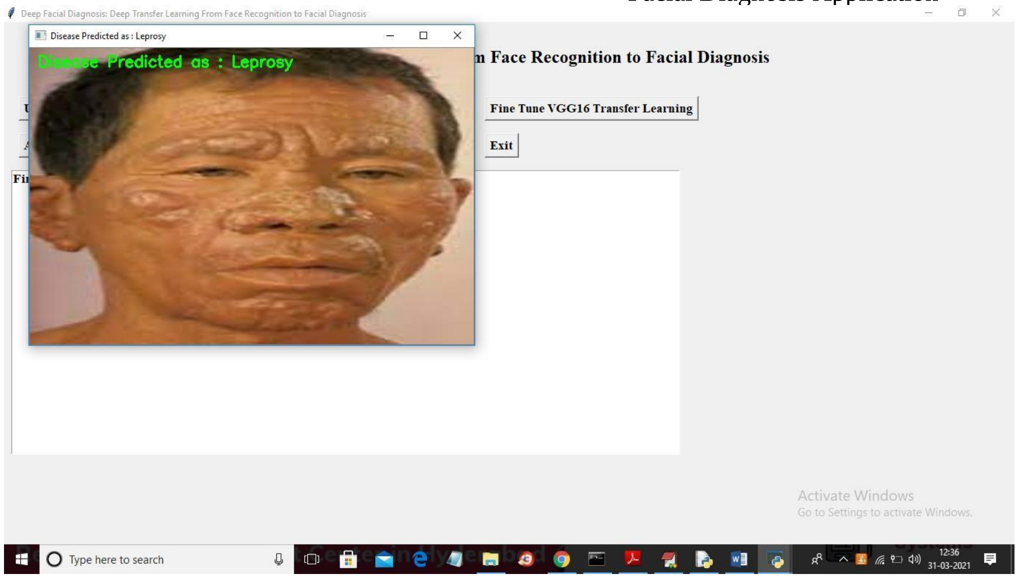
Screenshot 5.4 VGG16 training



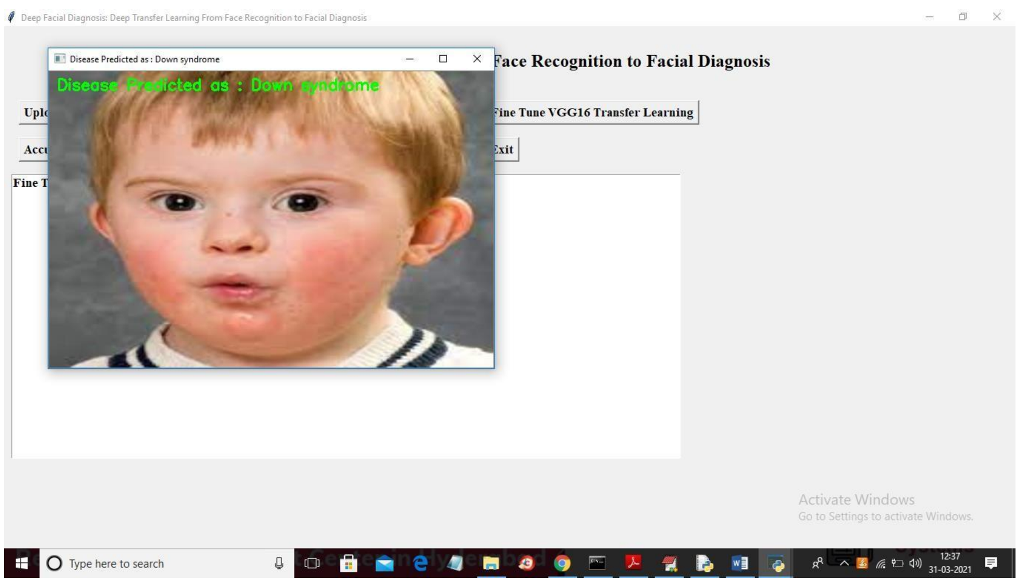
Screenshot 5.5 Accuracy & Loss histogram



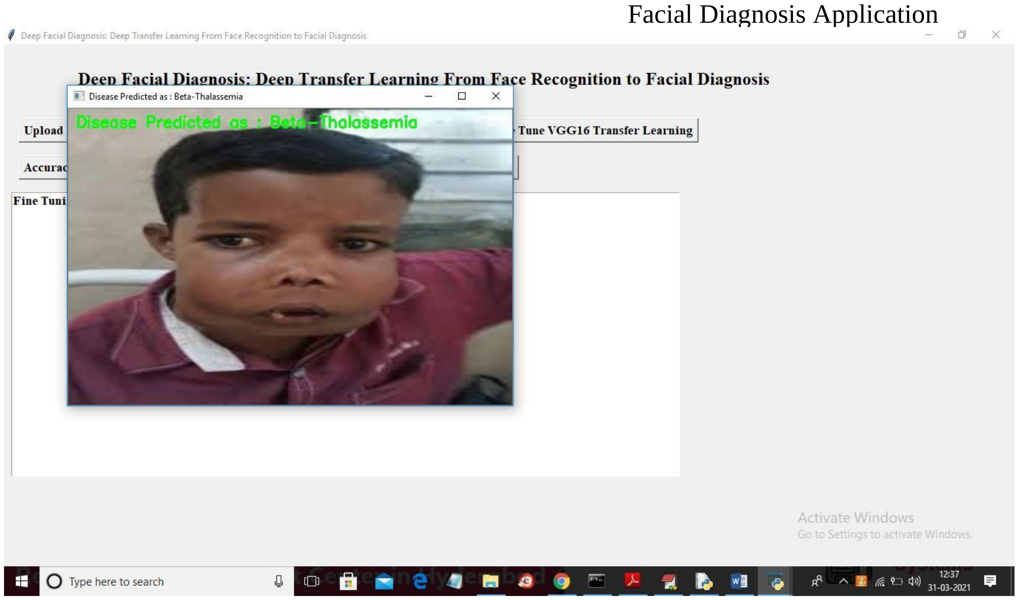
Screenshot 5.6 User input for prediction



Screenshot 5.7 Prediction Result Of Leprosy



Screenshot 5.8 Prediction Result Of Down Syndrome



Screenshot 5.9 Prediction Result Of Beta -Thalassemia

6.SYSTEM TEST

6. SYSTEM TEST

6.1 INTRODUCTION

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

6.2 TYPES OF TESTS

6.2.1 Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

6.2.2 Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

6.2.3 Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input	: identified classes of valid input must be accepted.
Invalid Input	: identified classes of invalid input must be rejected.
Functions	: identified functions must be exercised.
Output	: identified classes of application outputs must beexercised.
Systems/Procedures	: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

6.2.4 System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

6.2.5 White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

6.2.6 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box.you cannot see into it. The test provides inputs and responds to outputs without considering how the software works.

6.3 TEST CASES

6.3.1 CLASSIFICATION

Use case ID	Deep Facial Diagnosis Deep Transfer Learning From Face Recognition to Facial Diagnosis
Use case Name	Home button
Description	Display home page of application
Primary actor	User
Precondition	User must open application
Post condition	Display the Home Page of an application
Frequency of Use case	Many times
Alternative use case	N/A
Use case Diagrams	
Attachments	N/A

7. CONCLUSION

PROJECT CONCLUSION

More and more studies have shown that computer-aided facial diagnosis is a promising way for disease screening and detection. In this paper, we propose deep transfer learning from face recognition methods to realize computer-aided facial diagnosis definitely and validate them on single disease and various diseases with the healthy control. The experimental results of above 90% accuracy have proven that CNN as a feature extractor is the most appropriate deep transfer learning method in the case of the small dataset of facial diagnosis. It can solve the general problem of insufficient data in the facial diagnosis area to a certain extent. In future, we will continue to discover deep learning models to perform facial diagnosis effectively with the help of data augmentation methods. We hope that more and more diseases can be detected efficiently by face photographs.

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8.2 GITHUB LINK

https://github.com/ShivaPranavJ/deep_facial_diagnosis

9.PUBLICATION

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DEEP TRANSFER LEARNING FROM FACE RECOGNITION FOR FACIAL DIAGNOSIS APPLICATIONS

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ABSTRACT: Individuals have examined the connection among ailment and the face for millennia, which prompted the making of facial investigation. Profound learning calculations will be utilized to examine the capability of diagnosing illnesses from arbitrary 2D face pictures. In this paper, we advocate driving PC helped facial ID on various issues by using profound trade gaining from face acknowledgment. PC supported face recognizable proof of a solitary problem (beta-thalassemia) and various problems (hyperthyroidism, Down condition, and sickness) is done in explore with a moderately little dataset. In the tests, deep transfer learning from face acknowledgment outflanked ordinary ML techniques and doctors with top-1 exactness of practically 90%. Because of the administration of individual information, it is troublesome, costly, and tedious to gather sickness explicit face photographs by and by. Face symptomatic exploration data sets, as opposed to data sets used in other AI application areas, are many times private and limited. Profound exchange learning programs that are great in face examination with a short dataset could offer a minimal expense and subtle procedure for sickness observing and revelation.

Keywords *– Facial diagnosis, deep transfer learning (DTL), face recognition, beta-thalassemia, hyperthyroidism, down syndrome, leprosy.*

1. INTRODUCTION

As per Huangdi Neijing [1], the essential doctrinal hotspot for Chinese medication, "Qi and blood in the twelve Channels and 300 and 65 Guarantees all stream to the face and implant into the Kongqiao (the seven openings on the face)," this was accounted for millennia prior. It suggests that the affected areas exhibit abnormal alterations in the internal systems. "Facial diagnosis" is a method used in China to determine a patient's overall and local tumors by examining the features of the patient's face. Comparative thoughts could be tracked down in old India and Greece. Nowadays, practitioners using facial characteristics to diagnose diseases are referred to as facial diagnosticians. Face analysis has a drawback in that physicians need to have a lot of realworld experience in order to achieve high precision. Modern medical studies [11, 12], and [30] show that many diseases will show up on people's faces in the same unique ways. Due to restricted clinical assets, it is as yet hard for individuals in numerous remote and ruined regions to go through clinical assessments, bringing about treatment postpones in many cases. Requirements like significant expenses, long emergency clinic stand by times, and specialist patient clash, which prompts clinical conflicts, continue even in significant urban communities. We can rapidly and effectively perform painless sickness screening and ID with PC helped face examination. Therefore, face examination has colossal potential in the event that its prosperity and suitable mistake rate can be illustrated. We could evaluate the connection among sickness and appearance with the assistance of artificial intelligence.

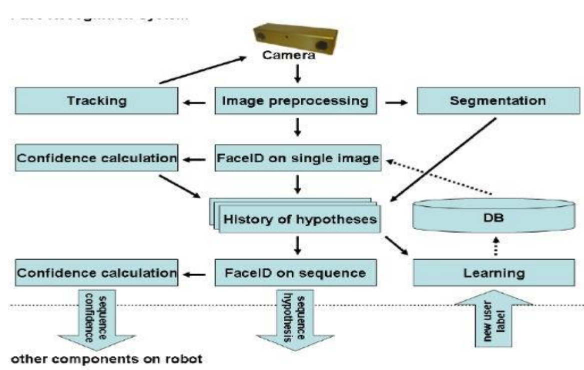

Fig.1: Example figure

Lately, deep learning innovation has progressed the best in class in various fields, especially PC vision. Nonlinear data handling and component learning are done with a multi-facet structure in profound realizing, which is enlivened by the construction of human cerebrums. In 2012, it accomplished the most noteworthy scores in the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) [42]. As the test advanced, various notable profound brain network models, like AlexNet, VGGNet, ResNet, Commencement ResNet, and SENet, arose. Deep learning methods for learning elements might have the option to convey the hidden data in information more really than fake highlights, as shown by the discoveries of ILSVRCs. Quite possibly of the latest advancement in research on man-made reasoning is profound learning. Face acknowledgment is the most common way of approving or perceiving the ID of people from faces in photos or recordings. It is a hotly debated issue in the field of PC vision. Face affirmation is the most well-known approach to differentiating a new kid on the block's face with another and choosing if they are a match. This is a singular correspondence. The endeavor of matching a given face picture to one in an informational collection of faces is known as face conspicuous confirmation. A one-to-numerous relationship exists. Either metric learning or particular calculation systems can achieve these two, or they can be joined into a solitary structure. As profound learning innovation has progressed lately, approaches in view of deep learning have slowly supplanted customary facial acknowledgment innovation. The Convolutional Neural Network (CNN) is the deep learning methodology for face acknowledgment that is used the most. CNN structures [7, 8], [27] for face affirmation, as FaceNet, VGG-Face, DeepFace, and ResNet, are propelled by those that perform well in ILSVRCs. Utilizing countless face pictures with marks from public face acknowledgment datasets [27, 43, 44], these CNN models are prepared to naturally gain proficiency with the most reasonable face portrayals for PC understanding and separation [57]. At the point when tried on some particular datasets, they accomplish high precision.

2. LITERATURE REVIEW

Imagenet classification with deep convolutional neural networks:

We prepared a gigantic, deep convolutional neural network to separate the 1.2 million high-goal pictures from the ImageNet LSVRC-2010 test into 1000 particular gatherings. On test information, we accomplished mistake rates in the best 1 and top-5 scopes of 37.5% and 17.0%, which were fundamentally higher than the earlier cutting edge. The cerebrum association, which has 650,000 neurons and 60 million limits, is included five convolutional layers, some of which are followed by max-pooling layers, and three totally related layers, the remainder of which is a 1000-way softmax. To accelerate preparing, we utilized non-immersing neurons and a convolution strategy that depended on an extremely quick GPU. To diminish overfitting in the completely connected layers, we used a clever regularization method known as "dropout," which ended up being very successful. What's more, we entered a form of this model in the ILSVRC-2012 rivalry, which we won with a main 5 test blunder pace of 15.3%, contrasted with the 26.2% of the second-best passage.

Going deeper with convolutions:

In the 2014 ImageNet Large-Scale Visual Recognition Challenge (ILSVRC), the new arrangement and identification benchmark was set by the "Inception" deep convolutional neural network design. This method stands out most from others because it makes better use of network processing resources. This was accomplished by employing a well-built architecture that maintained the same processing funding while expanding the network's width evaluated, is one version of our ILSVRC 2014 submission.

Very deep convolutional networks for large-scale image recognition:

We investigate how a convolutional network's accuracy at large-scale image recognition is affected by its depth in this study. Our main contribution is a design with very small (3x3) convolution filters that allows for in-depth analysis of networks with increasing depth. This exhibits that, in contrast with past best in class arrangements, expanding the profundity to 16 to 19 weight layers brings about a huge improvement. We won first and second places in the ImageNet Challenge 2014 classes for confinement and grouping based on these discoveries. Also, we show how well our portrayals adjust to different datasets to deliver state of the art results. To quicken further survey into the use of significant visual depictions in PC vision, we have made our two best-performing ConvNet models accessible to the greater public.

Deep residual learning for image recognition:

Preparing further neural networks requires more exertion. For preparing networks that are fundamentally more profound than those that have been used previously, we present a lingering learning worldview. We unequivocally reformulate the layers as learning lingering capabilities regarding the layers' contributions, as opposed to learning unreferenced capabilities. We show, using rich observational data, that these waiting

organizations gain gigantically from higher significance and are more direct to upgrade. We look at residual networks with up to 152 levels of depth on the ImageNet dataset, which are eight times deeper but eight times more complicated than VGG nets. There is a 3.57 percent error when these residual networks are joined on the ImageNet test set. In the ILSVRC 2015 classification test, this response came out on top. We also provide CIFAR10 studies at the 100 and 1000 levels. The thickness of the photographs is fundamental for some eye recognizing evidence tasks. We were simply ready to accomplish an overall increase of 28% on the COCO object acknowledgment dataset due to our especially profound models. As well as winning in front of the pack in the ImageNet location, ImageNet restriction,
COCO identification, and COCO division undertakings, we involved profound leftover nets in our entries to the ILSVRC and COCO 2015 rivalries.

Inception-v4, inception-resnet and the impact of residual connections on learning:

Deep neural networks have empowered the main advances in picture acknowledgment capacities lately. For instance, it has been demonstrated that the Inception design delivers exceptionally high levels of efficiency at extremely low processing costs. In the 2015 ILSVRC competition, cutting-edge results comparable to the most recent version of the Inception-v3 network were achieved through the utilization of leftover connections in conjunction with a more conventional architecture. This raises the question of whether it is beneficial to incorporate more connections into the Beginning plan. We demonstrate that training Inception networks is significantly sped up when leftover connections are used. Additionally, Inception networks with residual linkages typically perform slightly better than similarly priced networks without residual linkages. We likewise show various special, less complex structures for both leftover and non-remaining Origin organizations. On the categorization task for the ILSVRC 2012, the accuracy of single-frame recognition is significantly improved by these modifications. In addition, we demonstrate how to stabilize the training of extremely large residual Inception networks by utilizing the appropriate activation scaling. Utilizing a gathering of three residuals and one Inception v4, we accomplish a main 5 blunder of 3.08 percent on the ImageNet classification (CLS) test set.

3. METHODOLOGY

Due to a lack of medical supplies, patients in numerous remote and underdeveloped regions continue to experience delays in receiving treatment. In fact, constraints like high fees, lengthy wait times at emergency clinics, and specialist patient showdowns that lead to professional confrontations persist even in large cities. Computer-aided face assessments make non-invasive screening and disease detection simple and quick. If it can be demonstrated to be successful while still having a low rate of error, face detection holds a lot of promise. Using artificial intelligence, we might be able to measure the relationship between health and appearance.

Disadvantages:

- ❖ High hospital costs and lengthy wait times Disagreements between patients and doctors that result in lawsuits for medical malpractice

It is difficult to see a doctor sooner, which results in a late diagnosis because hospitals are now overcrowded. The author of this study uses a deep learning algorithm to distinguish illness from face diagnosis to address this issue. The author is working on developing a neural network that can predict illness from a computer in order to circumvent this issue. The author is using a prebuilt VGG16 neural network to guide exchange learning because, as the author claims, creating a computation with only a few examples will not yield better estimates.
In this transfer learning, we can use any prebuilt neural network and incorporate our own dataset training into the final layer of that prebuilt CNN algorithm. I assume that incorporating our tiny dataset into that prebuilt calculation model will yield worked-out speculative conclusions given that this calculation has already been demonstrated on a large dataset.

Advantages:

1. A low-cost and non-invasive method of sickness monitoring and discovery may result from the efficacy of deep transfer learning applied to face analysis with a limited dataset.
2. Face photographs will soon be able to identify a growing number of disorders, according to our prediction.

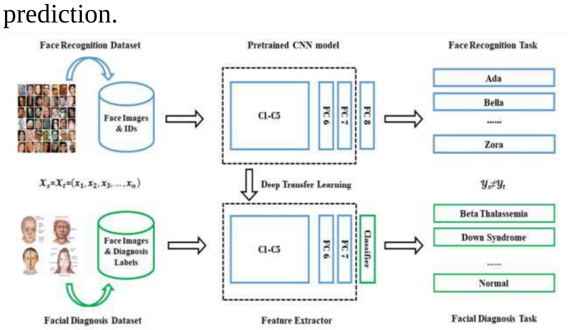

Fig.2: System architecture

MODULES:

- Upload facial diagnosis dataset
- Preprocess dataset
- Model generation
- Fine tune vgg16 transfer learning
- Accuracy & loss graph
- Upload test image & predict disease

4. IMPLEMENTATION

Algorithms:

VGG16:

VGG-16 is a 16-layer deep convolutional neural network. To stack a pretrained version of the association that was ready on, you can use a variation of the association that was ready on in excess of a million pictures from the ImageNet data base [1]. Photographs of consoles, mice, pencils, and different creatures can be arranged acknowledged by the organization. See Pretrained Significant Cerebrum Associations for other pretrained networks in MATLAB®.

A ConvNet, otherwise called a convolutional neural network, is a sort of counterfeit brain organization. A convolutional brain network comprises of various secret layers, an information layer, and a result layer. One of the most mind-blowing PC vision models that is presently accessible is VGG16, a CNN (Convolutional Neural Network). Utilizing a somewhat little (3x3) convolution channel plan, the creators of this model assessed the organizations and expanded the profundity, showing a critical into one of 1,000 distinct thing classifications by the pretrained network. As an immediate outcome of this, the organization has gained inside and out include portrayals for a different assortment of pictures. 224 by 224 picture input is improvement over earlier craftsmanship arrangements. Around 138 teachable boundaries were created when the profundity was expanded to 16 to 19 weight layers. With a accuracy of 92.7%, the article acknowledgment and arrangement calculation VGG16 can choose 1000 pictures from 1000 particular gatherings. A typical way to deal with picture order supplements transfer learning great.

- The 16 in VGG16 proposes 16 weighted layers. VGG16 has 21 layers, including thirteen convolutional layers, five Max Pooling layers, and three Thick layers. In any case, there are only sixteen weight layers, or layers with learnable limits.
- VGG16 perceives input tensor sizes of 224, 244 with three RGB channels.
- The most specific piece of VGG16 is that, rather than having incalculable hyper-limits, they zeroed in on using convolution layers of a 3x3 channel with stage 1 and used a comparable padding and maxpool layer of a 2x2 channel with stage 2. This was the procedure that set them beside various channels.

5. EXPERIMENTAL RESULTS

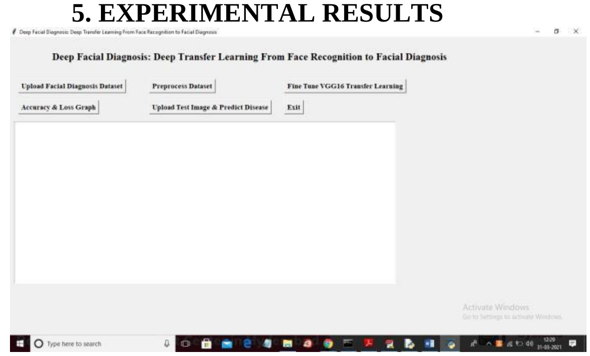

Fig.3: Home screen

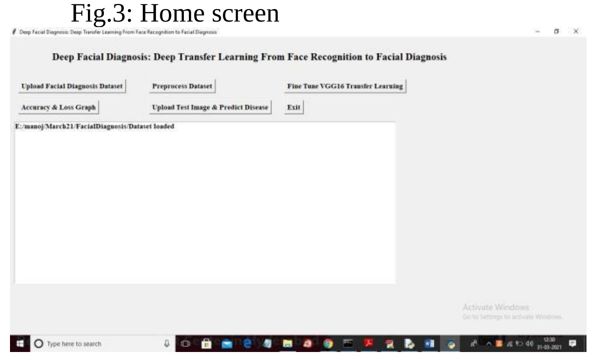

Fig.4: Upload facial diagnosis Dataset

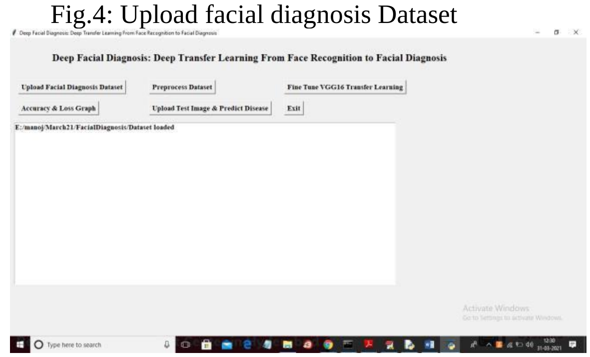

Fig.5: Preprocess dataset

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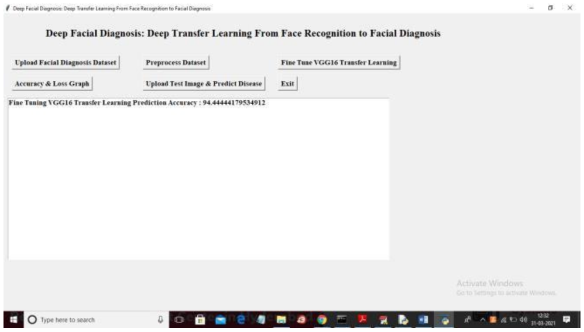

Fig.6: VGG16 training

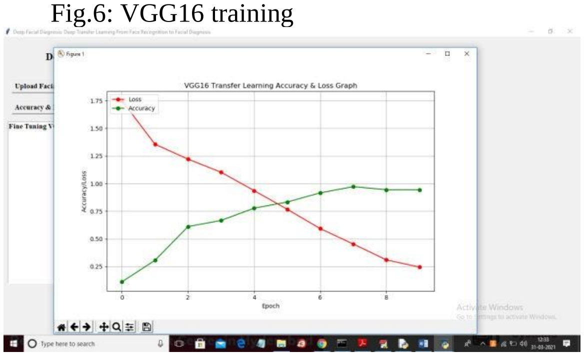

Fig.7: Accuracy & loss histogram

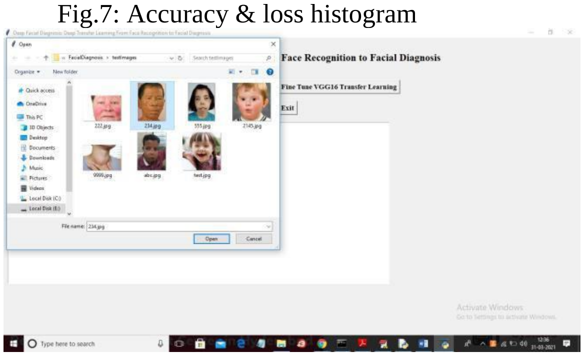

Fig.8: User input for prediction

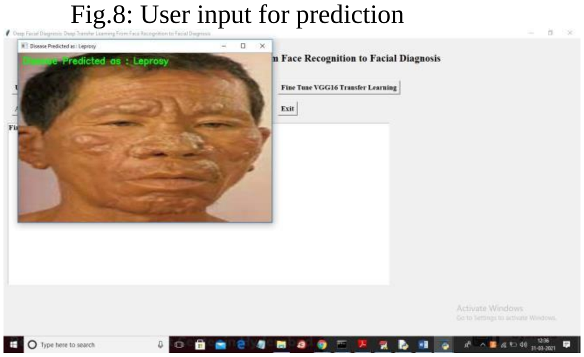

Fig.9: Prediction result

6.CONCLUSION

PC supported face examination has been demonstrated to be a promising device for sickness checking and location in a developing number of studies. We propose and assess profound exchange gaining from face acknowledgment calculations involving solid controls for both single and numerous problems to guarantee PC supported facial recognition. CNN as a component generator is the best deep transfer learning system for the restricted dataset of face examination, as shown by testing results with more than 90% accuracy. It might, somewhat, mitigate the more extensive issue of deficient information in the face analysis area. We will keep looking for deep learning models that can use data augmentation techniques to do face analysis well in the future. Face pictures are expected to be helpful in diagnosing new diseases.

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