Project Report

on

AGE AND GENDER ESTIMATION

Submitted by

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DECLARATION

We hereby declare that the report of the B.Tech Major Project Work entitled with the “Age and Gender Estimation” which is being submitted to Rajiv Gandhi University of Knowledge Technologies, RK Valley, in partial fulfillment of the requirements for the award of Degree of Bachelor of Technology in Computer Science and Engineering, is a bonafide report of the work carried out by me.The material contained in this report has not been submitted to any university or institution for award of any degree.

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CERTIFICATE

This is to certify that the project work titled on " **AGE AND GENDR ESTIMATION** " is a bonafied project work submitted by **P.V.Kusala Kumari-R170490** in the department of COMPUTER SCIENCE AND ENGINEERING in partial fulfillment of requirements for the award of degree of Bachelor of Technology in Computer Science and Engineering for the year 2022-2023 carried out the work under the supervision.

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1.ABSTRACT

Age estimation from a single human face image has been an important yet challenging task in computer vision and multimedia. Due to the large individual differences in human faces, including the differences in races and genders, the performance of a learning model depends largely on training data. The existing learning methods are challenged by insufficient numbers of images and poor-quality images in datasets, as well as by new low-precision data that are dissimilar to existing training data. In this project, we propose a learning method called the cross-dataset training convolutional neural network (CDCNN), which uses a general framework for cross-dataset training in age estimation. We adopted convolutional neural networks (CNNs) withVGG-16 architectures pre-trained on ImageNet and treated the age estimation problem

as a classification problem. For the classification results, softmax is utilized to map the output and provide value refinement. We conducted a series of experiments on the Craniofacial Longitudinal Morphological Face Database (MORPH), Cross-Age Celebrity Dataset (CACD), and Asian Face Age Dataset (AFAD). The results show that simultaneous training on multiple datasets using additional labeled data achieves a more impressive performance when compared to training on a single, independent dataset. Our proposed cross-dataset training model achieves state-of-the-art results on both the AFAD and CACD age estimation benchmarks with great generalizability.

2.INTRODUCTION

2.1 Overview

Age and gender, two of the key facial attributes, play a very foundational role in social interactions, making age and gender estimation from a single face image an important task in intelligent applications, such as access control, human-computer interaction, law enforcement, marketing intelligence and visual surveillance, etc. The enhancing of raw images that are received from the camera sources, from satellites, aircrafts and the pictures captured in day-to-day lives is called image processing. The images have been processed through many different techniques and calculations have been made on the basis and analysis of the studies. Training in ANN is done through the track of the examples. There are various such methods that fail to produce appropriate results.

It is also considered as a gradient method where the gradient of the error is evaluated by considering the weights of the given inputs. The detection of the data available in the images is very important. The data that the image contains is to be changed and modified for the detection purposes. In a Facial detection technique: The expressions that the faces contain hold a lot of information. Whenever a person interacts with the other person, there is an involvement of a lot of expressions.Age estimation is a multi-class problem in which the years are classified into classes. People with different ages have different facials, so it is difficult to gather the images. Various age detection methods are used. Features are the extracted from the neural network through the convolution network. .Most have utilized characterization plans composed especially for age or gender orientation estimation undertakings, including and others.

3.Technologies Used in the Estimation Process

1.Image Processing

Vision processing incorporates human perception and intelligence which makes the field most interesting to the research community as it can mimic human behaviour in the computer system by means of video surveillance system, integrating more intelligence to machines such as robots, as well as in ecology, biometrics and medical applications.

The basic 4 steps in image processing domain are pre-processing, segmentation, feature extraction and recognition and those has been keeping their strong importance in research mostly in the case of software implementation and very few implemented on hardware.

Finally in the recognition stage a set of signals are generated using this list which constitute the upper level of processing assigning a specific meaning to every detected object.

2. CNN For age and gender estimation

Gathering a substantial, marked image preparing set for age and gender estimation from social network image archives requires either access to individual data on the subjects showing up in the images, which is regularly private, or is tedious to physically name. Information sets for age and gender estimation from true social network images are in this way moderately constrained in size and in a matter of seconds no match in size with the much larger image arrangement information sets (e.g. the Image net dataset). requires recognizing eight classes; gender classification needs just two classes. This contrasted with, e.g., the ten thousand personality classes used to prepare the system utilized for face acknowledgment as a part each of the three shading channels is handled specifically by the system. Images are initially rescaled to 256 × 256 and a product of 227×227 is bolstered to the system. The three ensuing convolutional layers are then characterized as takes after.

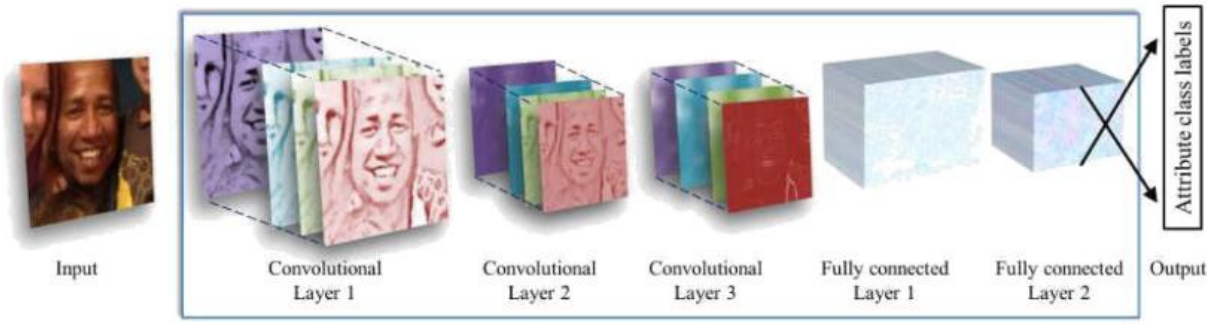


Figure 1: Illustration of CNN Architecture

Feature Extraction

The gender classification procedure is described in this section. Features extraction-deals with extracting features that are basic for differentiating one class of object from another. First, the fast and accurate facial features extraction algorithm is developed. The training positions of the specific face region are applied. The extracted features of each face in database can be expressed in column matrix show in figure 1.2

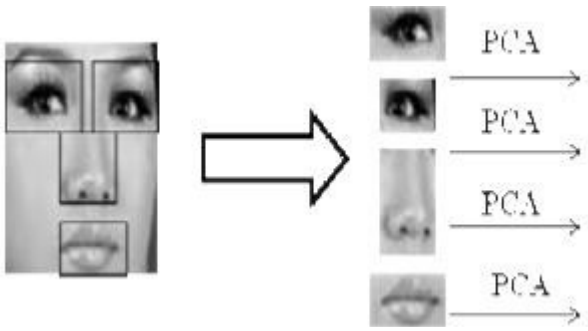


Figure 1.2: Facial Image

4. Purpose

The detection is the technique in which various factors are recognized on the basis of input and according to requirements. The age and gender detection is the issue which take consideration of researchers from last few years. In the topic on age and gender detection various techniques has been proposed to analysis features of the input image and on the basis of image features gender and approximation of age is defined. In this work, novel technique is proposed which is based on CNN for age and gender detection. This technique will scan the input image and detect key features. The simulation is performed in CNN and it is been analysed that proposed technique performs well in terms of fault detection rate and images that are received from the camera sources, from satellites, aircrafts and the pictures captured in day-to-day lives is called image processing. The images have been processed through many different techniques and calculations have been made on the basis and analysis of the studies. There is a need of analyzing and studying the digitally formedmages. There are two main and very common steps followed for image processing which is based upon

CNN that is a deep neural network (DNN). The improvement of an image such that the resulted image is of greater quality and can be used by other programs, is called image enhancement. The other technique is the most sought after technique used for extraction of information from an image. There is a division of the image into certain number of parts or objects so that the problem is solved. This process is called segmentation.

5.SCOPE

5.1 Problem Statement

The primary objective of the project is to detect the Age and gender using Deep Learning Technique (VGG16) on CACD & AFAD Dataset.

5.2 Objectives

The objective can be resolved by two ways

- Input the image from the Dataset to classify the Age and Gender.
- Live tracking using Web Camera to detect the Age and Gender.
- The next facet of our project focuses on coupling the architectures for age and gender recognition using CAFFNET deep learning model deployment to images.
- The task of detecting Age and Gender detection is still under process from many researchers, we have tried to develop the idea that can approximately guess the two parameters (Age & Gender) either by extracting the features from input image (from dataset) or through Live Camera using deep learning model.

5.3 Existing System

- Image Processing technique such as shape-based and texture-based.
- Acoustic and linguistic features were used for detection of age.
- Detection of age and gender using speech.

- Age and gender classification system for a home robot service through Speech.
- Machine Learning classifiers are used for early prediction

5.4 Motivation and Scope

Automatic age and gender classification has become relevant to an increasing amount of applications, particularly since the rise of social platforms and social media. Nevertheless, performance of existing methods on real-world images is still significantly lacking, especially

when compared to the tremendous leaps in performance recently reported for the related task of face recognition. 11

A Convolutional Neural work is a deep neural network (DNN) widely used for the purposes of image recognition and processing and NLP. Also known as a ConvNet, a CNN has input and output layers, and multiple hidden layers, many of which are convolutional. In a way, CNNs are regularized multilayer perceptron.

It is very difficult to accurately guess an exact age from a single image because of factors like makeup, lighting, obstructions, and facial expressions. And so, we make this a classification problem instead of making it one of regression.

The major applications are

- Detect faces
- Classify into Male/Female
- Classify into one of the 8 age ranges
- Put the results on the image and display it.

This will help us in many fields ranging from employee identification to human identification, defence security and CCTV footage identification. It can be used to identify people in somewhat blurred images.

6.PROPOSED WORK

6.1 Proposed System

To build a gender and age detector that can approximately guess the gender and age of the person (face) in a picture using Deep Learning on the Adience dataset.

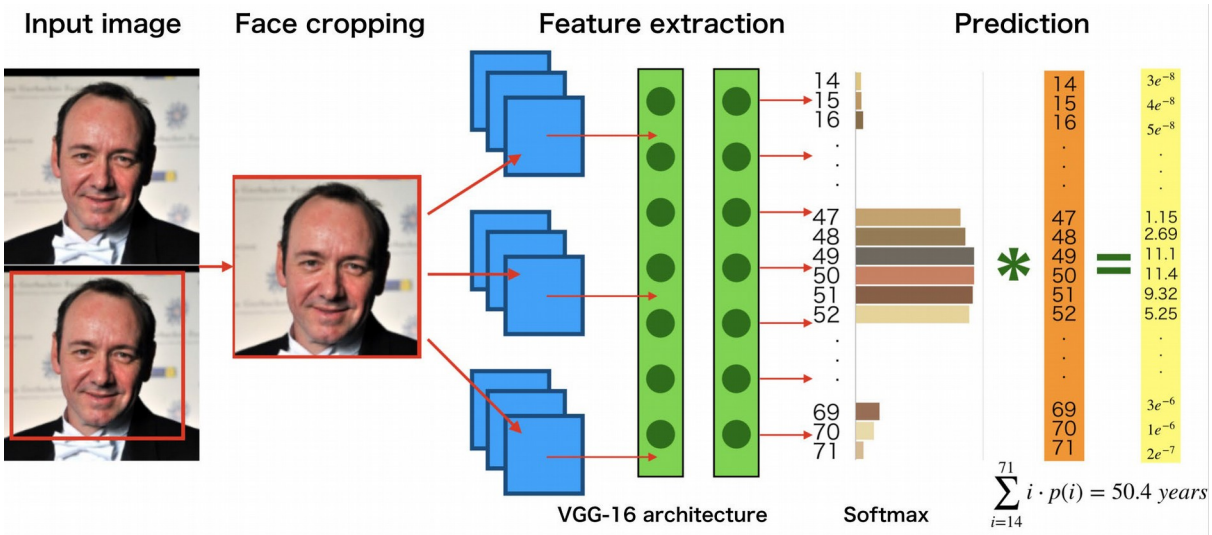


Fig : proposed system

In this Python Project, we will use Deep Learning to accurately identify the gender and age of a person from a single image of a face. We will use the models trained by Tal Hassner and Gil Levi. The predicted gender may be one of 'Male' and 'Female', and the predicted age may be one of the following ranges- (0 – 2), (4 – 6), (8 – 12), (15 – 20), (25 – 32), (38 – 43), (48 – 53), (60 – 100) (8 nodes in the final softmax layer). It is very difficult to accurately guess an exact age from a single image because of factors like makeup, lighting, obstructions, and facial expressions. And so, we make this a classification problem instead of making it one of regression.

6.2 The CNN Architecture

The convolutional neural network for this python project has 3 convolutional layers:

- Convolutional layer; 96 nodes, kernel size 7
- Convolutional layer; 256 nodes, kernel size 5
- Convolutional layer; 384 nodes, kernel size 3

It has 2 fully connected layers, each with 512 nodes, and a final output layer of softmax type.

To go about the python project, we'll:

- Detect faces
- Classify into Male/Female
- Classify into one of the 8 age ranges
- Put the results on the image and display it

6.3 The Dataset

For this python project, we'll use the Adience dataset; the dataset is available in the public domain . This dataset serves as a benchmark for face photos and is inclusive of various real-world imaging conditions like noise, lighting, pose, and appearance. It has a total of 26,580 photos of 2,284 subjects in eight age ranges (as mentioned above) and is about 1GB in size. The models we will use have been trained on this dataset.

For face detection, we have a .pb file- this is a protobuf file (protocol buffer); it holds the graph definition and the trained weights of the model. We can use this to run the trained model. And while a .pb file holds the protobuf in binary format, one with the .pbtxt extension holds it in text format.

2. We use the argparse library to create an argument parser so we can get the image argument from the command prompt. We make it parse the argument holding the path to the image to classify gender and age for.

3. For face, age, and gender, initializes protocol buffer and model.

4. Initialize the mean values for the model and the lists of age ranges and genders to classify from.

Then, we put up rectangles on the image for each such list of coordinates and return two things: the shallow copy and the list of faceBoxes.

5. But if there are indeed faceBoxes, for each of those, we define the face, create a 4-dimensional blob from the image. In doing this, we scale it, resize it, and pass in the mean values.

6. We feed the input and give the network a forward pass to get the confidence of the two classes. Whichever is higher, that is the gender of the person in the pictures.

7. Then, we do the same thing for age.

8. We'll add the gender and age texts to the resulting image and display this on as output.

6.4 Training And Testing Data

The database is divided in the CNN release layer (possible layer) on CNN contains 8 values for 8-year courses ("0-2", "4-6", "8--13", "15 - 20", "25– 32 "," 38-43 "," 48-55 "and" 60- ").

Training Data:

A training dataset is a set of examples used to train the model i.e. equations and parameters. Most of the methods used to train the samples tend to skip if the database is not mounted and used in a variety of ways.

Validation Data:

The validation data is also called the 'development dataset' or 'dev set' and is used to fit the hyper parameters of the classifier. . The ultimate goal is to select the network that performs best on the raw data which is why we use an independent validation database in the training dataset.

Testing Data:

Test data does not depend on training manual or validation data. If the model is suitable for both the training data and the experimental data it can be said that an excessive bias has occurred. Test data is data used only to evaluate the performance of a classifier or model. evaluation dataset was used to look at performance characteristics such as accuracy, loss, sensitivity, etc

7.SYSTEM REQUIREMENT SPECIFICATIONS

Prerequisites exam is simple for undertaking improvement. Prerequisites need to be archived, vast, quantifiable, and testable and characterised to some extent of detail adequate for framework plan. Necessities can be engineering, underlying, social, realistic, and beneficial. A Software Requirements Specification (SRS), product requirements specific in attaining the depiction planned reason and the weather for programming being worked on.

7.1 Functional Requirements

The tools to execute the Python programs can be many, among that we can go with Visual Studio, Anaconda Navigator (Jupyter Notebook) or any IDLE based on Python. The online tool from Google can be an effective solution towards the execution of Python coding.

7.1.1Approach 1: Microsoft Visual Studio

More efficient and powerful applications such as Website Development, Mobile Application Development and other Web-based Apps can be designed very effectively and easily. It support for productive design, Development of Cross-platform Application and (Artificial Intelligence) AI based power tools.

The major contributions from this product are:

- Project Scaling ability and support for the complexity.
- Real-time coding experience
- Automatic Code Writing tool
- Sharing Multiple Screen on Single Platform
- UnifiedcloudSupport

igure 5.1 Microsoft Visual Studio 2022 IDE, with callouts indicating the location of significant structures and functions.

7.1.2. Approach 2: Jupyter Notebook (Anaconda Navigator)

This tool is also known as IPython Notebook, and it is Open-Source Distribution Software and provides the platform for development of web applications, computational interactive and specific environment for the users to create

notebook documentations. It support for individual code execution , browser based interoperability, can plot various graphs using python libraries and also support for many open source libraries like Bootstrap, JQuery, Tornado, Matplotlib , Seaborn and others.

The features of Jupyter Notebook can be listed as:

- Flexible Notebook Interface
- Useful tool in Machine learning, Deep learning and Ai based Application and model Design.
- Creating and sharing the computational Documents.

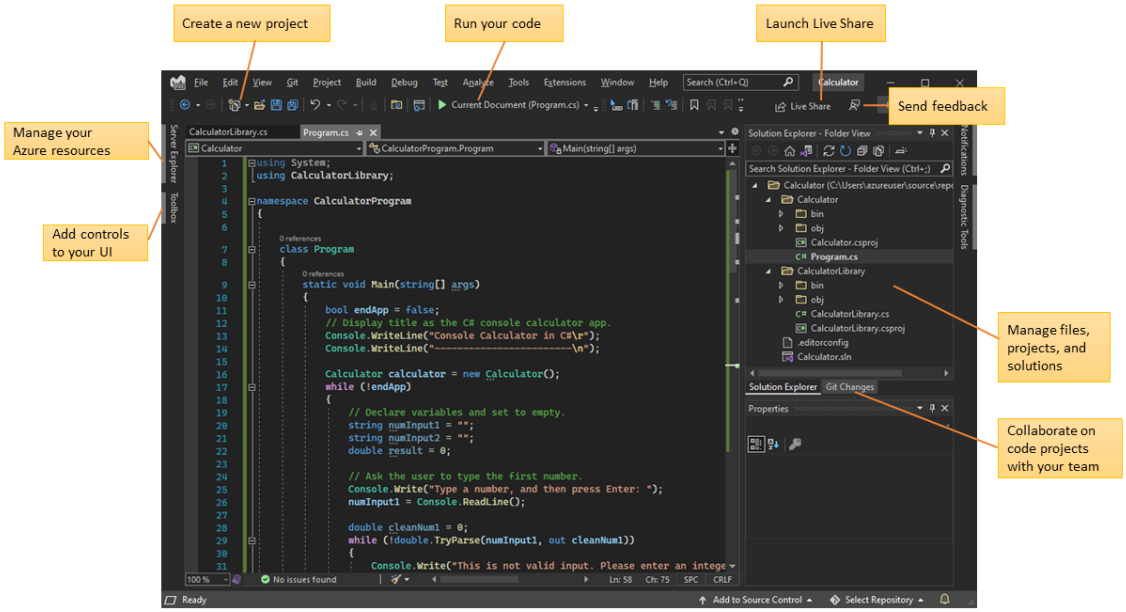


fig: Microsoft Visual Studio 2022 IDE, with callouts indicating the location of significant structures and functions.

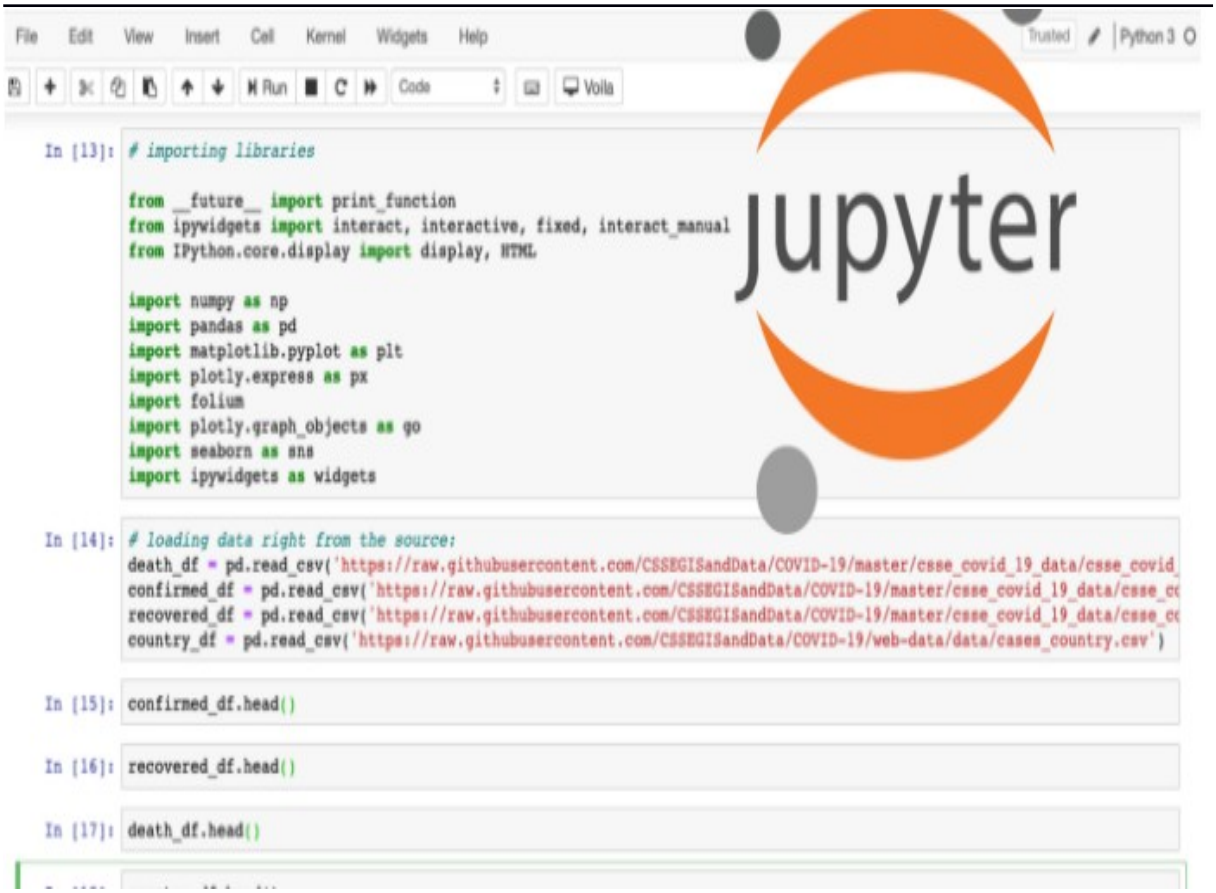


fig:Jupyter notebook

7.1.3 Approach 3: Python IDLE

Python IDLE (Python Integrated Development and Learning Environment) help is writing the code very effectively and efficiently and helpful tool to the Python learning who wants to start from the scratch and beginners can have an advantage to execute the code easily. This is a powerful interpreter and compiler to run the code.

It’s an Interactive Interpreter also known as shell, which executes the python written code, reads the input, evaluate the statements and print the output on the standard output screen provided. File Editor Help to edit the code, save the program in text files and store as .py file.

Figure : Python IDLE Download Page

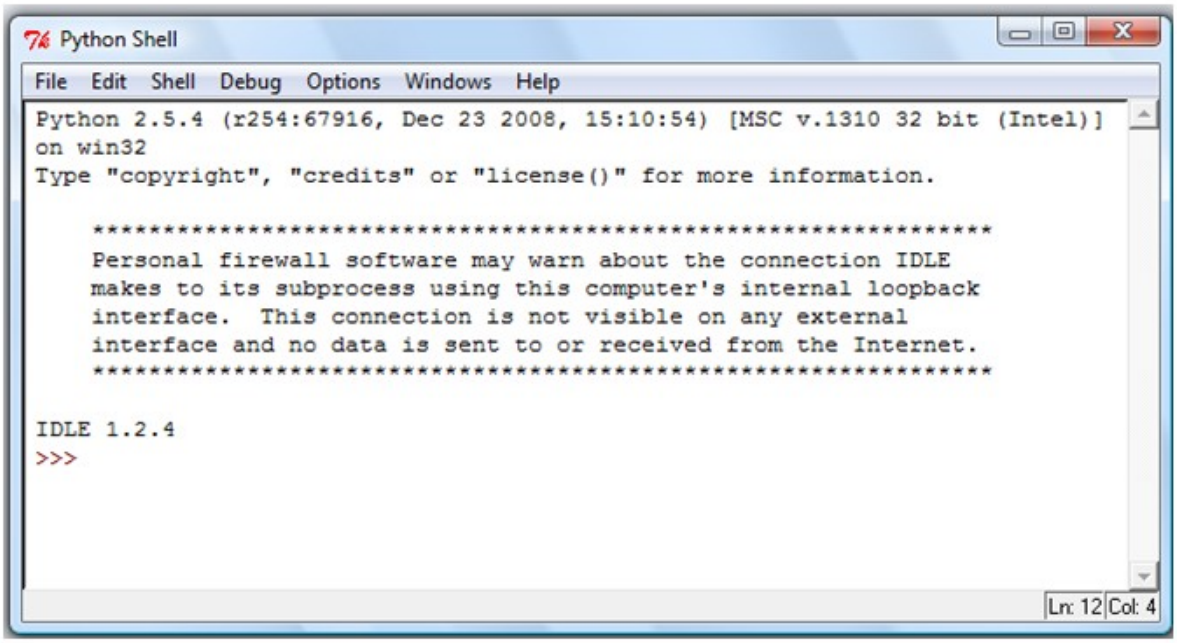


Figure : Python IDLE prompt to write and execute code.

7.1.4 Approach 4: Google Colab

Google Colab, Also called as Colab in short is a powerful Machine Learning, Deep Learning and Data Analysis Tool that allows mixing the Python script along with text document. Rich support for Plotting the graphs, Diagram, Charts, Import Images, HTML Tags Support and LATEX format API conversions. Additional functional is it

works on cloud model where document can be accessed and run on any platform independent of framework design and operating system. The runtime support for Virtual Hard Disk space and 12GB of RAM to execute the application is very excited feature of Colab. The uploading of files is very easy in this application so that it connects to the runtime.

Some of the important feature is:

- Remote Desktop Connection
- Runtime Environment
- Dataset Upload Features
- I/O operations and Operating System API Support
- General Processing Unit (GPU) availability

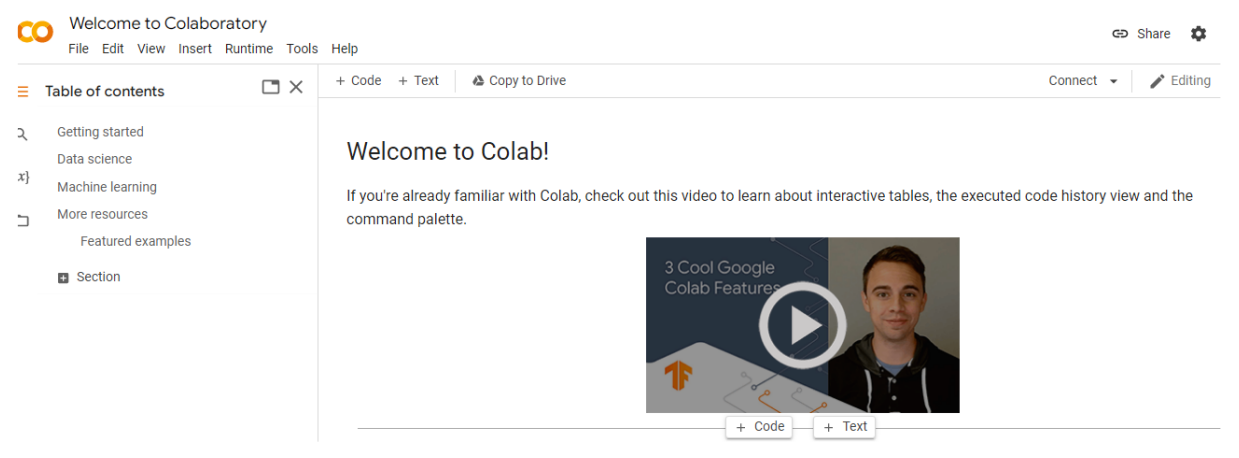


Figure 3.6: Welcome page of Google Colab

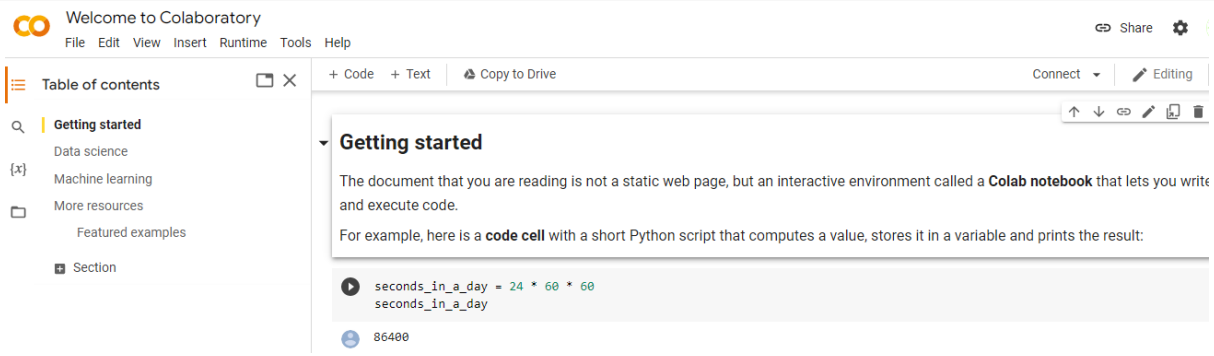


Figure Start the Application Page

7.2 Non-Functional Requirements

7.2.1 Hardware Requirements

Processor	:	3.0 GHz and Above
Output Devices	:	Monitor (LCD)
Input Devices	:	Keyboard
Hard Disk	:	1 TB or 500 GB
RAM	:	8GB or Above

7.2.2 Software Requirements

Scripting language	: Python Programming
Scripting Tool	: Anaconda Navigator (Jupyter Notebook) & Google Colab
Operating System	: Microsoft Windows 7, 8 ,10,or 11,linux
Dataset	: UCI Machine Learning Repository
Machine Learning Packages	: Numpy, Pandas, Matplotlib, Seaborn

Packages etc.

8.SYSTEM DESIGN/ANALYSIS

8.1 Limitations and Challenges

Most of the applications such as computer, human crowd surveillance, face processing, artificial intelligent, content based image retrieval and video surveillance etc. require face detection for identification and verification the enrolled users. The skin color segmentation is the major problem for face identification. Facial segmentation accuracy depends on the pose, noise, lighting conditions and distance between the object and the camera. The various types of challenges coming in the picture during detection are described below:

1. Pose: The most challenging situation is that the human face varies with respect to the relative camera face pose (45 degrees, profile, frontal and upside down).

2. Facial Expression: The facial expression such as anger, fear, disgust, happiness, sadness and surprise is most influential temperaments for human beings to communicate their feelings.

3. Illumination: Illumination is a major challenge during the detection process. This factor is related to the lightening and angle of the light.

4. Occlusion: Occlusion is the main challenge during gender detection because sometimes the face is partially covered and occluded by others objects.

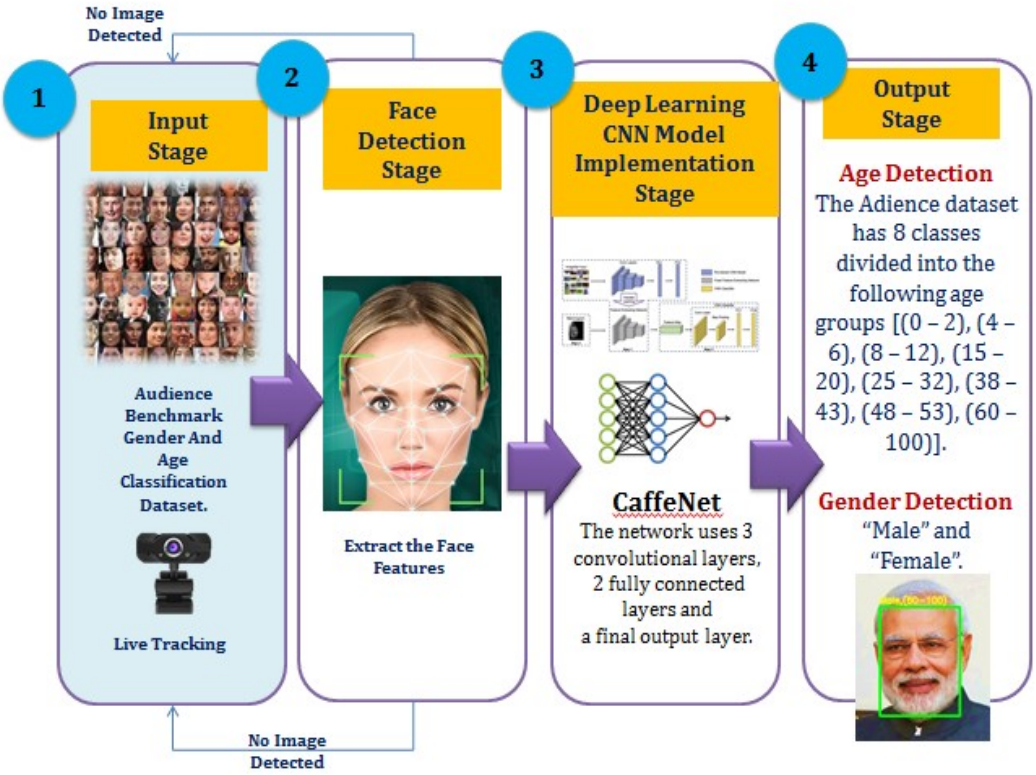
5. Imaging Condition: During the face image capture some factors such as different lightening conditions and camera characteristic (lenses, sensor response) affect the face recognition accuracy.

6. Different Facial Features: Different type of facial features such as glasses, beard, hair moustache, scars, moles, tattoos, skin color and makeup affect the face recognition accuracy.

7. Face Size: This factor is also a major challenge because face size can vary a lot person to person. Not only different people have different sized faces but the face closer to the camera and far away from the camera also pose a challenge.

8.Age: It is difficult to gather the information among the small aged ones.

SYSTEM DESIGN/ANALYSIS



MODULE 1: Data Collection

In order to get the input fast there are two options to feed the data into the algorithm.:

1. Input the image to the system into two ways :
    1. Using Bench mark data set i.e., CACD and AFAD Dataset.
    2. Second : Own dataset
        - User can use the system webcam or any other webcam camera device to directly take the live data.
        - Second User can use "—image <name>.jpg" . This method reads the jpeg file, processes it and gives back the output.

Figure 5.2 Inputs to the System

MODULE 2: FACE DETECTION

Process:

- Detect the face from the input provided and create frames
- If image is not found- ☾ Return to input Stage.
- If the face is detected, Parse the frame into VGG16 network Model
- Identify faces in the webcam or input image and prepare these images for the 2 deep learning models, i.e. age and gender models
- Send processed faces to the models and receive prediction outcomes
- Render prediction outcomes with bounding boxes to screen

MODULE 3: Processing using Deep Leaning VGG16 Algorithm

- Initializations:
- This process allows us to extract data from the detected face in previous step.
- Once the face has been detected in the frame. We can start its processing using Deep Learning Model.
- The model will carry out the testing and training phase and will give different prediction.
- The Gender prediction can be either of two: Male and Female.
- People with different ages have different facials, To make the process faster we have created age groups.
- The Age prediction can be either of these 8 groups:
- (0 – 2), (4 – 6),
- (8 – 12), (15 – 20),
- (25 – 32), (38 – 43),
- (48 – 53) and (60 – 100).

ER-Diagrams:-

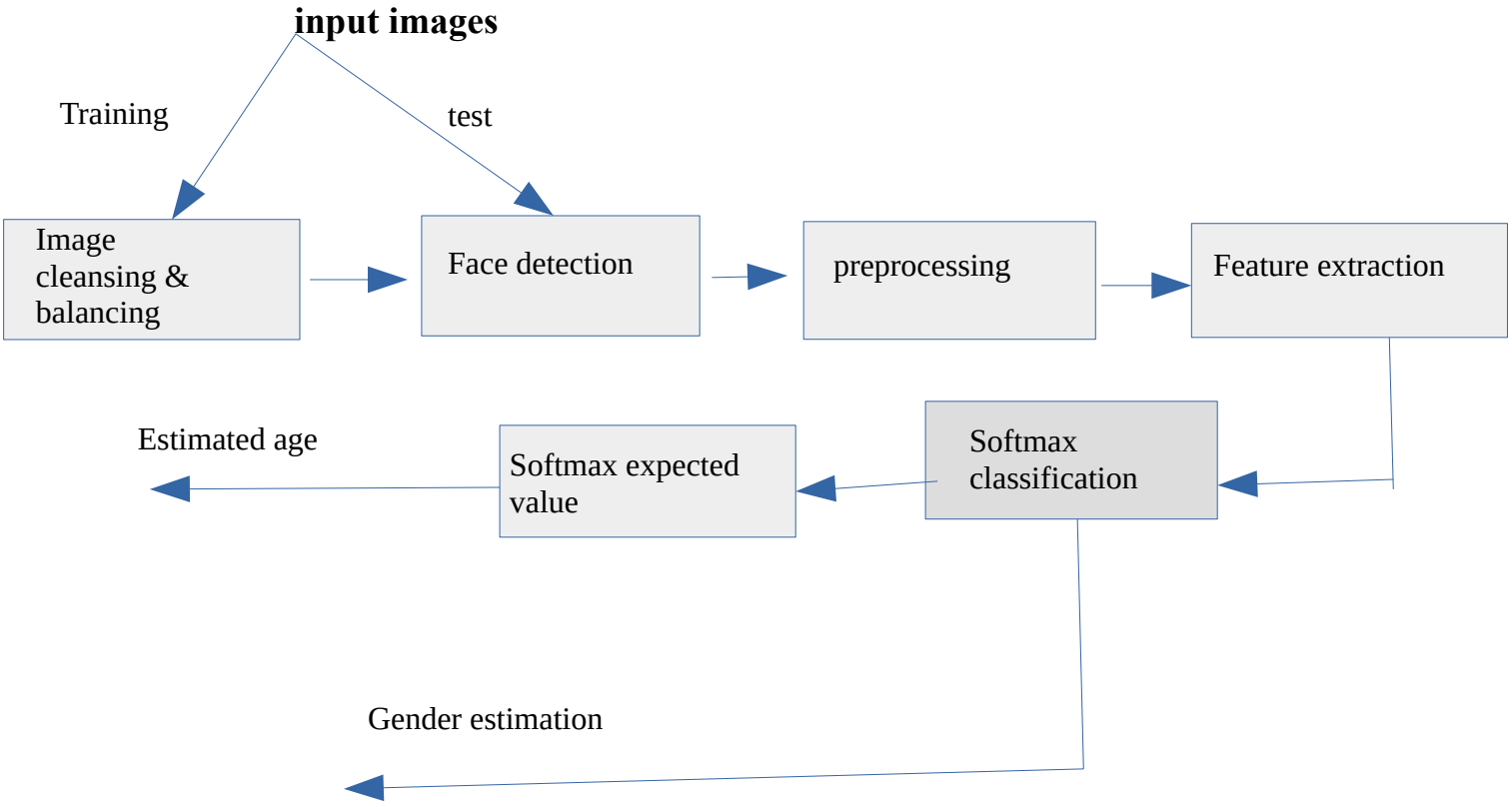
he Entity-Relationship (ER) model was originally proposed by Peter in 1976 [Chen76] as a way to unify the network and relational database views. Simply stated the ER model is a conceptual data model that views the real world as entities and relationships. A basic component of the model is the Entity-Relationship diagram which is used to visually represent data objects. Since Chen wrote his paper the model has been extended and today it is commonly used for database design for the database designer, the utility of the ER model is:

--> It maps well to the relational model. The constructs used in the ER model can easily be transformed into relational tables.

--> It is simple and easy to understand with a minimum of training. Therefore, the model can be used by the database designer to communicate the design to the end user.

--> In addition, the model can be used as a design plan by the database developer to implement a data model in specific database management software.

Schematic Diagram



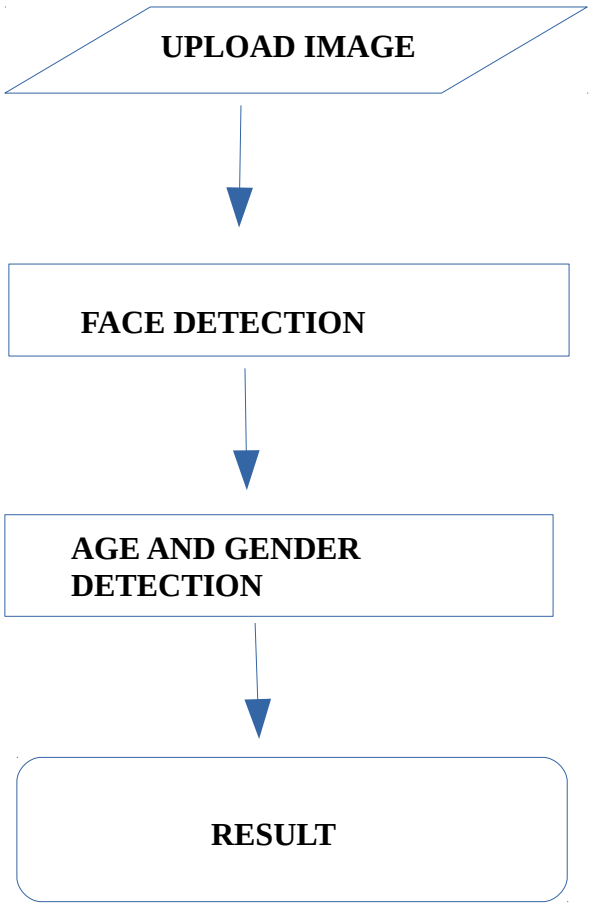
Finally Predicted is displayed on the screen

10. Flow Diagram

Flow diagram is a collective term for a diagram representing a flow or set of dynamic relationships in a system. The term flow diagram is also used as a synonym for flowchart, and sometimes as a counterpart of the flowchart.

Flow diagrams are used to structure and order a complex system, or to reveal the underlying structure of the elements and their interaction.

Figure 5.3 Flow Diagram



Sequence Diagram

The sequence diagram is a systematic approach to show the relationship and interactions between objects and every object or entity is executed sequentially. Sequence of occurrence of events can also be depicted by using the sequence diagram. Sequence diagram is mostly used in Software Development models, Business Models and making the SRS of the project.

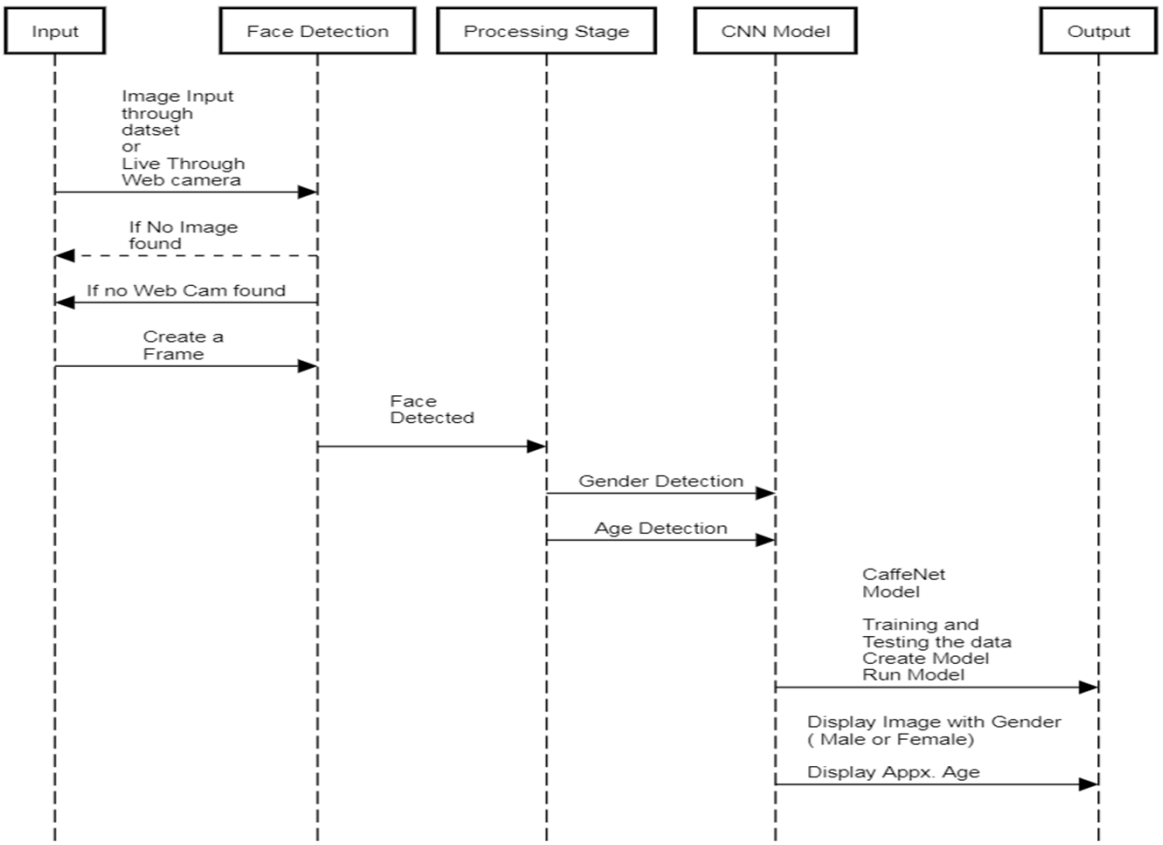


Figure 5.4 Sequence Diagram

11.IMPLEMENTATION SOURCE CODE

In this Project, we will use Deep Learning to accurately identify the gender and predict the age of a person from a single image of a face.

- **Step1: Import the Libraries**

```
import cv2 as cv
import math
import time
```

import argparse

- **Step2: Detect The face :**
- We create a function for any Face Detector capable of producing Bounding Boxes for faces in an image.

```
def getFaceBox(net, frame, conf_threshold=0.7):
  frameOpencvDnn = frame.copy()
  frameHeight = frameOpencvDnn.shape[0]
  frameWidth = frameOpencvDnn.shape[1]
   blob = cv.dnn.blobFromImage(frameOpencvDnn, 1.0, (300, 300), [104, 117, 123], True, False)
```

For Face, Age and Gender initialize protocol buffer and model.

- For face detection, we have a .pb file- this is a protobuf file (protocol buffer); it contains the graph definition and the trained weights of the model.
- We can use this to run the trained model. And while a .pb file holds the protobuf in binary format, one with the .pbtxt extension holds it in text format. These are TensorFlow files.
- For age and gender, the .prototxt files describe the network configuration and the .caffemodel file defines the internal states of the parameters of the layers.

```
faceProto = "opencv_face_detector.pbtxt"
faceModel = "opencv_face_detector_uint8.pb"

ageProto = "age_deploy.prototxt"
ageModel = "age_net.caffemodel"

genderProto = "gender_deploy.prototxt"
genderModel = "gender_net.caffemodel"
```

Step 4: Initialize the mean values for the model and the lists of age ranges and genders to classify from.

```
MODEL_MEAN_VALUES = (78.4263377603, 87.7689143744, 114.895847746)
```

ageList = ['(0-2)', '(4-6)', '(8-12)', '(15-20)', '(25-32)', '(38-43)', '(48-53)', '(60-100)']

genderList = ['Male', 'Female']

Step 5: Now, use the readNet() method to load the networks. The first parameter holds trained weights and the second carries network configuration.

ageNet = cv.dnn.readNetFromCaffe(ageProto,ageModel)

genderNet = cv.dnn.readNetFromCaffe(genderProto,genderModel)

faceNet = cv.dnn.readNet(faceModel,faceProto)

Here, net is faceNet- this model is the DNN (Deep Neural Network) Face Detector

Step 6: Video Capture from Live Web Cam

- **If no image is detected**

```
frameFace, bboxes = getFaceBox(faceNet, frame)
   if not bboxes:
      print("No face Detected, Checking next frame")
      continue
```

- **If Image is Detected**

```
 blob = cv.dnn.blobFromImage(face, 1.0, (227, 227), MODEL_MEAN_VALUES, swapRB=False)
      genderNet.setInput(blob)
      genderPreds = genderNet.forward()
      gender = genderList[genderPreds[0].argmax()]
                  print("Gender : {}, confidence = {:.3f}".format(gender, genderPreds[0].max()))
      ageNet.setInput(blob)
      agePreds = ageNet.forward()
      age = ageList[agePreds[0].argmax()]

      print("Age : {}, confidence = {:.3f}".format(age, agePreds[0].max()))
      label = "{},{}".format(gender, age)
```

cv.putText(frameFace, label, (bbox[0]-5, bbox[1]-10), cv.FONT_HERSHEY_SIMPLEX, 0.75, (0, 0,255), 2, cv.LINE_AA)

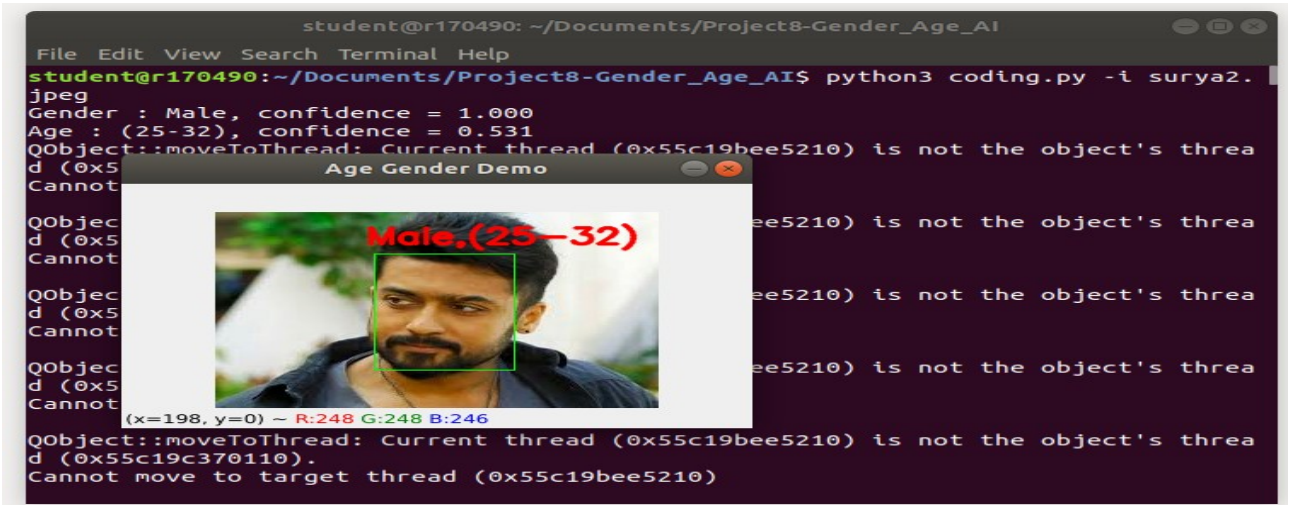
cv.imshow("Age Gender Demo", frameFace)

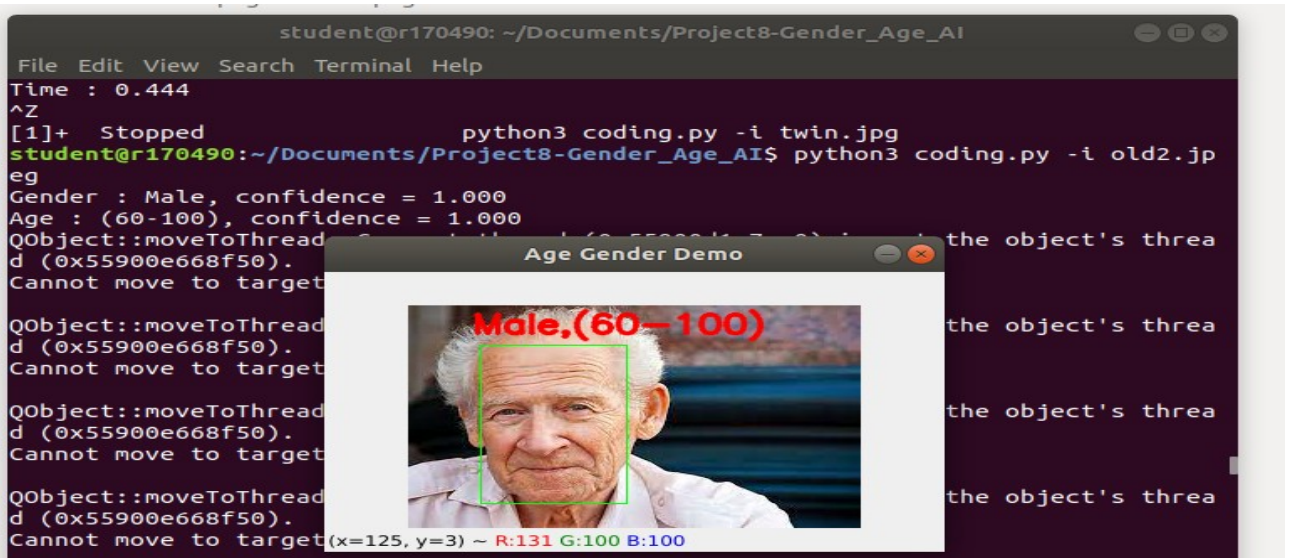
name = args.i

cv.imwrite('./detected/'+name,frameFace)

print("Time : {:.3f}".format(time.time() - t))

12.RESULTS





13.CONCLUSION

In this work, it is concluded that age and gender research has been the focus of the last few years. Despite the fact that many of the strategies of the past focused on issues of age and sexuality, not so long ago, this work certainly focuses on the compelling images taken in laboratory settings. Such settings do not adequately reflect the general appearance types of current reality photos on social networking sites and online archives. Web images, anytime, are not just about how complex they are: they are equally saturated.

Easy access to great collections of high quality video readings of a learning machine with ongoing preparation information. CNN can be used to provide effects of age and age order, not by looking at the smallest size of the uneducated image of age and sexuality; Finally, I hope that more training material will be found with work age and gender cohesion that will allow effective techniques from other forms of big data sets to be used this place. We hope you found this project well-read and useful in your quest.

FUTURE ENCHANCEMENT

When changing a dataset, the same model can be trained to predict the feelings of race etc. Age and gender classifications can be used to predict age and gender in uncontrolled real-time situations such as train stations, banks, buses, airports, etc. For example, depending on the number of male and female passengers by the age on the train station, toilets and restrooms can be built to facilitate transportation.

14.REFERENCES

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