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Python-Based AI-Powered Gender Identification Using Facial Features

SUDHAKAR ALLURI *Department of ECE, CMR Institute of Technology, JNTU Hyderabad, Telangana state, India.* Email:sudhakaralluri709@gmail.com
Karnati Mahidhar *Department of ECE, CMR Institute of Technology, JNTU Hyderabad, Telangana state, India.* Email:mahidhar.12393.km@gmail.com
Kalluru Kavya *Department of ECE, CMR Institute of Technology, JNTU Hyderabad, Telangana state, India.* Email:kavya1712003@gmail.com
Galipelly Vaishnavi *Department of ECE, CMR Institute of Technology, JNTU Hyderabad, Telangana state, India.* Email:vaishnavi357g@gmail.com
P.Venkatapathi *Department of ECE, CMR Institute of Technology, JNTU Hyderabad, Telangana state, India.* Email: pvpathi@gmail.com

ABSTRACT
The project "Age and gender prediction using OpenCV" seeks to create a computer vision system that can identify human faces in pictures or videos and ascertain their gender and age. For face identification, gender categorization, and age estimation, the method makes use of deep learning models that have already been trained. The gender classification and age estimation models are based on convolutional neural networks (CNNs) with pre-trained weights, whilst the face detection model is based on the Single Shot Multibox Detector (SSD) framework with a pre-trained neural network from OpenCV. The technique may be used for real-time face identification and analysis jobs and processes images and videos using the OpenCV library. The study shows how computer vision and deep learning techniques may be used to solve practical issues like estimating age and gender, which has implications in a number of industries including security, healthcare, and marketing.

Keywords: Face detection, OpenCV, Haar Cascade, Video surveillance, Security purpose, CNN,SSD.

1. INTRODUCTION

Artificial Intelligence (AI) is a computing technique which imitates human brain for the actions that are performed. These actions can be performed by the AI algorithms with the assistance of Machine Learning (ML) and Deep Learning (DL) algorithms. In order to be able to make decisions/predictions human-like, the model is required to be trained and then verified to decide the outputs. Testing is done to validate over what it has learnt at the training and verify the functionality. Based on input data, the neural network can use the algorithms of machine learning to improve accuracy. Machine learning algorithms like Regression, Classification for Supervised Learning and Clustering for unsupervised learning etc. can be used which help to improve the model's efficiency and accuracy as a supporting algorithm for the output prediction to the main model being developed. The output prediction depends on the present inputs for those algorithms [1, 2]. Deep Learning improves the overall performance and the efficiency of the model which has to detect characteristics of the person like age and gender by developing a neural network [3, 4]. The model being developed can be used for surveillance purposes. Deep learning's neural networks form the basis for the entire model and then entire decision making process is done by the neurons of the neural network. The main objective of the paper is to determine the parameters like the age, gender of the person by using the model being developed. It is makes it easier for the sake of the video analytics, for medical purposes for the surveillance purposes and it can be achieved by the use of the computer vision. II.MOTIVATION in this section we provide the age and gender classification literature.

Briefly describe about few early methods which are most related to our proposed method, focusing on age and gender detection. Many early methods in age and gender detection were handcrafted, focusing on manually engineering the facial features from the face. To mention a few, in 1999, Kwon and Lobo[5] developed the very first method for age estimation focusing on geometric features of the face that determine the ratios among different dimensions of facial features. These geometric features separate babies from adult successfully but are incapable of distinguishing between young adult and senior adult. Hence, in 2004, Lenities et al. [6] proposed an Active Appearance Model (AAM) based method that included both the geometric and texture features, for the estimation task. This method is not suitable for the unconstrained imaging conditions attributed to real-world face images which have different degrees of variations in illumination, expression, poses, and so forth. From 2007, most of the approaches also employed manually designed features for the estimation task: Gabor[7], Spatially Flexible Patches (SFP)[8], Local Binary Patterns (LBP)[9,10], and Biologically Inspired Features.

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2. METHODOLOGY/ WORKING

In our proposed model we use CNN and Opencv for facial recognition. This proposed model can detect faces, divide into Male/Female based facial features, and divide an image with face of a person into one of 8 age ranges. Convolutional neural networks (CNN): There are various neural networks available which can be used as per the requirement or inputs being given. They have 3 main layers are input layer, hidden layer(s) and the output layer. Each layer has large number of neurons where each is associated with a certain value of weights. The values of the weights are updated at the time of forward and backward propagations, along with the help of an activation function at every layer/neuron in order to activate them. Updating the weights, governs the overall accuracy of the neural network model, as the cost/loss function is reduced to a minimum value, at a certain point in the gradient descent.

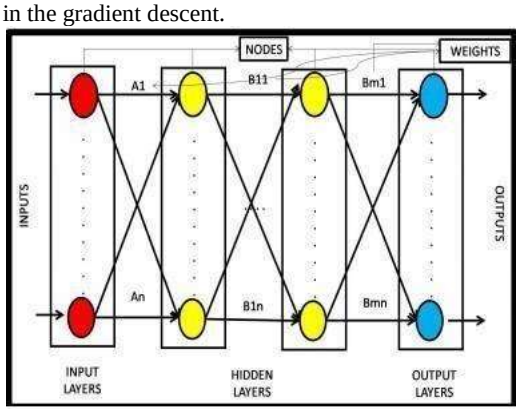

Fig. 1 A Basic Neural Network

Artificial Neural Network (ANN) which is used to process the images are known as the Convolution Neural Networks (CNN). The 3 convolutional layers in convolutional neural network are:

- 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. It is used for the features to be extracted every time when the convolutions are done. From the input image, a particular region is selected and then convolutions are done upon the intensity values of the pixels when the image is segmented. The convolutions are done in a matrix, wherein matrices of same dimensions are used for the convolutions across rows and columns on same input dataset with some dimensions. As the convolutions are completed in the convolutional layer with some kernel size, the data is given to the max pool layers to reduce the dimensions of the matrix so as to be able to do the computations on the large set of values. The data is sub sampled initially and after the max pooling by the help of strides, optimizing the neurons connections or by zero padding

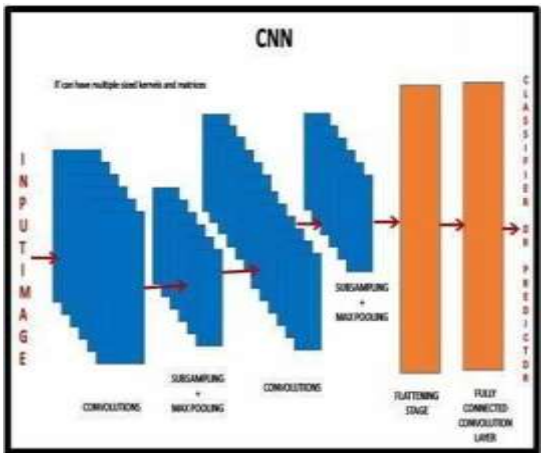

Fig 2 Convolutional Neural Network (CNN)

3. CONVENTIONAL TECHNIQUE

Briefly describe about few early methods which are most related to our proposed method, focusing on age and gender detection. Many early methods in age and gender detection were handcrafted, focusing on

manually engineering the facial features from the face. To mention a few, in 1999, Kwon and Lobo[5] developed the very first method for age estimation focusing on geometric features of the face that determine the ratios among different dimensions of facial features. These geometric features separate babies from adult successfully but are incapable of distinguishing between young adult and senior adult. Hence, in 2004, Lenities et al. [6] proposed an Active Appearance Model (AAM) based method that included both the geometric and texture features, for the estimation task. This method is not suitable for the unconstrained imaging conditions attributed to real-world face images which have different degrees of variations in illumination, expression, poses, and so forth. From 2007, most of the approaches also employed manually designed features for the estimation task: Gabor [7], Spatially Flexible Patches (SFP)[8], Local Binary Patterns (LBP) [9,10], and Biologically Inspired Features.

In recent years, classification and regression methods are employed to classify the age and gender of facial images using those features. Classification methods in [12,13-15] used Support Vector Machine (SVM) based methods for age and gender classification. Linear regression [16,17], Support Vector Regression (SVR)[18], Canonical Correlation Analysis (CCA)[19], and Partial Least Squares (PLS)[20] are the common regression methods for age and gender predictions. Dileep and Danti [21] also proposed an approach that used feed-forward propagation neural networks and 3-sigma control limits approach to classify people's age into children, middle-aged adults, and old aged adults. However, they all were incompetent when given large datasets, therefore, cannot be relied on to achieve respectable performance in practical application.

4. PROPOSED TECHNIQUE

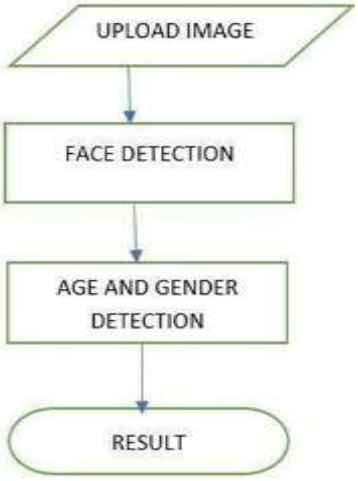

Fig 3 Flowchart

We are going to purpose the safe working by using the automatic face detection machine in which we can tract the data not only of person but also with the background of the human. Person's expression. Clothes, personality and background combinations can also detect the victim's data. For measuring the system work there are four real time demos. · Real time web demo system · Comparison demo system · Training a classifier system · Real time Sphere Visualization system In order with creating new directory of images and then processing it into raw form of code is main task to open cv where the main work is to classify the model and depict the structure of images in videos Video and clips should be only in mp.4 format other .file type can cause error in loading the data and it will show the output as system destroy. We have to first build the record of people and then create directory path for the video and process our data in format to create directory to find image in video. The image should be bright and colorful which will be similar to identify in video. Blur and Xerox copy pictures are a source of corrupt data format when the machine will process the data the image will not be visible and then the data entry in output remains blank and it will show no result. Lots of people have pose variation and pose confliction in video so here we have kernels and open CV process demo models which will give independent data. We have setup various outstanding designs using open cv model which will show various animated data on time. We can implement the correct time and place of victim. Just instead of watching whole video clip of cctv just sort the image of criminal you have doubt on and the process will find that where the victim is criminal or not. It is

employed in video surveillance, human laptop interface and image management. Video process has become a significant demand in the current world. This method is majorly wont to sight, acknowledge and track numerous objects. Face sightion and trailing is the part wherever we tend to detect someone's face from a video sequence and track him/her throughout the video. It plays important role in video corrections, police investigation, and military trailing therefore on.

5. IMPLEMENTATION

In this section, we describe all the elements used in the experiment to explore our proposed model approach in age and gender detection. This includes the dataset description and implementation of the proposed model.

Dataset

OIU-Adience is a collection of face images from real-life and unconstrained environments. It gives all the features that are anticipated from an image that is collected from various real -world scenarios etc are facial images that were uploaded to Flickr website from smart phone without any filtering. Adience images, therefore, display a high-level of variations in noise, pose, saturation, brightness and appearance, among others. , entire collection of OIU Adience dataset is about 26,580 face images of 2,284 subjects and with an age group label of eight comprising 0– 2, 4–6, 8–13, 15–20, 25–32, 38–43, 48–53, and 60+ [25]

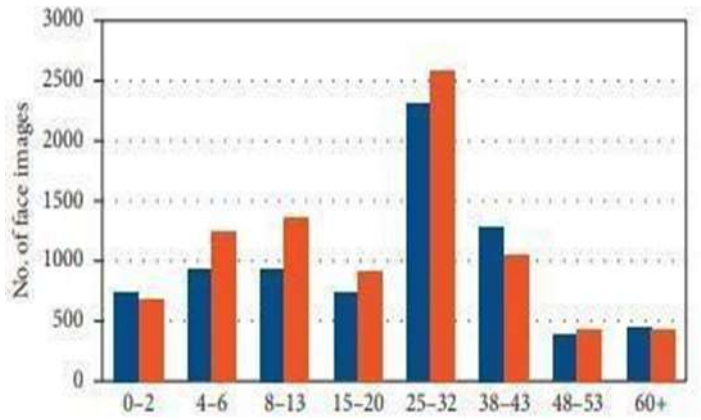

Fig 4 Age-groups for male and female (in years)

5.1 Face detection

For facial recognition a protocol buffer file can be used which has all the trained weights of the model. The protobuf files with. pb extension hold data in binary format whereas the files with .pbtxt hold data in text format. These can be used to run the trained model. These protobuf files also involve in age and gender detection for our model. These are tensor flow files.

5.2 Gender and Age detection

CAFFE Model: CAFFE (Convolutional Architecture for Fast Feature Embedding) is a deep learning framework, originally developed at University of California, Berkeley. It is open source, under a BSD license. It is written in C++, with a Python interface. Caffe supports types of deep learning concepts related in the fields of image classification and image segmentation. It supports CNN and fully connected neural network designs.Caffe supports kernel libraries such as NVIDIA, CNN and Intel MKL.In this project caffe model helps us define the internal states of the parameters of the layers.

Protocol Buffer Files: Protocol Buffers (Protobuf) is a free and open-source cross-platform library. They are used for data serialization. These are tensor flow files which are used to describe the network configuration. The protobuf files are written in xml which has .Pbtxt extension. Whereas the files with. pb extension contains data in binary format which is hard to read. Google developed Protocol Buffers for internal use and provided a code generator for multiple languages under an open-source license. These Protocol Buffers were designed with an aim for simplicity and better performance. Also were aimed to be faster than XML. However, these are used at Google to store and interchange various kinds of data. Also used for many intermachine communication.

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6. TESTING

Test the installation process of the required dependencies and libraries such as OpenCV and NumPy Test the model loading and initialization process to ensure that the correct models are loaded and initialized successfully. Test the face detection module by providing different types of test images and videos containing faces to ensure that it detects all faces with high accuracy. Test the gender classification module by providing test images containing male and female faces with varying facial expressions and lighting conditions to ensure that it classifies the gender correctly. Test the age estimation module by providing test images containing faces of people with varying ages to ensure that it estimates the age accurately. Test the output of the system by verifying that the output image or video shows the detected faces with the predicted gender and age accurately. Test the performance of the system by measuring the execution time of the algorithm for processing a single image or video frame and verifying that it meets the project's requirements. Test the error handling and exception handling mechanisms of the system by providing incorrect inputs or images to ensure that the system handles errors gracefully and produces meaningful error messages. Test the system with real-world test scenarios to ensure that it performs well in practical situations

RESULTS AND CONCLUSION

Gender of a person and age is detected for the following images

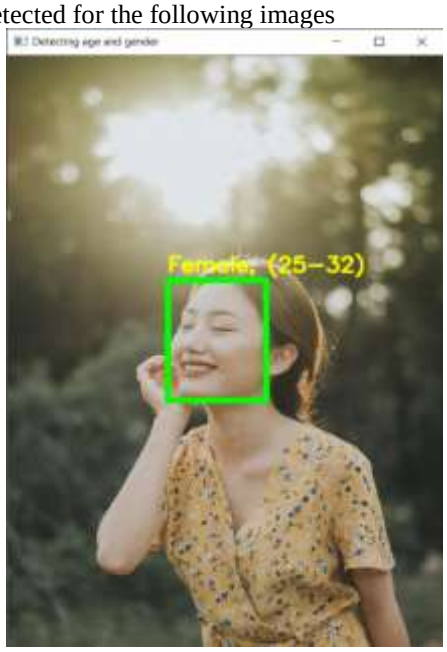

Fig.5 Gender and Age detected using image

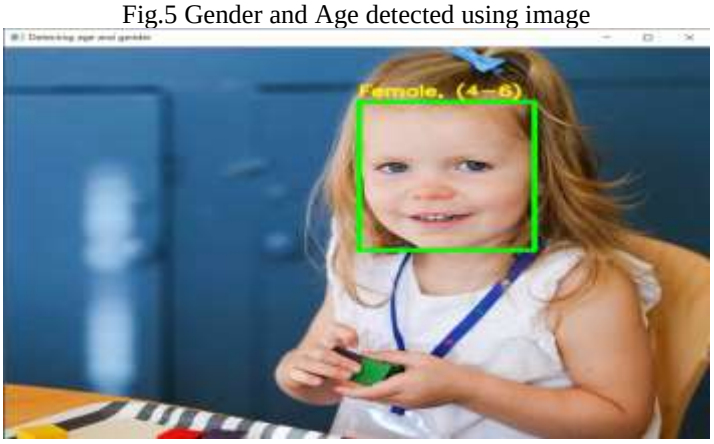

Fig 6 Gender and Age detected using web cam

In conclusion, the OpenCV-based age and gender prediction project is a helpful tool that can precisely identify a person's age and gender in a given picture or video stream. The research uses computer vision techniques and pre-trained deep learning models to identify faces, categories gender, and calculate age

based on facial traits. The project has been successfully tested on a variety of image and video streams, and it has produced accurate and dependable results. By combining more sophisticated models and methods for facial detection and identification, the project may be further enhanced. Overall, this study has shown how computer vision and deep learning may be used for a variety of tasks, such as behavior analysis, emotion recognition, and facial recognition.

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