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Gender and Age Estimator

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ABSTRACT:This research paper is about "Gender and Age Estimator" the objective of the project is to provide user an algorithm which will detects the face and predict the age and gender of given face. In this project, the concept of residual neural networks is being used which can overcome the problem of vanishing gradient which is overcome by Res Net. The project is divided into 2 modules. The first module is residual module which create convolution layers and batch normalization and make all negative pixel as zero. After that module 1 will use pooling in order to reduce dimension and noise. After that it will Create convolution, identity blocks, pooling and fully connected layer.
Module 2 workflow would be something like this

- Load Haar cascade frontal face classifier and go to path weights file
- Load weight in ResNet module
- Initialize webcam and scan face
- If the image is detected according to haarcascade, crop them
- Else print, no face found
- Predictions will be done by ResNet module
- If predicted gender is >0.5, print female else male. Similar case with age
- On initializing the webcam, it will show gender and age estimator
- Exit when user presses enter key.

KEYWORDS: Face recognition, age and gender predictor, Residual neural networks, OpenCV, python

I. INTRODUCTION

As technology enhances, the applications that combine the advanced fields of pattern recognition and image processing are used to find age and gender. In today's world, age plays a prominent role, when you appear for an interview, health check-ups. The information of age is used in many governments, private and advertising sector organization to find the culprits, employee eligible for the job, audience to be targeted for their publicity of product respectively. However, it's not that easy to find the age of a person, and there are constraints that restrict us from seeing the correct age among the set of images. Human face contains lot of information through their expressions.

These expressions confuse us while finding the age, and as their expression change, the facial feature differs, resulting in either higher or low than the people's ideal age. Age estimation is a subfield of face recognition and face tracking which in combination can predict the health of the individual. Many health care applications use this mechanism to keep track of health by monitoring their daily activities. Gender classification is also a subfield of face that aims to algorithmically identify the gender of individuals in photographs and videos. Gender also plays an important role in intelligent applications, such as access control, human-computer interaction, law enforcement, marketing intelligence and visual surveillance, etc. Gender and age are used as [2]biometrics to identify humans uniquely. To predict the age and gender, we will use a wide range of machine learning and deep learning algorithms. Neural networks is one of the most used techniques for age and gender detection. We will use OpenCV library to capture images, Haar Cascade classifier for face detection and Residual networks for gender and age estimation. OpenCV is a collection of software algorithms put together in a library to be used for computer vision applications.

Deep Neural Networks are becoming deeper and more complex. On adding more layers to a Neural Network can make it more robust for image-related tasks but can also cause them to lose accuracy. Therefore, to improve the accuracy of our model, we will use Residual networks in place of deep neural networks for age and gender estimation.

Methodology

The implementation contains 4 main steps:
1. Receive input frame from the webcam
2. Identify faces in the webcam and prepare these images for the deep learning models, i.e. age, gender models.

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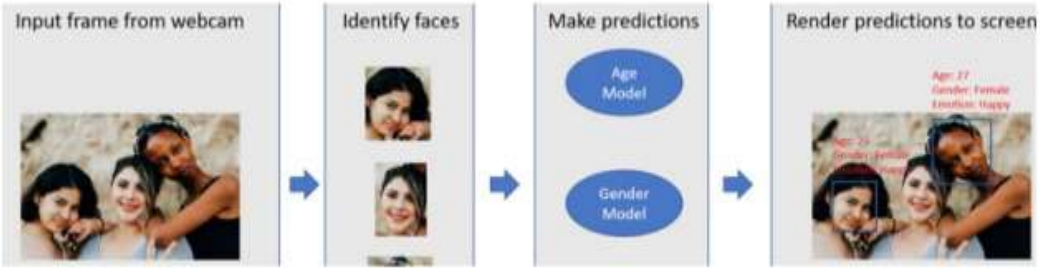
3. Send processed faces to the models and receive prediction outcomes.

4. Render prediction outcomes with bounding boxes to screen

I. METHODOLOGY OF AGE AND GEDER AND FACE ESTIMATOR



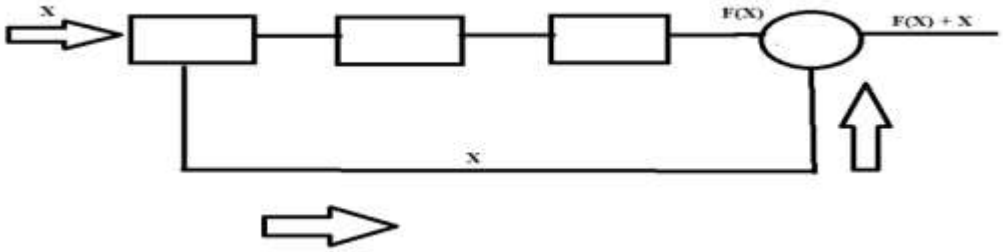
II. WORKFLOW OF GENDER AND AGE ESTIMATOR

Residual Networks

 Deep Neural Networks have the problem of Vanishing gradient which is overcome by Res Net. Whenever we use backpropagation and chain rule of calculus, we face the problem of vanishing gradient. The problem of vanishing gradient states that if we start moving in backward direction that is from the last layers of the neural network to the earlier layers(backpropagation), if we go on finding the derivative of each layer's weights and then multiply the derivative of each layer weights with the previous layers, then we get a very less value of weight at the earlier layers (this is the problem of vanishing gradient).

 Res Net overcomes this problem by using a concept called Skip connection in which the original input is added to the output of convolutional block. By doing so, we skip some of the layers, so that the value at the earlier layers do not become very less.

II. Residual block and concept of skip connections is shown.



BLOCKS USED IN RESNET AND RESNET ARCHITECTURE

[1]We have two types of blocks in Res Net- Identity and Convolution Block. Identity block is used when input size is equal to output size whereas Convolution Block is used. whenever input size and output size is not equal. Identity block is the same as a simple Res Net block using skip connections. In a convolution block, we add an extra convolution layer from input to output. magnetic field becomes many times stronger, flowing around the coil and through its center in a doughnut shape. When the coil of the solenoid is energized with current, the core moves to increase the flux linkage by closing the air gap between the cores. The movable core is usually spring-loaded to allow the core to retract when the current is switched off. The force generated is approximately proportional to the square of the current and inversely proportional to the square of the length of the air gap.

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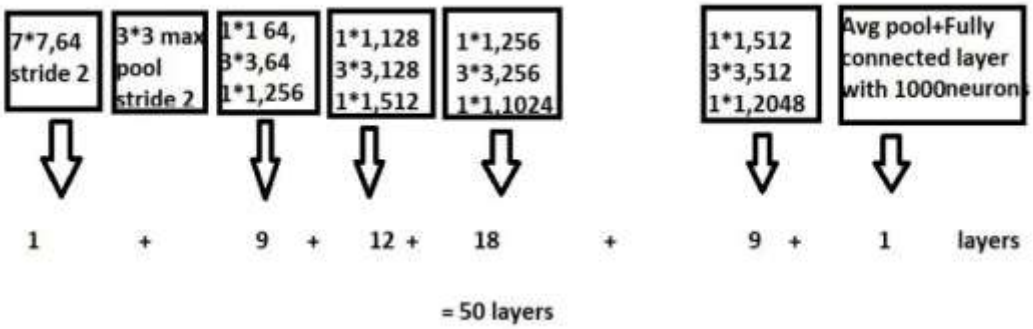

III. Diagram showing the architecture of Res Net

This diagram shows the architecture of Res Net 50.
The first layer has a filter size of 7*7, with stride 2 and we have 64 such filters. After the first layer, we have a 3*3 max pool with stride 2.
Pooling is done to reduce the size of the image and the number of parameters. The most common types of pooling used are Average and Max pool. Here we are using Max pool of 3*3 which means we divide the image into 3*3 blocks and from each 3*3 block, we take only the maximum values.
The next layer consists of 1*1 filter size with 64 filters and we have 3 such layers. Similarly, we have 3 layers with 3*3 filter size with 64 such filters and 3 layers with 1*1 filter size with 256 filters. The next layer is of filter size 1*1 with 128 such filters and stride of 2. The image size is changed on using stride of 2. So, here we use a convolution block (as input size is not equal to output size). Then we have 3 layers of 1*1 filter size and 128 filters. We have 4 layers each of 3*3 filter size with 128 filters and 1*1 filter size with 512 such filters. Next, we have a layer of 1*1 filter size with 256 filters and stride 2, so here also we need a convolution block, followed by 5 more similar layers, 6 layers of each 3*3 filter size with 256 filters and 1*1 filter size with 1024 filters. Similarly, we have one more convolution block for 1*1 filter size and 512 filters. with stride 2 and 2 more similar layers. Then there are 3 layers each for 3*3 with 512 filters and 1*1 size with 2048 filters.
At last, we have a layer for average pooling where only the average value of each block/grid is considered followed by a fully connected layer with 1000 neurons.
So, in total we have 50 layers.

III. MODULES IS AGE AND GENDER ESTIMATOR

WORKFLOW OF MODULE 1 (Residual Networks)

IV. Workflow of module1

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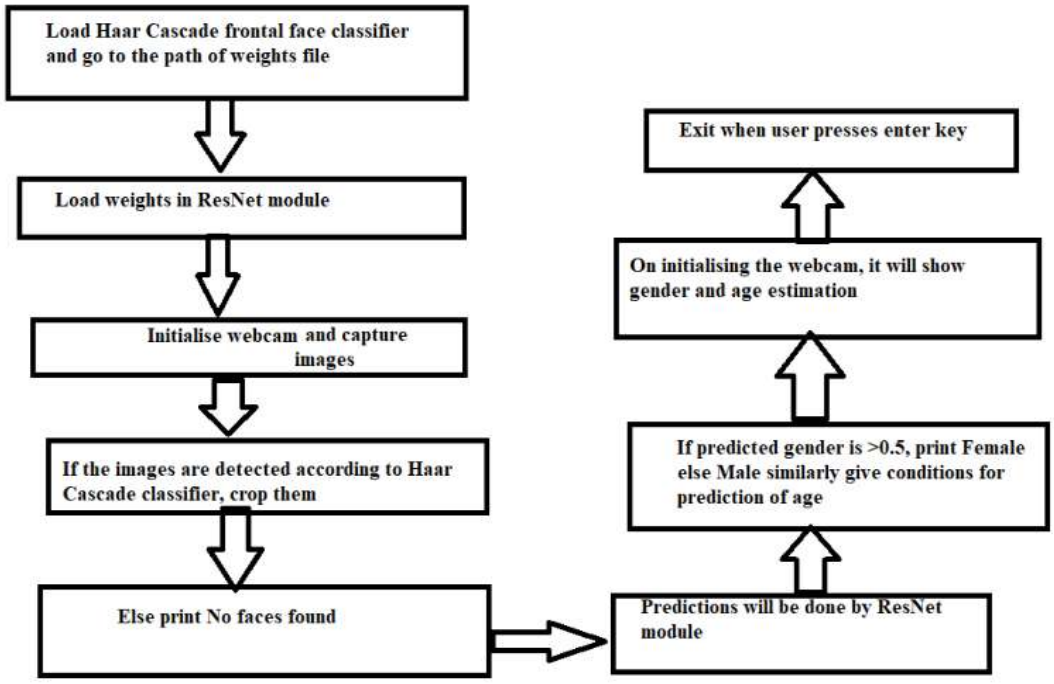
[3]Convolution layers include applying convolution operation on the input image with a filter which helps in extracting important features in an image.

Batch normalization is done by taking a semi batch of values , taking the mean and variance of all the values and then normalize each data value in terms of mean.

WORKFLOW OF MODULE 2 (real time demo)



V. Workflow of module 2

Prerequisites of workflow 2

 Keras should be installed on the system. Keras is easy-to-use open-source Python library for developing and evaluating deep learning models.

Open CV is used for Computer vision and image capturing.

Weights hdf5 file should be downloaded. Keras stores its model and model weight separately. Model weights are all the parameters of the model used in the layers of model. All the model weights are stored in this weights hdf5 file.

Haar Cascade Frontal face classifier is used for face detection.

VI. OUTOUT OF AGE AND GENDER ESTIMATOR

IV. RESULTS AND OUTPUT

As we can see from the figure, the person shown in the image is a Male and his actual age is between 20 to 25 years, the model correctly classifies the person as male and also shows a correct estimation of his age. There are many papers published on Face Recognition with various technologies in it having various accuracies associated with it. By using our methodology, we are able to get a better accuracy than other models

V. CONCLUSION AND FUTURE SCOPE

Gender classifier and age estimator was built using Residual networks and Keras. This part had two modules, one for Res Net and the other for real time testing of the model. Similar to the first section, this section also used Haar Cascade Classifier for face detection. A weights hdf5 file was used to store Keras weights. A function is called which would pick up/load the Haar cascade classifier and weights file and then all the weights were loaded into the Res Net module. After which the webcam was initialised and OpenCV was used for capturing images. If the image was classified according to the Haar Cascade classifier, pre-processing was done on the image such as cropping of the face etc. At last, we got a model that is able to work both as a Face Lock as well as a Gender classifier and age estimator.

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