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School of Information and Technology

Age and Gender Identification using Deep Learning

A project submitted
in fulfillment of the requirements for the degree of
M.Tech. (SE)

By

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ABSTRACT:

Age and gender classification has received more attention recently owing to their important role in user-friendly intelligent systems. In this project, we propose a Deep neural network (DNN) based architecture for joint age-gender classification. Ever the less, the 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.Automatic age and gender classification has become relevant to an increasing amount of applications, particularly since the rise of social platforms and social media.After we get the pretrained dataset, with the help of cameras, we identify the age and gender of the input of a person.

Keywords: Age and Gender prediction, Deep Convolutional Neural Networks, Deep learning, Caffe model .

INTRODUCTION:

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. Here we use caffe model, A **deep neural network** (DNN) which is an artificial **neural network** (ANN) with multiple layers between the input and output layers. Caffe is a deep learning framework made with expression, speed, and modularity in mind. It is developed by Berkeley AI Research (BAIR) and by community contributors. Yang qing Jia created the project during his PhD at UC Berkeley.

LITERATURE REVIEW:

Paper Title	Author and Year	Proposed Methodology	Advantages	Limitations/challenges
Gender and Age Classification of Human Faces for Automatic Detection of Anomalous Human Behaviour	Xiaofeng Wang,Azliza Mohd Ali, Plamen Angelov. Year:2017	deep CNN architecture and SVM classifier ,AlexNet and SVM classifiers,Empirical Data Analytics (EDA),deep CNNs	This method will reduce the scope in identifying suspicious persons in the forensic investigation area. accuracy for gender and age classifications are 90.33% and 80.17% respectively	longer training time for neural networks, non-guaranteed convergence of neural networks,
Age and Gender Classification using Local Appearance Descriptors from Facial Components	Fabiola Becerra-Riera Heydi Mendez-V ´ azquez ´ Annette Morales-Gonzalez Year:2017	componentbased approach with local descriptors,HOG (Histograms of Oriented Gradient),Support Vector Machine (SVM) classifiers with RBF kernels	simple method, comparable and in some cases better than deep learning approach.	HOG is very sensitive to image rotation. **HOG** is not good choice for classification of textures or objects which can often be detected as rotated image. The disadvantage is that the final descriptor vector grows larger, thus taking more time to extract and to train using a given classifier.
Development of Android Application for Gender,Age and Face Recognition Using OpenCV	Alen Salihbašić * and Tihomir Orehovački Year:2019	LBP(Local Binary Pattern),LBPH (Local Binary Pattern Histogram) algorithm	No need to training gender and age recognition models.	The andriod application has several drawbacks such as illumination, pose of the person, facial expressions, face coverage, camera features as well as the performance of the mobile device
Age and Gender Prediction using Deep Convolutional Neural Networks	Insha Rafique,Awais Hamid,Sheraz Naseer,Muhammad Asad,Muhammad Awais,Talha YasirTalha Yasir Year:2019	Convolutional Neural Network (CNN)	Using deep CNN, model is trained to an extent that accuracy of Age and Gender become 79% using HAAR cascading	CNN has limited computational resources.CNN had a much larger execution time

Facial Age Estimation based on Discrete Wavelet TransformDeep Convolutional Neural Networks	Yen-Feng Chen and Wen-Shiung Chen Year:2019	discrete-wavelet-transform deep convolutional neural networks (DWT-DCNN)	iscrete wavelet transform (DWT) is a powerful tool for signal and image processing	shift sensitivity, poor directionality, and lack of phase information.
Age Estimation From Facial Image Using Convolutional Neural Network(CNN)	Sadia Mahjabin,Md. Mahfujul Alam,Kamrul Hasan Talukder Year:2019	Convolutional Neural Network (CNN) based on ResNet50 model.	requires less training data	CNN had a much larger execution time than the SVM algorithm. Also, CNN did not perform as well when facial features were not available.CNN not suitable for monitoring a large number of sites.
Gender and age classification based on human features to detect illicit activity in suspicious sites	Edgar A. Torres,Sergio L. Granizo,Myriam Hernández-Álvarez Year:2019	Haar-like features and SVM classifiers.	better accuracy than the CNN classifier.	SVM algorithm is not suitable for large data sets
Deep Learning based approach to detect Customer Age, Gender and Expression in Surveillance Video	Dr. Earnest Paul Ijjina,Goutham Kanahasabai,Aniruddha Srinivas Joshi Year:2020	Haar Feature Selection,Adaboost,y Cascading Classifiers.	Recognize faces of consumers in below average video resolution. AdaBoost Algorithm is it is fast, simple and easy to program	AdaBoost is from empirical evidence and particularly vulnerable to uniform noise. Weak classifiers being too weak can lead to low margins and overfitting.
Human Age and Gender Estimation using Facial Image Processing	Syed Taskeen Rahman, Asiful Arefeen, Shashoto Sharif Mridul, Asir Intisar Khan, Samia Subrina Year:2020	Naive Bayes Classification,y BUET facial database. RGB format to HSV(using matlab2016)	76.3% accuracy in the age group classification while it shows 86.6% accuracy in the gender Classification. fast and auspicious	Naive Bayes Classification can be wrong in some cases, so you shouldn't take its probability outputs very seriously.
Gender and age detection using Deep Learning	Aryan Saxena, Prabhagad Singh, Shailendra Narayan Singh Year:2021	Deep learning with CNN(convolutional Neural Network)	Accuray rate is 92%	significantly slower due to an operation such as maxpool. large Dataset to process and train the neural network. Poor performance at different angles,different lighting conditions.

PROPOSED SYSTEM WITH ARCHITECTURE:

1) **Process of Deep learning Algorithm:**

(i) Training Phase:

We are using pretrained caffe model for our project.

(ii) Gender and Age identification phase:

We are taking input image from the camera and then we are extracting facial features like eye, eyebrows, chin, lip, mustache, beard, etc and then these features compared with existing Deep learning caffe model and finally age and gender label is will be shown.

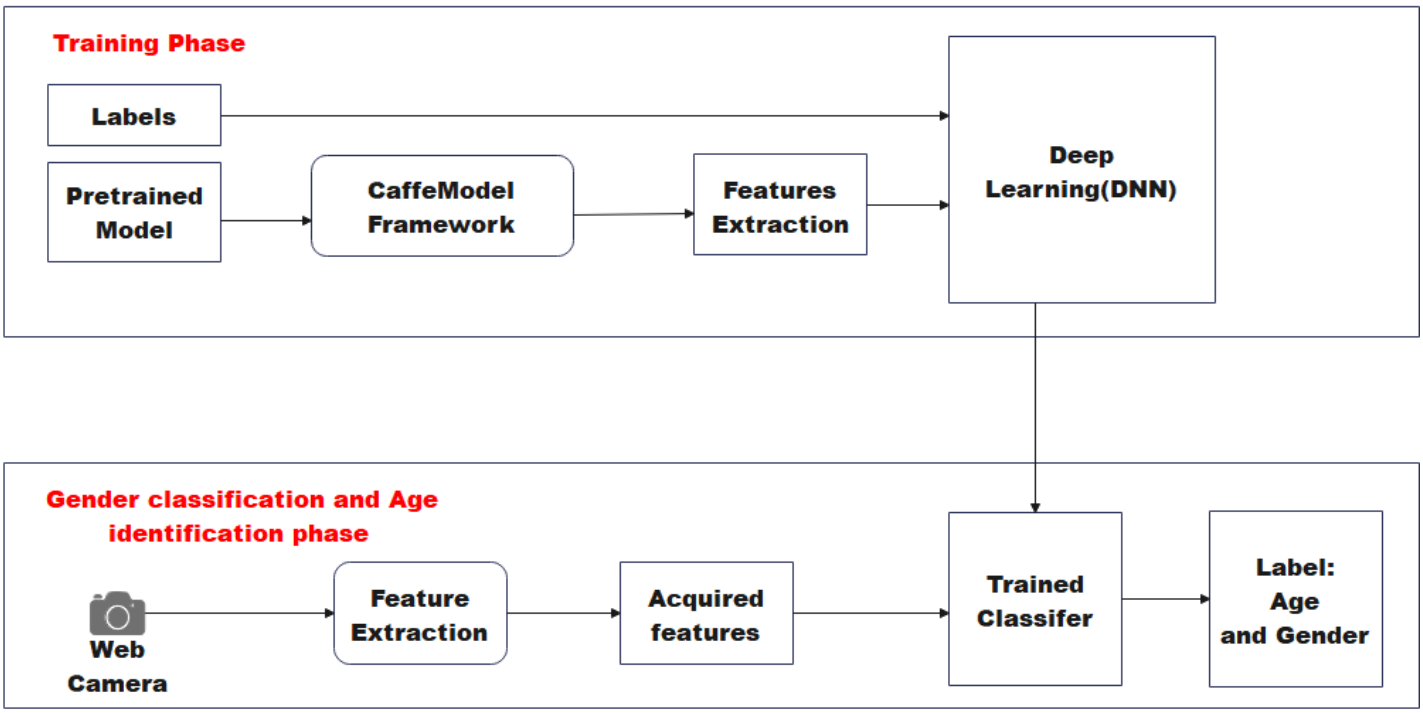
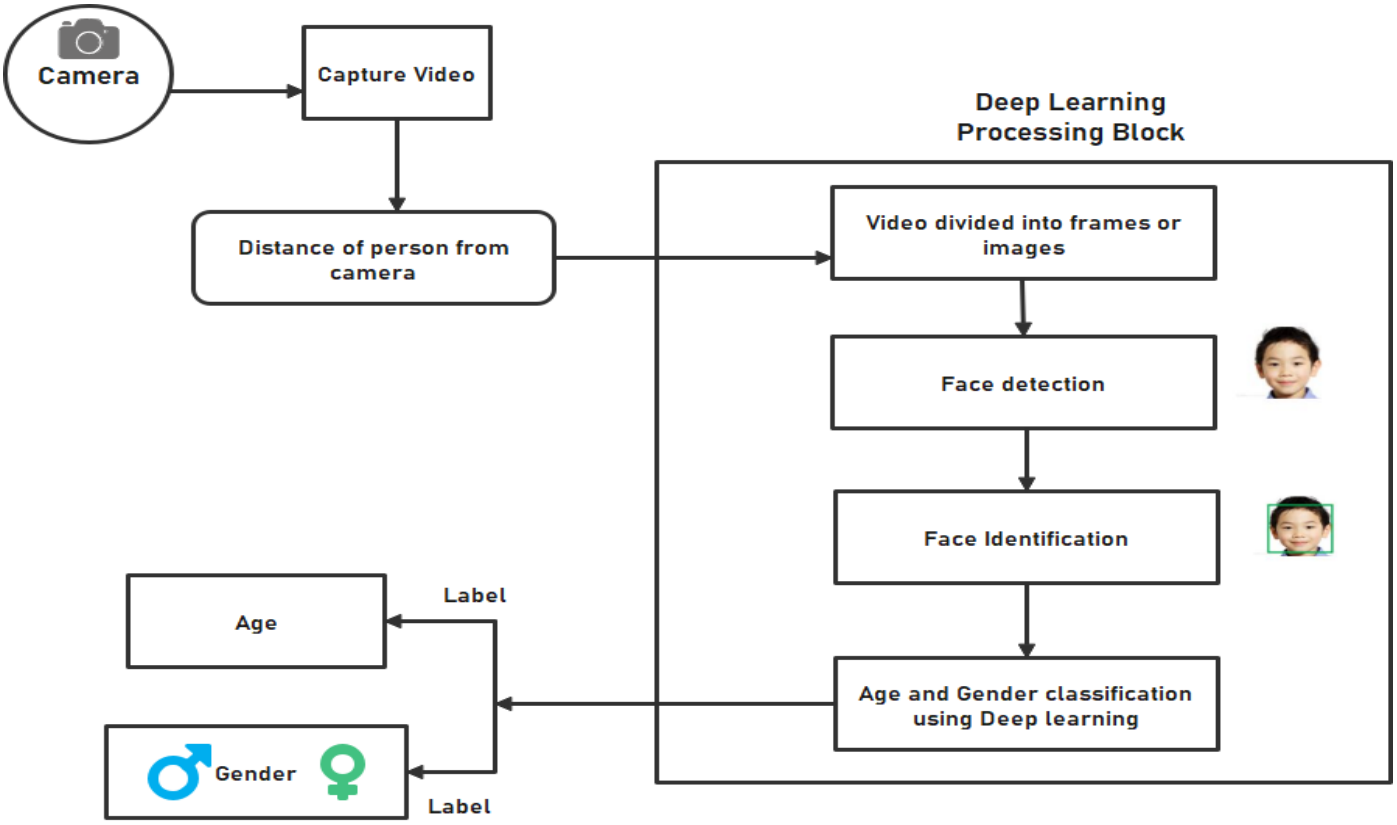


Fig.1. Process of deep learning algorithm

PROPOSED ARCHITUCTURE:

We will take input image from the webcam of laptop and if the distance between camera and person is in correct range then video will be divided into frames or images. From those images face detection and face identification will happen. With help of pretrained deep neural network caffe framework we will label like Age and gender of the person.



PRETAINED MODELS:

1. faceProto = "opencv_face_detector.pbtxt"
2. faceModel = "opencv_face_detector_uint8.pb"
3. ageProto = "age_deploy.prototxt"
4. ageModel = "age_net.caffemodel"
5. genderProto = "gender_deploy.prototxt"
6. genderModel = "gender_net.caffemodel"

2) PROPOSED METHODOLOGY:

A) Deep Convolutional Neural Networks

Convolutional neural network is one of the artificial neural network. Three characteristics of the convolutional neural networks are observed, sharing weights, locally connection and pooling the sampling. This kind of structure reduces the number of weights, decrease the complexity and has better robustness to zoom, rotation and translation. Deep convolutional neural network is composed of several convolutional layers and pooling layers. Convolutional Neural Network supplies an end-to-end model to learn the features to extract image and classify by using stochastic gradient descent algorithm. Features of each layer are obtained from local region of last layer by sharing weights. According to this characteristic, convolutional neural network seems more suitable for application of learning and expressing image features.

B) **Framework:**

Deep networks are compositional models that are naturally represented as a collection of inter-connected layers that work on chunks of data. Caffe defines a net layer-by-layer in its own model schema. The network defines the entire model bottom-to-top from input data to loss. As data and derivatives flow through the network in the forward and backward passes Caffe stores, communicates, and manipulates the information as blobs: the blob is the standard array and unified memory interface for the framework. The layer comes next as the foundation of both model and computation. The net follows as the collection and connection of layers. The details of blob describe how information is stored and communicated in and across layers and nets.

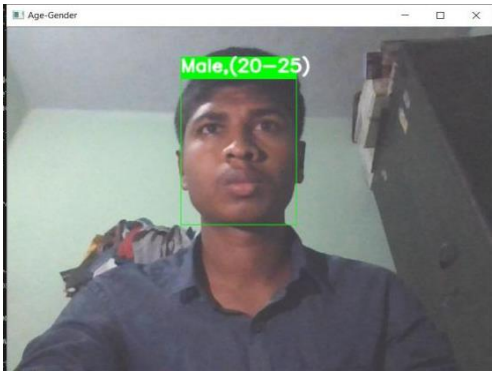
C) Libraries Used:

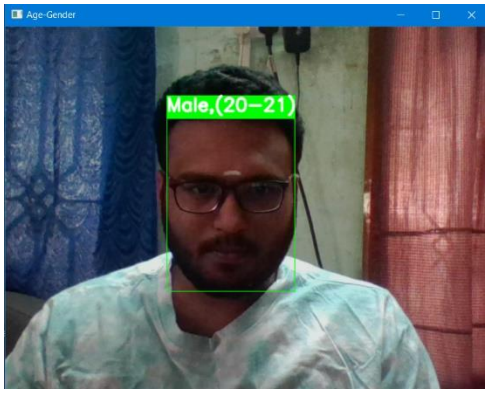
OpenCV:

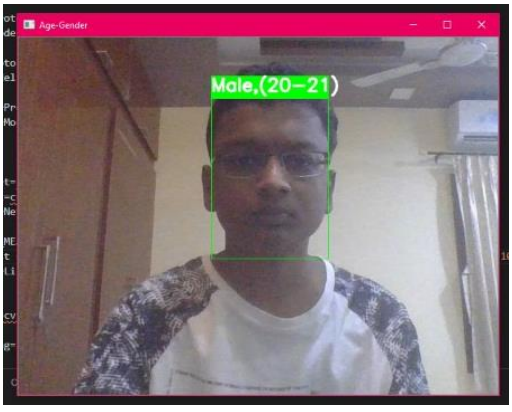
OpenCV is short for Open Source Computer Vision and in its is an open-source Computer Vision and Machine Learning library. This library is mainly used in processing the image and video real-time and is also used for boasting analytics. Moreover, it aslo supports the multiple Deep Learning frameworks like Caffe Model,TensorFlow and PyTorch.
OpenCV has a structure which means that the package includes many shared or static libraries.

RESULTS AND DISCUSSION:

1) Results Snapshots:







RESULTS OBTAINED:

1) Results obtained and Accuracy of Male age range:

Number of Inputs Tested	Age and Gender input	Actual Age range and Gender	Output of our program	Accuracy
10	0-2, Male, Female	Male,0-2	Male,0-2	88%
10	4-6, Male, Female	Male,4-6	Male,4-6	89%
10	8-12, Male, Female	Male,8-12	Male,8-12	90.1%
10	15-20, Male, Female	Male,15-20	Male,15-20	91.2%
10	20-35, Male, Female	Male,20-35	Male,20-35	95.2%
10	35-48, Male, Female	Male,35-48	Male,35-48	96%
10	48-60, Male, Female	Male,48-60	Male,48-60	89.9%
10	60-100, Male, Female	Male,60-100	Male,60-100	92.5%

2) Results obtained and accuracy of Female age range

Number of Inputs Tested	Age and Gender input	Actual Age range and Gender	Output of our program	Accuracy
10	0-2, Male, Female	Male,0-2	Male,0-2	88%
10	4-6, Male, Female	Male,4-6	Male,4-6	89%
10	8-12, Male, Female	Male,8-12	Male,8-12	90.1%
10	15-20, Male, Female	Male,15-20	Male,15-20	91.2%
10	20-35, Male, Female	Male,20-35	Male,20-35	95.2%
10	35-48, Male, Female	Male,35-48	Male,35-48	96%
10	48-60, Male, Female	Male,48-60	Male,48-60	89.9%
10	60-100, Male, Female	Male,60-100	Male,60-100	92.5%

CODE:

```
import cv2



def faceBox(faceNet,frame):
    frameHeight=frame.shape[0]
    frameWidth=frame.shape[1]
    blob=cv2.dnn.blobFromImage(frame, 1.0, (300,300), [104,117,123], swapRB=False)
    faceNet.setInput(blob)
    detection=faceNet.forward()
    bboxs=[]
    for i in range(detection.shape[2]):
        confidence=detection[0,0,i,2]
        if confidence>0.7:
            x1=int(detection[0,0,i,3]*frameWidth)
            y1=int(detection[0,0,i,4]*frameHeight)
            x2=int(detection[0,0,i,5]*frameWidth)
            y2=int(detection[0,0,i,6]*frameHeight)
            bboxs.append([x1,y1,x2,y2])
            cv2.rectangle(frame, (x1,y1),(x2,y2),(0,255,0), 1)
    return frame, bboxs



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"
```

```
faceNet=cv2.dnn.readNet(faceModel, faceProto)
ageNet=cv2.dnn.readNet(ageModel,ageProto)
genderNet=cv2.dnn.readNet(genderModel,genderProto)

MODEL_MEAN_VALUES = (78.4263377603, 87.7689143744, 114.895847746)
ageList = ['(0-2)', '(4-6)', '(8-12)', '(15-20)', '(20-35)', '(38-43)', '(48-53)', '(60-100)']
genderList = ['Male', 'Female']


video=cv2.VideoCapture(0)

padding=20

while True:
    ret,frame=video.read()
    frame,bboxs=faceBox(faceNet,frame)
    for bbox in bboxs:
        # face=frame[bbox[1]:bbox[3], bbox[0]:bbox[2]]
        face = frame[max(0,bbox[1]-padding):min(bbox[3]+padding,frame.shape[0]-
1),max(0,bbox[0]-padding):min(bbox[2]+padding, frame.shape[1]-1)]
        blob=cv2.dnn.blobFromImage(face, 1.0, (227,227), MODEL_MEAN_VALUES,
swapRB=False)
        genderNet.setInput(blob)
        genderPred=genderNet.forward()
        gender=genderList[genderPred[0].argmax()]


        ageNet.setInput(blob)
        agePred=ageNet.forward()
        age=ageList[agePred[0].argmax()]


        label="{},{}".format(gender,age)
```

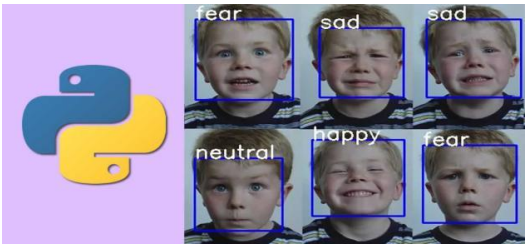
```
            cv2.rectangle(frame,(bbox[0], bbox[1]-30), (bbox[2], bbox[1]), (0,255,0),-1)

            cv2.putText(frame, label, (bbox[0], bbox[1]-10), cv2.FONT_HERSHEY_SIMPLEX, 0.8,
(255,255,255), 2,cv2.LINE_AA)

        cv2.imshow("Age-Gender",frame)

        k=cv2.waitKey(1)

        if k==ord('q'):

            break

video.release()

cv2.destroyAllWindows()
```

CONCLUSION:

In this project, we discussed an interesting application of Deep Learning applied to faces. We estimated the age and figure out the gender of the person from a web cam image. We used caffe model ,deep learning framework to execute this application.
Age Prediction should be approached as a Regression problem since we are expecting a real number as the output and this was achieved through this caffe deep neural network model.In summary, an efficient and feasible algorithm has been proposed and implemented in this project. We got around 90% for age prediction and 95% for gender prediction.

FUTURE WORK:

- Here, we estimated the age and gender in the present time.
- In adding to that we can also add the emotion prediction with the present system.



REFERENCE:

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Year:2017

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3)Development of Android Application for Gender,Age and Face Recognition Using OpenCV.Authors:Alen Salihbašić * and Tihomir Orehovački

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4)Age and Gender Prediction using Deep Convolutional Neural Networks

Authors:Insha Rafique,Awais Hamid,Sheraz Naseer,Muhammad Asad,Muhammad Awais,Talha YasirTalha Yasir

Year:2019

5)Facial Age Estimation based on Discrete Wavelet TransformDeep Convolutional Neural Networks. Authors:Yen-Feng Chen and Wen-Shiung Chen

Year:2019

6)Age Estimation From Facial Image Using Convolutional Neural Network(CNN)

Authors:Sadia Mahjabin,Md. Mahfujul Alam,Kamrul Hasan Talukder Year:2019

7)Gender and age classification based on human features to detect illicit activity in suspicious sites. Authors:Edgar A. Torres,Sergio L. Granizo,Myriam Hernández-Álvarez

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8)Deep Learning based approach to detect Customer Age, Gender and Expression in Surveillance Video.Authors:Dr. Earnest Paul Ijjina,Goutham Kanahasabai,Aniruddha Srinivas Joshi

Year:2020

9)Human Age and Gender Estimation using Facial Image Processing.Authors:Syed Taskeen Rahman, Asiful Arefeen, Shashoto Sharif Mridul, Asir Intisar Khan, Samia Subrina

Year:2020

10)Gender and age detection using Deep Learning. Authors:Aryan Saxena, Prabhagad Singh, Shailendra Narayan Singh

Year:2021