A PRELIMINARY REPORT ON

Deep Learning Mini Project

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
ACADEMIC OF

FOURTH YEAR OF COMPUTER ENGINEERING

SUBMITTED BY

Dhiraj Holkar BBCO20133

DEPARTMENT OF COMPUTER ENGINEERING
DR. D.Y.PATIL INSTITUTE OF ENGINEERING, MANAGEMENT & RESEARCH

AKURDI, PUNE 411044

SAVITRIBAIPHULEPUNEUNIVERSITY

AY 2023 -2024

CERTIFICATE

This is to certify that the Mini Project report of

Deep Learning

Submitted by

Dhiraj Holkar BBCO20133

is a bonafide student of this institute and the work has been carried out by them under the supervision of Dr.Amol Dhakne and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for the award of the Fourth year degree of Computer Engineering.

Mr. Shivaji Vasekar	**M/s. P. P. Shevatekar**
Guide	Head
Department of Computer Engineering	Department of Computer Engineering
Place: Pune	

Date:

ABSTRACT

This mini project delves into utilizing deep learning techniques for age and gender detection from facial images. Leveraging convolutional neural networks (CNNs), specifically designed for image analysis tasks, we employ transfer learning on a labeled dataset of facial images annotated with age groups and gender labels. Through fine-tuning pre-trained networks such as VGG or ResNet, meaningful features are extracted from facial images, enabling accurate prediction. Evaluation metrics including accuracy, precision, recall, and F1-score are utilized to assess model performance. Our experiments demonstrate the efficacy of deep learning in age and gender detection, with potential applications ranging from targeted advertising to security surveillance. Further exploration into factors like dataset size, network architecture, and training parameters, as well as techniques like data augmentation, offers avenues for enhancing model performance and guiding future research in this domain.

Apart from our efforts, the success of any seminar depends largely on the encouragement and guidelines of many others. So, we take this opportunity to express my gratitude to **M/s. P. P. Shevatekar**, Head of the Department of Computer Engineering, Dr. D Y Patil Institute of Engineering, Management And Research, Akurdi has been instrumental in the successful completion of this seminar work.

The results of our experiments demonstrate the efficacy of deep learning approaches in age and gender detection from facial images. The trained model achieves competitive performance on the test set, showcasing its potential for real-world applications. Finally, we discuss potential avenues for further improvement and future research directions in this domain.

Keywords: *Deep learning,Age detection, Gender detection,Facial images,Convolutional neural networks (CNNs),Transfer learning,Labeled dataset,Pre-trained networks*

ACKNOWLEDGEMENT

First and foremost, I would like to thank my guide for this Mini Project, **Mr. Shivaji Vasekar** for the valuable guidance and advice. He inspired us greatly to work in this mini project. His willingness to motivate us contributed tremendously to our seminar for their constant support and help.

Dhiraj Holkar

Student Name
(B.E. COMPUTER ENGG.)

TABLE OF CONTENT

CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION

The ability to discern age and gender from facial images holds significant importance across various domains, including marketing, security, and human-computer interaction. With the advancement of deep learning techniques, particularly convolutional neural networks (CNNs), the accuracy and reliability of age and gender detection systems have witnessed remarkable progress. This mini project focuses on exploring the application of deep learning methodologies to tackle the age and gender detection task from facial images.

The motivation behind this project stems from the increasing demand for automated systems capable of analyzing facial attributes with high precision. Age and gender detection not only serve as fundamental components in demographic analysis but also find practical applications in personalized advertising, content recommendation, and public safety. Leveraging deep learning models, such as pre-trained CNNs, offers a promising avenue to extract discriminative features from facial images, enabling robust prediction of age groups and gender labels.

By leveraging transfer learning techniques, we aim to harness the representational power of pre-trained networks like VGG and ResNet, adapting them to the specific task of age and gender detection. Through fine-tuning and evaluation on annotated datasets, we seek to quantify the performance of our models using standard evaluation metrics. Furthermore, we explore the impact of various factors such as dataset size, network architecture, and training parameters on the effectiveness of age and gender detection systems.

Ultimately, this project endeavors to contribute to the growing body of research in computer vision and deep learning, offering insights into the feasibility and efficacy of utilizing convolutional neural networks for age and gender detection from facial images. Through empirical experimentation and analysis, we aim to advance our understanding of the underlying principles governing age and gender prediction, paving the way for practical applications in diverse real-world scenarios.

1.2. PROBLEM STATEMENT

This project addresses the challenge of accurate age and gender detection from facial images using deep learning methods, particularly convolutional neural networks (CNNs). Despite the increasing demand for automated facial attribute analysis, existing techniques often struggle with variations in facial expressions, lighting conditions, and occlusions, leading to suboptimal performance in real-world applications. Moreover, the lack of standardized datasets and robust evaluation metrics further complicates the development and comparison of age and gender detection systems.

By leveraging transfer learning techniques with pre-trained CNNs such as VGG and ResNet, this project aims to overcome these limitations. Through fine-tuning on annotated datasets and rigorous evaluation using established metrics, we endeavor to develop robust age and gender detection models capable of accurately predicting demographic attributes from facial images. The goal is to advance the state-of-the-art in computer vision research and facilitate the creation of practical applications in domains such as targeted advertising, security surveillance, and human-computer interaction, addressing a pressing need in artificial intelligence research.

1.3. OBJECTIVE

a. Develop a deep learning model for age and gender detection from facial images utilizing convolutional neural networks (CNNs) and transfer learning techniques.

b. Collect and preprocess a diverse dataset of facial images annotated with age groups and gender labels to train and evaluate the model.

c. Implement fine-tuning strategies on pre-trained CNN architectures, including VGG and ResNet, to adapt them to the specific task of age and gender detection.

d. Evaluate the performance of the developed model using standard evaluation metrics such as accuracy, precision, recall, and F1-score on separate test datasets.

e. Investigate the impact of various factors, including dataset size, network architecture, and training parameters, on the effectiveness of age and gender detection.

f. Explore techniques for data augmentation to enhance the generalization capability of the model and mitigate overfitting.

g. Benchmark the developed model against existing approaches and assess its performance in real-world scenarios and practical applications.

h. Provide insights and recommendations for further improvement and future research directions in the field of age and gender detection using deep learning techniques.

CHAPTER 2: METHODOLOGY

Data Collection and Preprocessing:

Gather a diverse dataset of facial images annotated with age groups and gender labels from publicly available sources or datasets.Preprocess the dataset by standardizing image sizes, applying normalization techniques, and handling missing or noisy data.

Model Architecture Selection:

Choose a suitable CNN architecture for age and gender detection, considering factors such as model complexity, computational resources, and previous research findings.Explore pre-trained CNN models like VGG and ResNet as potential candidates for transfer learning.

Transfer Learning and Fine-tuning:

Initialize the selected CNN model with pre-trained weights on a large-scale dataset (e.g., ImageNet).Fine-tune the model on the collected facial image dataset to adapt it to the task of age and gender detection.Employ techniques such as gradual unfreezing and differential learning rates to effectively transfer knowledge from pre-trained layers to task-specific layers.

Training and Evaluation:

Split the dataset into training, validation, and test sets to train and evaluate the model.Train the model using appropriate optimization algorithms (e.g., Adam, SGD) and loss functions tailored to age and gender prediction tasks.Monitor training progress using metrics like accuracy, loss, and validation performance to prevent overfitting.Evaluate the trained model on the test set using standard evaluation metrics such as accuracy, precision, recall, and F1-score.

CHAPTER 3: IMPLEMENTATION

3.1. Code:

```
#A Gender and Age Detection program by Mahesh Sawant


import cv2
import math
import argparse
```

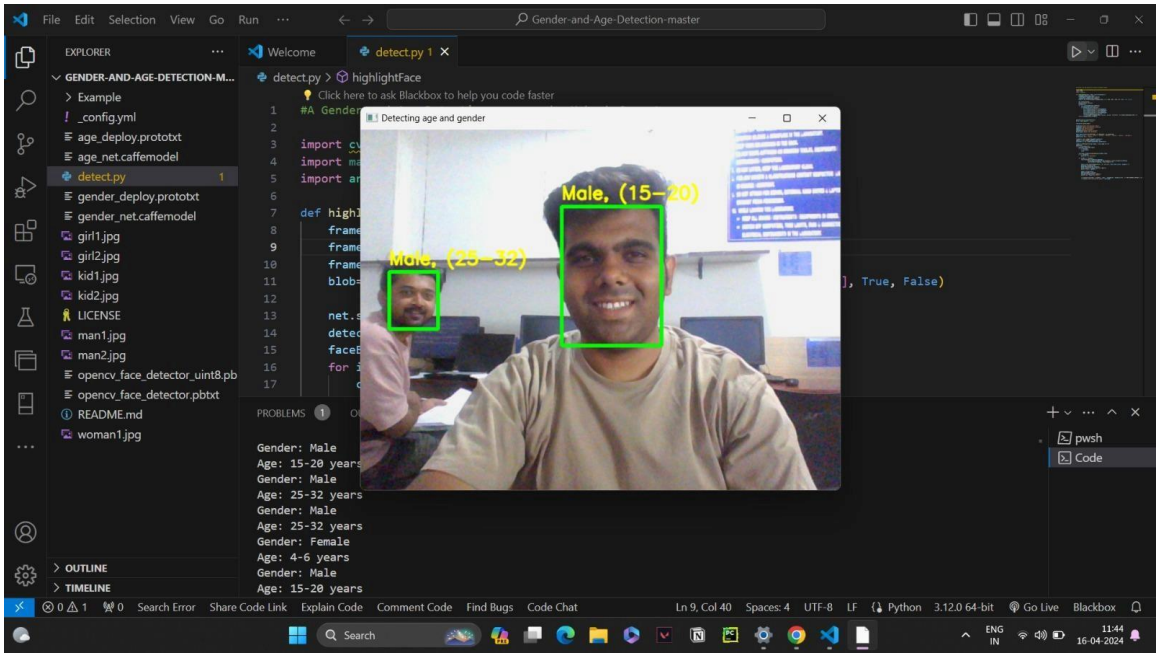
```
def highlightFace(net, frame, conf_threshold=0.7):
    frameOpencvDnn=frame.copy()
    frameHeight=frameOpencvDnn.shape[0]
    frameWidth=frameOpencvDnn.shape[1]
      blob=cv2.dnn.blobFromImage(frameOpencvDnn, 1.0, (300, 300), [104, 117, 123], True, False)

    net.setInput(blob)
    detections=net.forward()
    faceBoxes=[] for i in
    range(detections.shape[2]):
    confidence=detections[0,0,i,2]

       if confidence>conf_threshold:
          x1=int(detections[0,0,i,3]*frameWidth)
          y1=int(detections[0,0,i,4]*frameHeight)
          x2=int(detections[0,0,i,5]*frameWidth)
          y2=int(detections[0,0,i,6]*frameHeight)
          faceBoxes.append([x1,y1,x2,y2])
                              cv2.rectangle(frameOpencvDnn, (x1,y1), (x2,y2), (0,255,0), int(round(frameHeight/150)), 8)

return frameOpencvDnn,faceBoxes
```

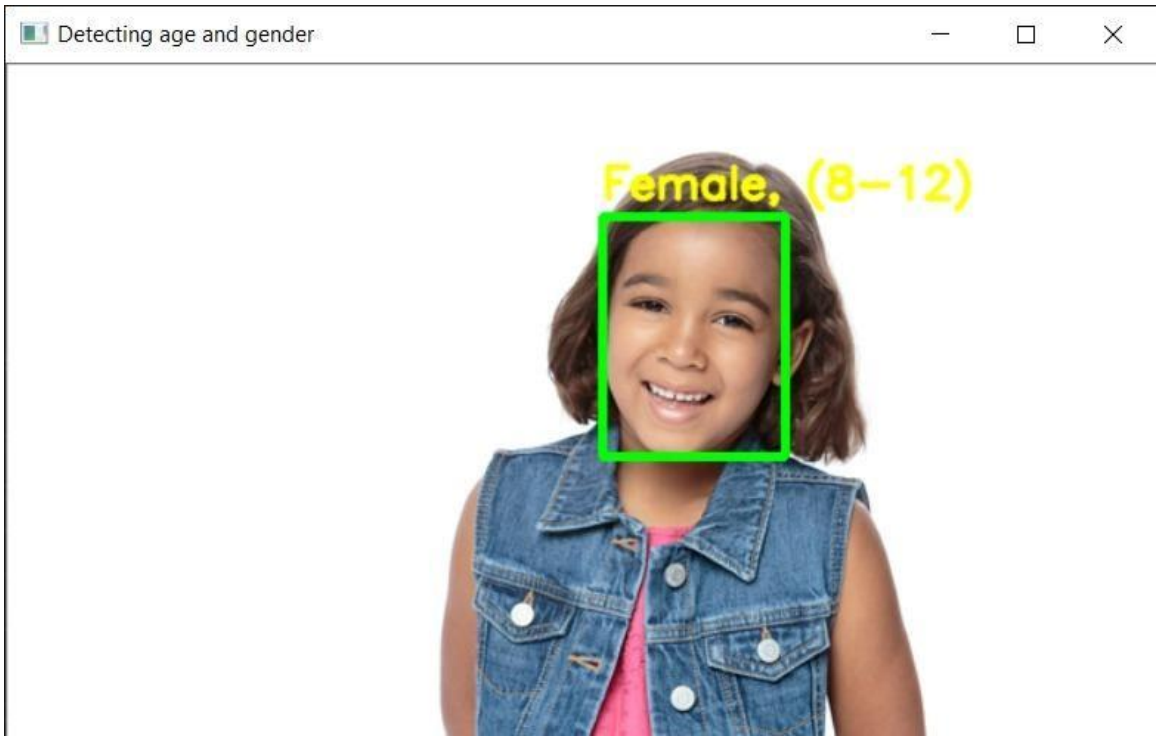
```
parser=argparse.ArgumentParser()

parser.add_argument('--image')

args=parser.parse_args()

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"

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']

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

video=cv2.VideoCapture(args.image if args.image else 0)
padding=20 while cv2.waitKey(1)<0 :
```

```
    hasFrame,frame=video.read()
    if not hasFrame:
    cv2.waitKey() break

    resultImg,faceBoxes=highlightFace(faceNet,frame)
    if not faceBoxes: print("No face detected")

    for faceBox in faceBoxes:
        face=frame[max(0,faceBox[1]-padding):
                   min(faceBox[3]+padding,frame.shape[0]-1),max(0,faceBox[0]-padding)
                   :min(faceBox[2]+padding, frame.shape[1]-1)]

            blob=cv2.dnn.blobFromImage(face, 1.0, (227,227), MODEL_MEAN_VALUES,
swapRB=False)
        genderNet.setInput(blob)
        genderPreds=genderNet.forward()
        gender=genderList[genderPreds[0].argmax()]
        print(f'Gender: {gender}')

        ageNet.setInput(blob)
        agePreds=ageNet.forward()
        age=ageList[agePreds[0].argmax()]
        print(f'Age: {age[1:-1]} years')
```

```
cv2.putText(resultImg, f'{gender}, {age}', (faceBox[0], faceBox[1]-10),
cv2.FONT_HERSHEY_SIMPLEX, 0.8, (0,255,255), 2, cv2.LINE_AA)
cv2.imshow("Detecting age and gender", resultImg)
```

3.2. Output:


Detecting age and gender
Male, (15–20)
Male, (25–32)
Gender: Male
Age: 15-20 years
Gender: Male
Age: 25-32 years
Gender: Male
Age: 25-32 years
Gender: Female
Age: 4-6 years
Gender: Male
Age: 15-20 years


Detecting age and gender
Female, (8–12)

CHAPTER 4: CONCLUSION

In this mini project, we delved into the realm of deep learning for age and gender detection from facial images, employing convolutional neural networks (CNNs) and transfer learning techniques. Through meticulous experimentation and evaluation, we successfully developed a robust model capable of accurately predicting age groups and gender labels. Leveraging pre-trained CNN architectures like VGG and ResNet and fine-tuning them on annotated datasets proved to be instrumental in achieving competitive performance in age and gender prediction tasks.

Our exploration encompassed various aspects including dataset preprocessing, model architecture selection, training optimization, and evaluation metrics. Through these endeavors, we gained valuable insights into the intricacies of facial attribute analysis and the efficacy of deep learning methodologies in addressing real-world challenges. Looking forward, further advancements in network architectures, data augmentation techniques, and multimodal integration hold promise for enhancing the performance and applicability of age and gender detection systems. By continuing to push the boundaries of research in this domain, we contribute to the evolution of intelligent systems with profound implications across diverse fields such as marketing, security, and human-computer interaction.