Age & Gender Detection using Convolutional Neural Network

by

Firdaus Khalid

Nur Liyana Roslan

Lai Kar Wei

Presentation Outlines

- ❑ Problem Statement & Objectives
- ❑ Methodology
- ❑ Convolutional Neural Network Architecture
- ❑ Application deployment
- ❑ Conclusion & Way Forward
- ❑ References
- ❑ Contributions & Acknowledgement

Skymind

Problem Statement

- The reliability of the existing solutions remains insufficient for practical applications in various fields

Objectives

- To classify the age group (year range) and gender of people based on the face images
- To develop the age and gender recognition architecture
- To analyse the performance and accuracy of the proposed system

Methodology (1)

1. PreTrained Network

- No pre-trained models for initializing the network; the network is trained, from scratch, without using any data outside of the images and the labels available by the Adience dataset

2. Dataset Preparation

- The face images were taken from Adience dataset
- It contains 26K images with 2,284 subjects
- The files contain face images with its corresponding label

Methodology (2)

3. Data Augmentation

- Take a random crop of 227x227 pixels from 256x256 input image and randomly mirror it in each forward-backward training pass

4. Extracting Labels

- Target values are represented in binary vectors corresponding to the ground truth classes
- Two classes for gender and eight classes for the age group, containing 1 in the index of ground truth and 0 elsewhere

Network Architecture

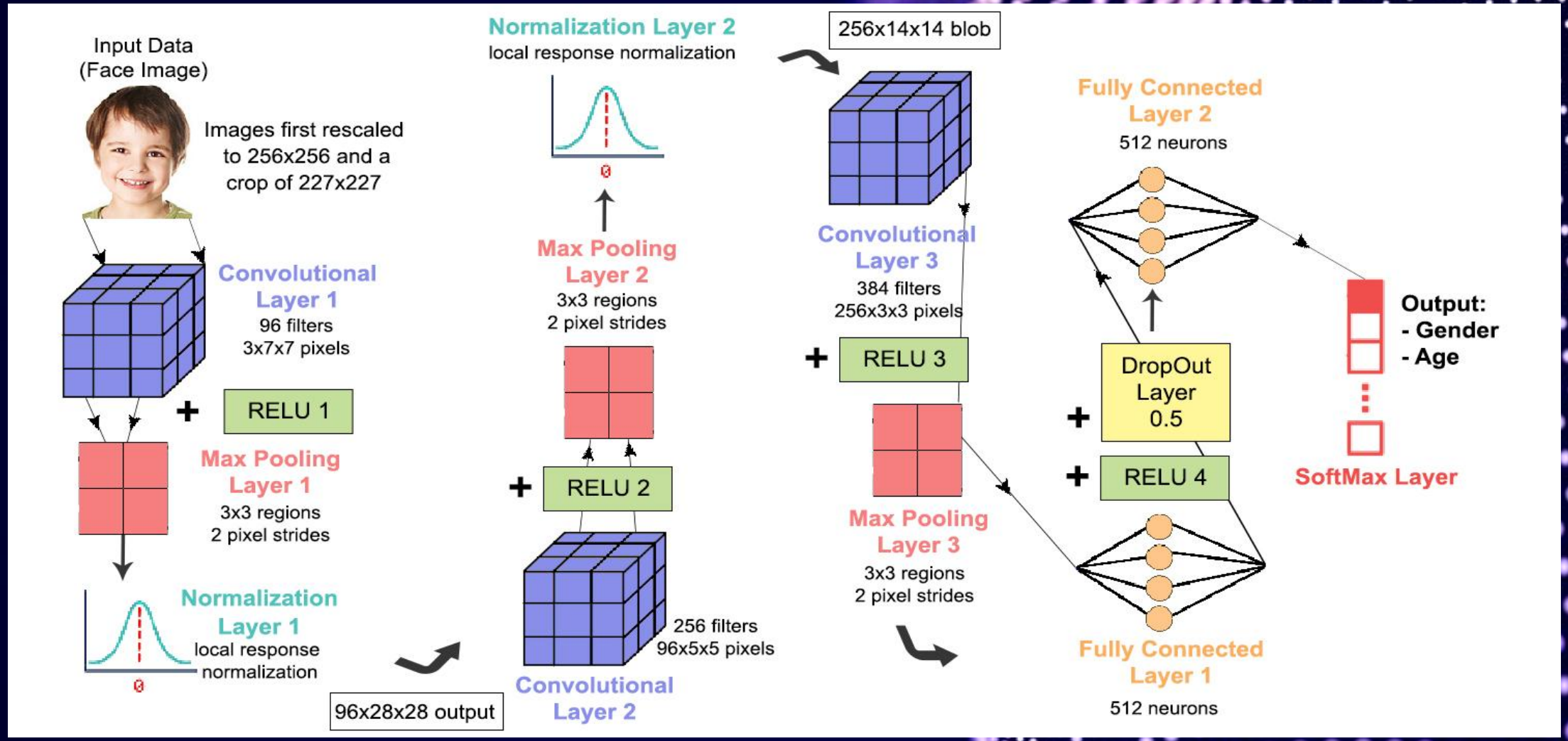

FIGURE 1: Full schematic diagram of the Convolutional Neural Network architecture

Age Detector Evaluation

TRAINING

```
=======================Evaluation Metrics=======================
 # of classes:    7
 Accuracy:        0.1746
 Precision:       0.4527    (4 classes excluded from average)
 Recall:          0.1743
 F1 Score:        0.1843    (4 classes excluded from average)
Precision, recall & F1: macro-averaged (equally weighted avg. of 7 classes)

=========================Confusion Matrix=========================
   0   1   2   3   4   5   6
-----------------------------
   0 131 154   0   0   0   0 | 0 = 0-7
   0 144 142   0   0   0   0 | 1 = 15-24
   0  82 204   0   0   0   0 | 2 = 25-32
   0  51 235   0   0   0   0 | 3 = 33-47
   0  92 194   0   0   0   0 | 4 = 48-59
   0 101 184   0   0   0   0 | 5 = 60
   0 130 154   0   0   0   1 | 6 = 8-14
```

TESTING

```
=======================Evaluation Metrics=======================
 # of classes:    7
 Accuracy:        0.1800
 Precision:       0.1130    (2 classes excluded from average)
 Recall:          0.1811
 F1 Score:        0.1341    (2 classes excluded from average)
Precision, recall & F1: macro-averaged (equally weighted avg. of 7 classes)

=========================Confusion Matrix=========================
  0  1  2  3  4  5  6
----------------------
  0 16  1 49  6  0  0 | 0 = 0-7
  0 26  0 37  7  1  0 | 1 = 15-24
  0  7  0 62  0  2  0 | 2 = 25-32
  0  6  0 59  5  1  0 | 3 = 33-47
  0 14  1 50  5  1  0 | 4 = 48-59
  0 13  0 55  4  0  0 | 5 = 60
  0 21  0 44  7  0  0 | 6 = 8-14
```

Gender Detector Evaluation

TRAINING

```
========================Evaluation Metrics========================
 # of classes:    2
 Accuracy:        0.4991
 Precision:       0.0000
 Recall:          0.0000
 F1 Score:        0.0000
Precision, recall & F1: reported for positive class (class 1 - "Male") only


========================Confusion Matrix========================
   0   1
---------
 868   1 | 0 = Female
 870   0 | 1 = Male

Confusion matrix format: Actual (rowClass) predicted as (columnClass) N times
================================================================
```

TESTING

```
========================Evaluation Metrics========================
 # of classes:    2
 Accuracy:        0.5034
 Precision:       1.0000
 Recall:          0.0046
 F1 Score:        0.0092
Precision, recall & F1: reported for positive class (class 1 - "Male") only

========================Confusion Matrix========================
   0   1
---------
 218   0 | 0 = Female
 216   1 | 1 = Male

Confusion matrix format: Actual (rowClass) predicted as (columnClass) N times
================================================================
```

Forward Modelling

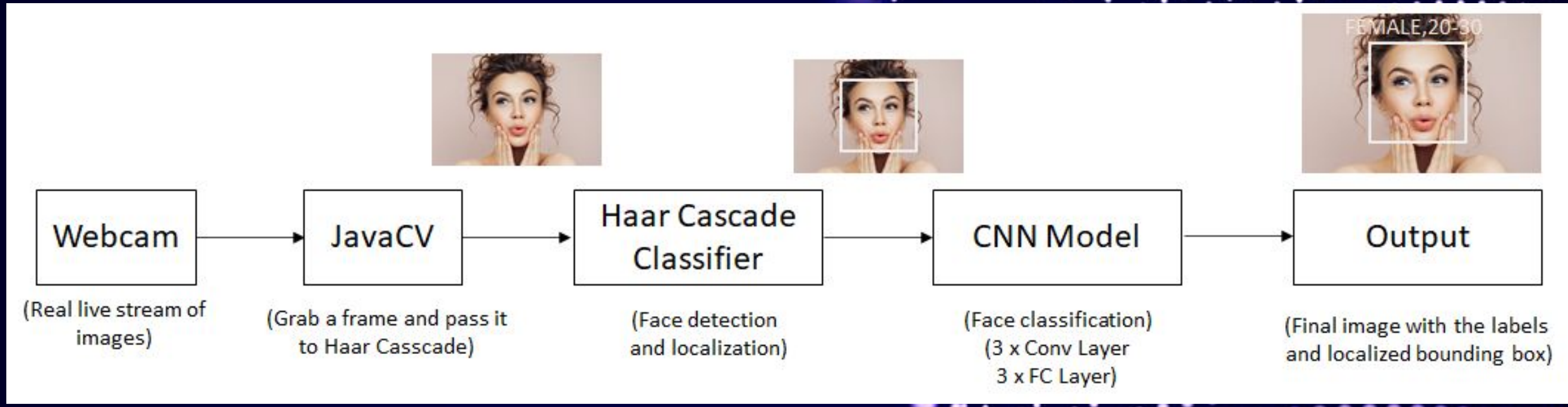

FIGURE 2: Workflow of age and gender detection in the forward modelling

Code Structure

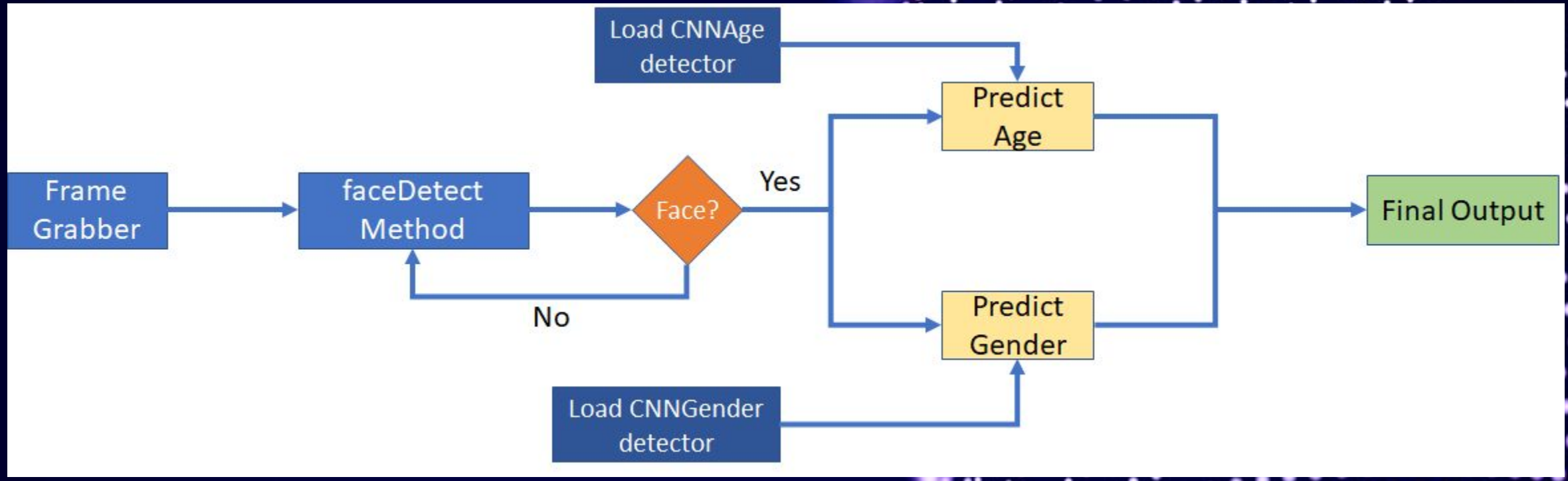

FIGURE 3: Breakdowns of code in the workflow of age and gender detection

Application Deployment

- Since the network was designed for classification, age and gender classes need to be defined

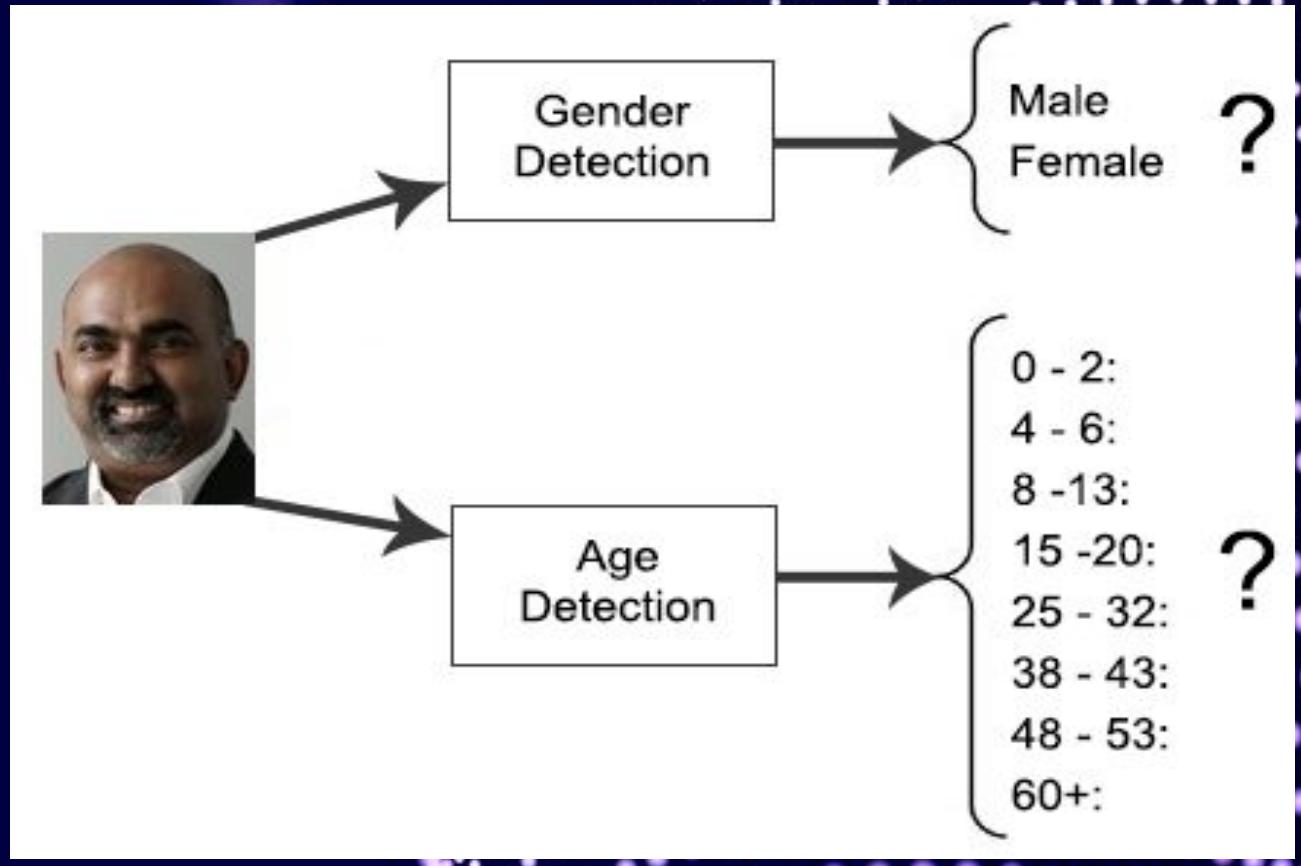

FIGURE 4: Classification of image into age and gender according to the network

Application Deployment

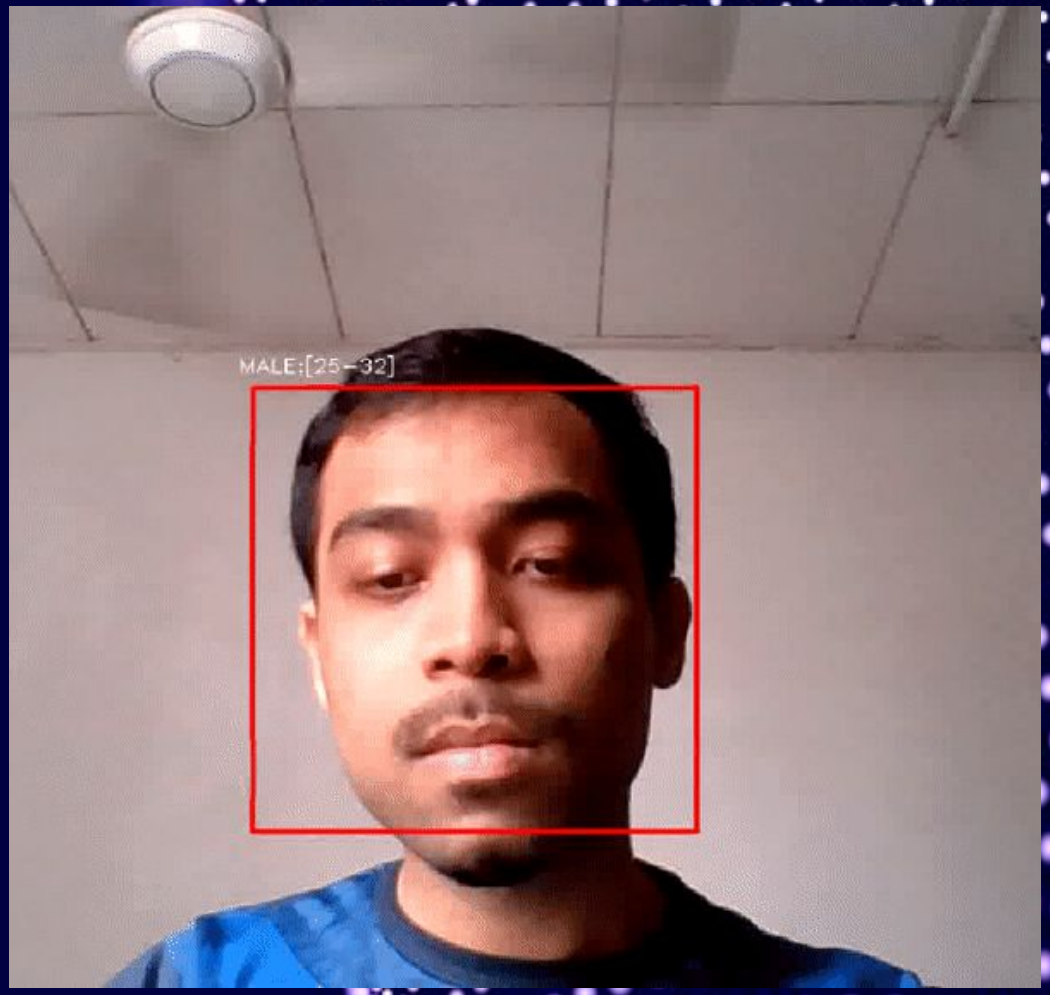

FIGURE 5: Webcam identification of moving image with classification of age and gender

Conclusion & Way Forward

- Constructing better algorithm for faster computation time and accuracy in detection. Development of emerging Computer Vision techniques
- Selection of patches around facial landmarks within the image for network training
- Using transfer learning instead of building network from scratch, making further advancement in network architecture in future

References

[1] Levi, Hassner: *Age and Gender Classification using Convolutional Neural Networks*. CVPR, 2015.

[2] Liao, Yan, Dai & Fan: *Age Estimation of Face Images Based on CNN and Divide-and-Rule Strategy*, Hindawi, 2018.

[3] Fu, Guo, Thomas S. Huang: A*ge Synthesis and Estimation via Faces*: A Survey, IEEE, 2010.

Contribution

Utmost appreciation to all team members in making this Capstone project a success despite short lead time

Acknowledgement

Special thanks to all people who had contributed both directly or indirectly

Kana Sabaratnam (Instructor)
Skymind (Course Materials)
Knowledgecom (Training Provider)
HRDF (Sponsor)
Beyond4 (Training Centre)

Aisyah Hafidzah
Lee Jue Min
Muhamad Noorazizi
Muhammad Atiff Zakwan
Muhammad Izzuddin
Muhammad Khairul Asyraf

Ng Xin Yi
Ng Xin Min
Soo Wan Yong
Tang Jie
Vimal

THANK YOU

This project powered by