SRI VENKATESWARA COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Facial Features Based Human Age, Gender And Ethnicity Identification System

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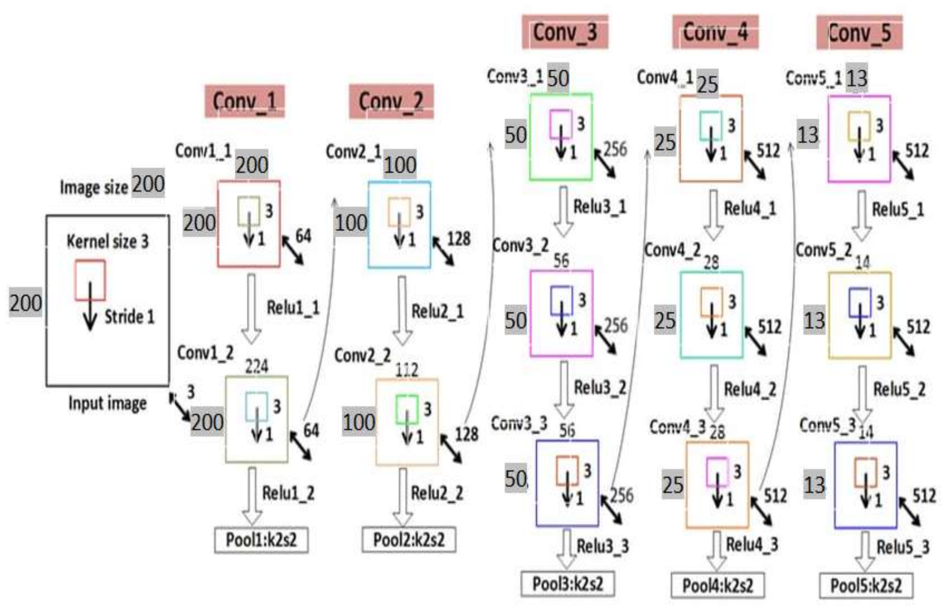
Abstract

- Since the rise of social platforms and social media, automatic age, ethnicity, and gender classification have been relevant to a growing number of applications.
- Nevertheless, the performance of existing methods on real-world images is still significantly lacking.
- As a result, we show that learning representations using deep-convolution neural networks (CNN) can result in a considerable improvement in performance on these tasks.
- For image-based gender, age, and ethnicity estimates, deep neural networks with pre-trained weights are used.
- VGG is used to investigate transfer learning.
- Finally, a hierarchy of deep CNNs is explored, which first classifies participants by gender and then predicts age and ethnicity using separate models.

Proposed Architecture Diagram

VGG16 is a convolution neural net (CNN) architecture which is trained from scratch for facial recognition using VGG Face Dataset.



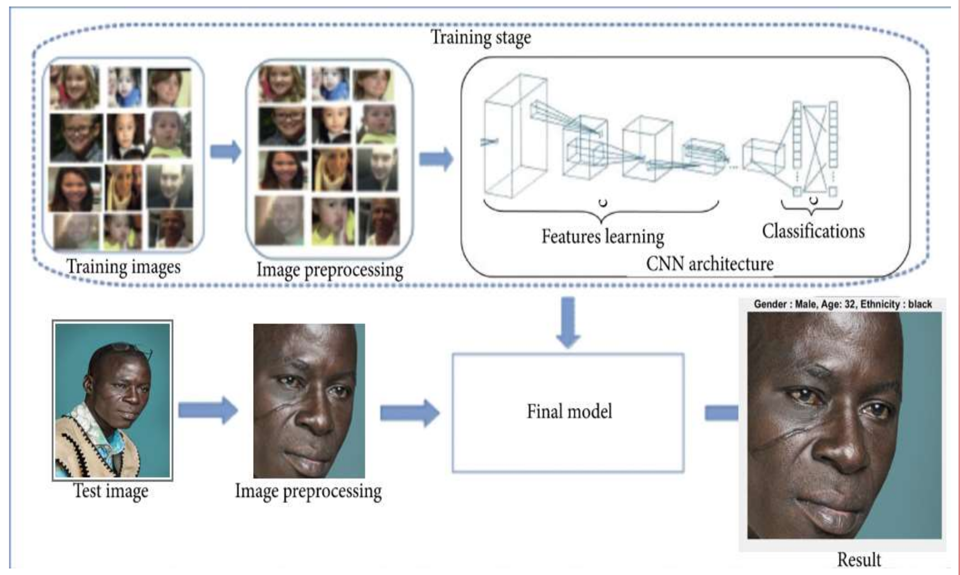
Here we use, Convolution layer of 3x3 kernel ,stride 1x1 and padding(1),starting with 200x200 input features. Max pool layer of 2x2 pool size and stride 2x2 and has no zero padding of the system.

We use the below formula to determine the number of output features from each layer.

$$n_{out} = \left[\frac{n_{in} + 2p - k}{s}\right] + 1$$

n_{in}: number of input features
n_{out}: number of output features
k: convolution kernel size
p: convolution padding size
s: convolution stride size

Project Workflow



Modules

Primary modules used in this project are:

- **Image Pre-processing**: Iimproves the image data (features) by suppressing unwanted distortions and enhancement of some important image features.
- **Detection**: Refers to the localization of an object which means the segmentation of the image and identifying the position of the object of interest.
- **Feature extraction and training: I**dentifies the most interesting patterns of the image, features that might be unique to a particular class and that will, later on, help the model to differentiate between different classes. This process where the model learns the features from the dataset is called model training.
- **Classification**: Categorizes detected objects into predefined classes by using a suitable classification technique that compares the image patterns with the target patterns.

Hardware and Software Requirements

Software:

- Operating System - Windows 11
- Software Programming Package - MATLAB R2022a

Hardware:

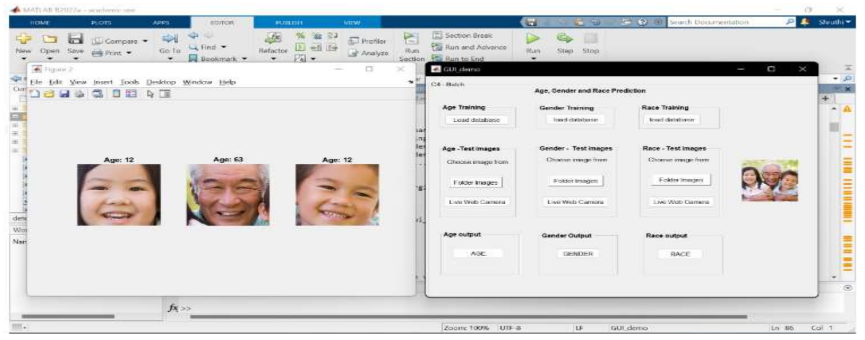
- Processor Type - Pentium -IV
- Speed - 2.4 GHZ
- Ram - 8 GB
- Hard disk - 552 GB SSD

System Used:

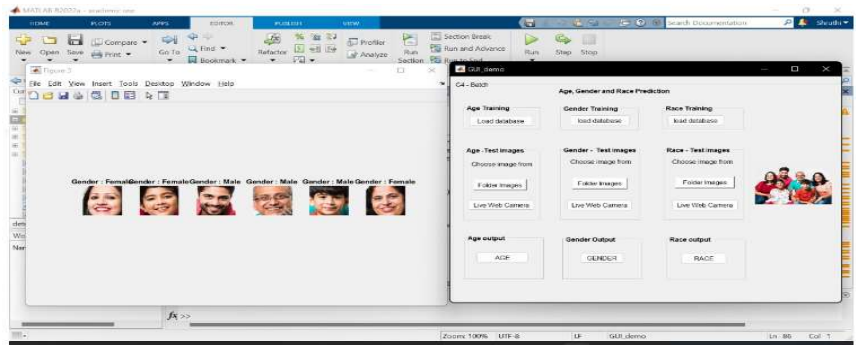
- Name of the Company: MI
- Version: 21H2

Implementations

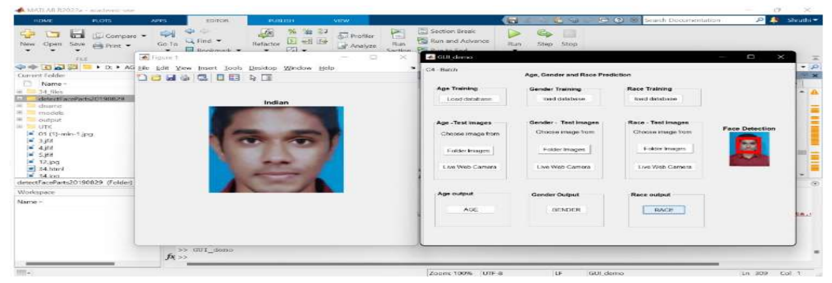
AGE



GENDER

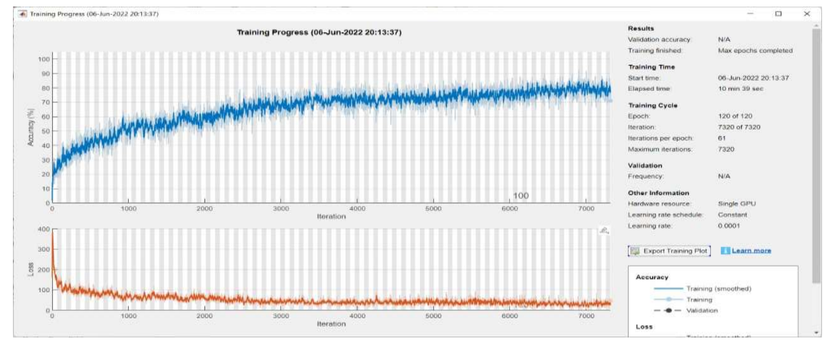


RACE

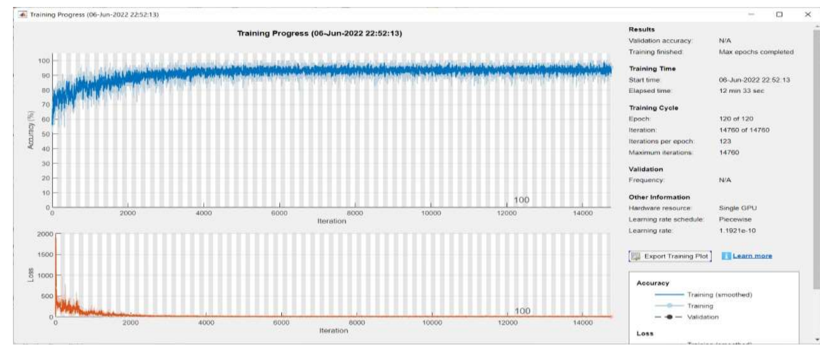


Graphs

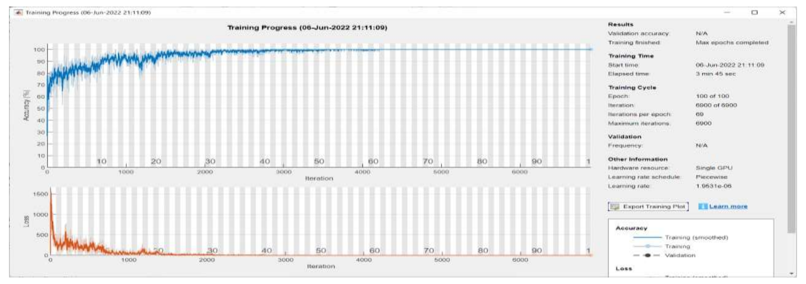
AGE
Training accuracy - 81%
Validation error - 33.13%



GENDER
Training accuracy - 91%
Validation error - 8.16%



RACE
Training accuracy -98 %
Validation error - 3.06%



Conclusion and Future works

- The proposed approach utilizes a superior system performance in order to increase the estimation accuracy of demographic variables.
- It demonstrates that the suggested facial features-based Gender, Age, and Ethnicity estimation outperforms the majority of state-of-the-art techniques in UTK databases.
- In addition, the proposed method performed admirably in the difficult databases.
- In future different optimization and regularisation functions can be incorporated to the proposed system to increase the accuracy and also decrease the false prediction rate.

References

N. Kumar, A. Berg, P. Belhumeur, and S. Nayar. (2021), "Describable visual attributes for face verification and image search." IEEE Trans. PAMI, 33(10):1962–1977, 2021.

Zhuang, Z., Landsittel, D., Benson, S., Roberge, R., Shaffer, R. (2019), "Facial anthropometric differences among gender, ethnicity, and age groups." Annals of Occupational Hygiene (2019)