GENDER RECOGNITION USING FACIAL IMAGE

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Problem Statement

Problem Statement : Given a facial image of a person Predict Gender and Race of that person.

Abstract : Estimating the position of gender on gender spectrum, and race form the input facial image.

Scope: Automated gender recognition is important in many applications area such as human computer interaction, biometric, demographic research, surveillance etc. The model can also be extended to detect the age, country of origin etc.

Background

1) Using facial embeddings improves accuracy of models.
2) Using VGGnet architecture increases accuracy.
3) Using BHEP as pre-processing improves accuracy
4) Input images contains single subject
5) Not much concentration on side view images.
6) No mask on face

Dataset and Features / Project Requirements / Product Features

Dataset used: 14K images from FairFace dataset. It has 7440 male images and 6560 female images. It has 2K images of each of the 7 races(EastAsian (964Male), White (1034Male), LatinoHispanic (999Male), SouthEastAsian (1036Male), Black (998Male), Indian (1025Male), MiddleEastern (1384Male))

Functional Requirements.

1) Image should be of png or jpg format.
2) Image should be frontal or side view of a person only.
3) Single person should be present in an image.
4) Interface: An interface to upload an image and get the gender spectrum as output.

Non Functional Requirements.

1) Usability: Interface will be used for usability.
2) Accuracy : Expecting high accuracy with our proposed model.
3) Reliability : Model should have good accuracy so that it can be reliable.
4) Performance : For any testing instance, the model must provide result as fast as possible

Design Approach / Methods

We have used BHEP as preprocessing. We have implemented 2 models. One is using CNN(VGG16) and other is KNN using facial embeddings.
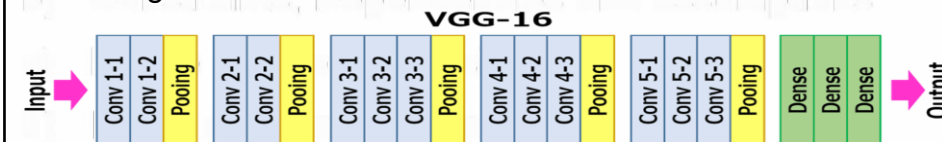
Assumptions, Constraints & Dependencies:

1) Facial image as input (image is always valid)
2) Requirements are basic tensorflow, Anaconda libraries, good GPU for training model, google colab.

Results and Discussion

a) Results of BHEP & Facemask algo

b) Results for gender recognition

Dataset	Accuracy (CNN)	Accuracy (KNN)
With mask & BHEP	~~73.75%~~ 78.14%	70.61%
With mask & without BHEP	~~77.75%~~ 79.91%	75.32%
Without mask & with BHEP	79.87%	78.21%
Without mask & without BHEP	80.62%	78.63%

c) Results of race recognition

Dataset	Accuracy (CNN)	Accuracy (KNN)
With mask	55.17%(VGG16)	70 % (k selected by GridsearchCv,1K dataset)
Without mask	54.91%(VGG16)	54.4 % (k=3,1K dataset)

Summary of Project Outcome

1) BHEP algorithm as preprocessing didn't improve the performance of the mode
2) For gender recognition, CNN is performing better & hence have used that model as the final model for the user interface.
3) For race recognition, VGG16 is performing better & hence have used that model as the final model for the user interface.
4) An user interface is provided that can be used to input image & it'll provide the output.

Conclusions and Future Work

Key points:

1) BHEP algorithm didn't improve performance
2) CNN model performed better than KNN for gender recognition
3) KNN model performed better than CNN for race recognition

Future work:

1) The project can be extended to detect the country of origin, age of the person etc. from the input image
2) The project can be extended to perform with real time images

References

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