# Detecting Demographics of People in Images Using Computer Vision

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## Introduction

The proposed research project aims to develop an algorithm for demographic analysis of human faces in images using computer vision techniques. This analysis can provide valuable insights into demographics such as age, gender, and race, which can be useful for various applications such as security, and marketing.

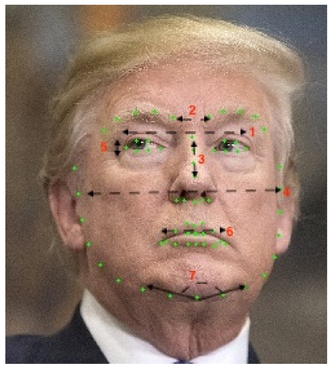
## Research Questions

- Does the facial textures extracted using LBP impact the classification of age and ethnicity?
- How do the geometric features computed using facial landmarks from the dlib library, in combination with deep learning, help in gender classification?
- How effective is deep learning-based simultaneous classification of age, gender, and race using facial images?

## Methods

The Facial landmarks are detected using dlib library as shown by green dots in Figure1. **7 geodesic distances**:

1. Eye Distance
2. Eyebrow Gap
3. Nose Height
4. Face Width
5. Eye Height
6. Lip Width
7. Jaw Angle




(a) Geodesic distances between facial landmarks

(b) Facial texture extracted using LBP

Figure 1. Comparison of facial landmark distances and LBP texture

We created a single-shot custom model to classify an image based on age, race/ethnicity and gender. We used 4 convolutional layers with dropout as opposed to L2 regularization. Using global average pooling we aggregated our features to concatenate LBP features with dlib features. We added skip connections to increase model complexity and to decrease model run time. We created 2 versions of the model- one with LBP and one without.

## Flowchart

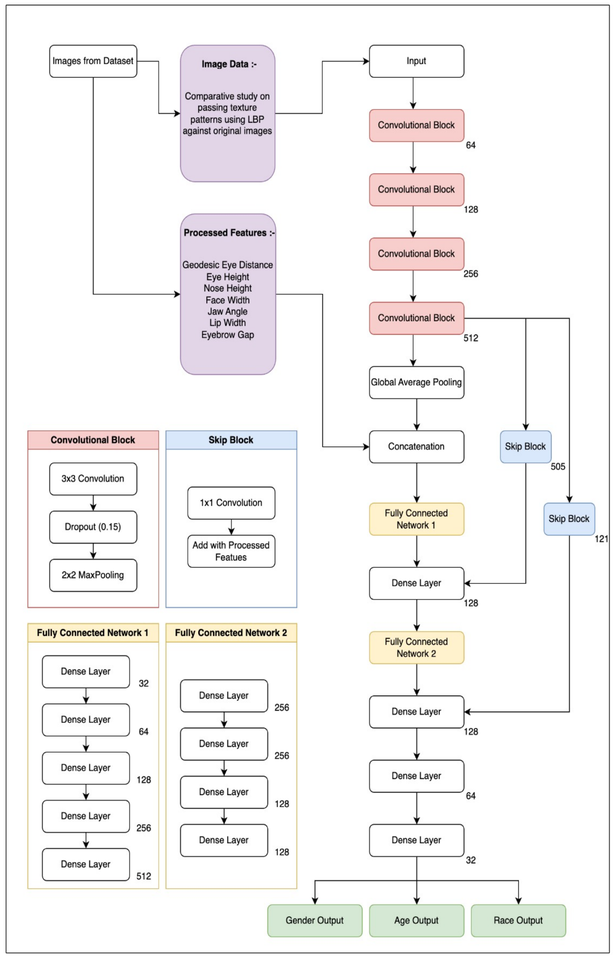



Figure 2. Model Architecture

## Data

**Dataset Used:**

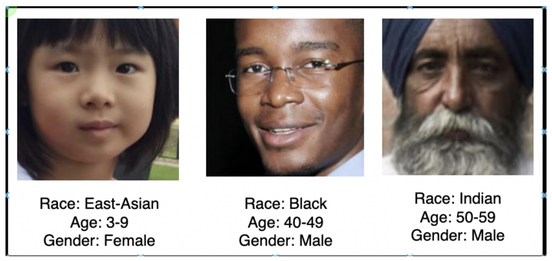
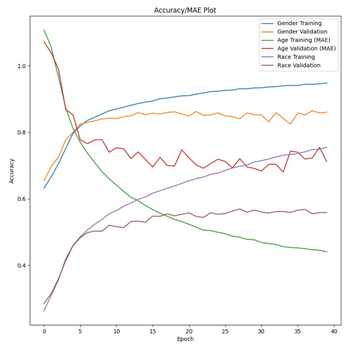
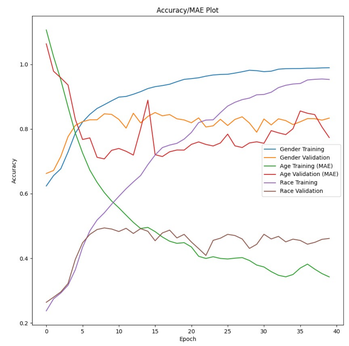



Figure 3. Sample Images from FairFace

## Results




(a) Model without LBP




(b) Model with LBP

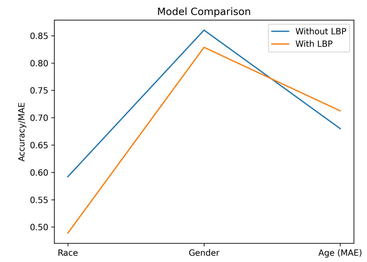



Figure 5. Model Comparison

## Conclusion

We found that LBP makes ethnicity classification more complex. The dlib features with deep learning produce good results.

## Future Work

The following things are being considered for our future work:

- **Additional Facial Features**
- **Addressing Bias** Involve collecting diverse training data, developing new metrics for evaluating algorithmic fairness.
- **Model Explainability**

## References

[1] Zaheer Abbas.
Joint demographic features extraction for gender, age and race classification based on cnn.
*International Journal of Advanced Computer Science and Applications*, 10(12):460–467, 2019.