

# Probing Fairness of Ocular Biometrics Methods Across Demographic Variations

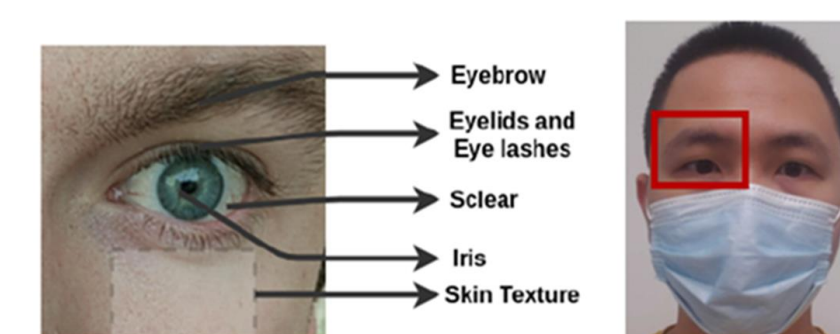


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## Abstract:

- Facial analysis technology related to recognizing identities and deducing visual attributes, such as race, gender, and age, is widely **adopted** in policing, surveillance, and consumer applications
- Recent research suggest **least performance of face analysis** technology for the black race, women, and older adults, and has been attributed to facial morphological differences, make-up and skin-tone etc.
- Ocular biometrics is an **alternate solution** over face biometrics due to its accuracy, security, better robustness against facial expression, better privacy, and can be captured using the regular RGB camera
- The aim of this project is to **probe the fairness** of ocular biometrics across demographics



Ocular biometric regions labeled and availability in the presence of mask.

## Key Problems Addressed:

- The hypothesis is as the ocular region has better robustness to facial morphological changes and skin-tone across demographics, it may have **an advantage** over face biometrics in terms of equitable performance
- Solutions will be developed to **mitigate** bias of the ocular technology across demographic variations

## Technical Approach:

1. Performance **evaluation** of ocular analysis methods across race, gender, and age over face
  - Deep learning and hand-crafted features based methods will be evaluated for ocular biometrics
2. Cause and effect analysis using **explainable AI** of performance differential across demographic variations

## Scientific Impact:

- Along with the **ban** of facial biometrics, there is a recent urge to investigate fair biometric modalities and methods
- The **publicly available** methods and tools developed in this project will be applicable for other biometric modalities and other AI applications



Grad-CAM Visualization

Impact of other covariates

3. Proposing solutions to **mitigate** performance differential
  - Fairness-aware loss functions, gender and race-based classifiers, patch-based methods and multi-modalities will be investigated to mitigate bias

## Broader Impact (society):

- The project will develop solution towards **trustable, equitable and secure** biometric technology for end-users
- Equitable biometric solutions are especially required for **law enforcement**.

## Broader Impact (education and outreach):

- The **curriculum** of machine learning and computer vision based courses at WSU will be updated.
- The **workshops** on fairness of AI will be organized at high impact IEEE and IAPR conferences (CVPR, ICPR)

## Broader Impact and Broader Participant:

- Policymakers and **law enforcement** will be engaged with the findings
- All major **tech players** rolling out biometric product will be engaged
- Females and **undergraduates** in STEM will be trained

