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VISION LAB
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High Speed Automatic Facial Recognition Using Biomimetic Filtering

Introduction

The goal of this project is to test and improve the detection rate (speed and accuracy) of a facial recognition algorithm developed by the Vision Lab. The detection rate may be affected by various conditions, including: lighting quality, angle of the camera, and distance/altered appearance of the subject.

The team's conceptual design for optimizing facial recognition in various lighting conditions includes the implementation of an assortment of optical filters, both colored gel and polarizing filters, which can be placed in front of the camera lens.

Objective: Biomimetic Filtering Techniques

It is known that in human sight, blue light contributes to eye strain[1]. Specifically, blue light (which is found everywhere) scatters and is not easily focused due to its short wavelength/high energy state when compared to other types of visible light, as illustrated in Figure 1. Inspired by nature, our design incorporates biomimetic filtering techniques to reduce the amount of blue light that the camera sees when taking a picture.

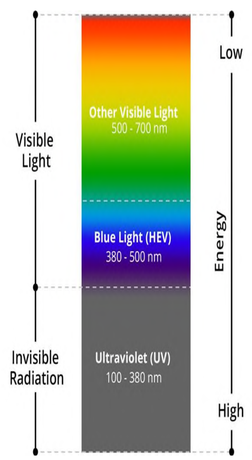
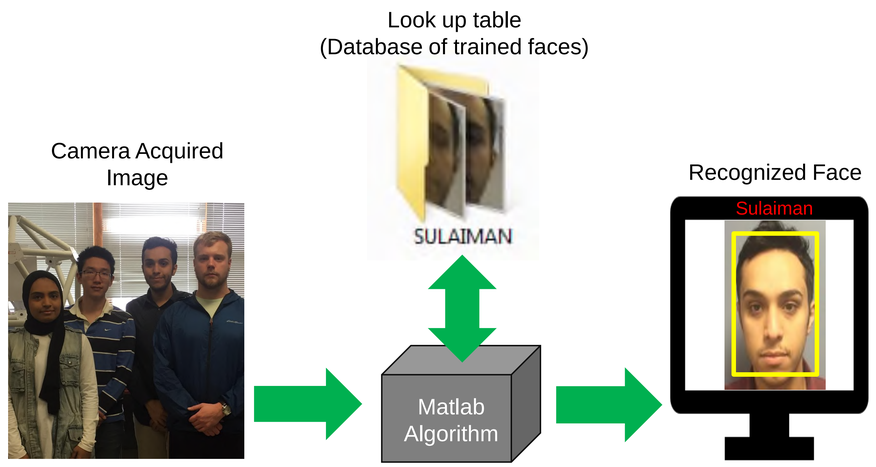


Figure 1: Light Spectrum[1]

Proposed Scheme

Our proposed method for image enhancement is by utilizing biomimetic filtering techniques. To eliminate unwanted parts of the lighting spectrum, we used various optical filters including red, orange, and polarized filters. In theory these filters should offset the bluish cast from daylight and fluorescent light.

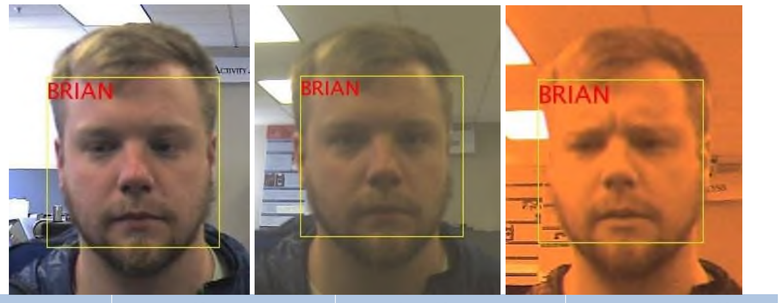
Facial Recognition Process



Procedures

The team trained an established algorithm to detect faces from the frontal view of the subject, +30 angle view of a face, and -30 angle view of a face in various lighting conditions. Each member of the team selected 30 photos of their face displaying different emotions and camera angles to be used as the database. Once the database was complete, the team trained the algorithm to detect people in the database. The team timed the rate of detection for no optical filters, a red filter, and an orange filter to see how the filters affect detection rate.

Experimental Results



	No Filter	Red Filter	Orange Filter
Time	1.395 Seconds	1.22 Seconds	0.93 Seconds
Distance	5 ft	5 ft	5 ft

After testing the algorithm with different optical filters, the team notice the orange filter to have the fastest detection rate. All testing was done at 5 feet under fluorescent lights which may attribute to the improved results using an orange filter. More testing needs to be completed to verify these results.

Future Work

Future research and testing will be done under various lighting and distances. The team plans to implement polarized filters next to enhance the acquired image from the camera. Applications include: missing persons, shoplifting criminals, dementia patients.

References

[1]https://photographylife.com/lens-filters-explained/
[2]http://www.graphics.com/article-old/photography-fundamentals-white-balance
http://www.tiffen.com/displayproduct.html?tablename=filters&itemnum=67POL

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