

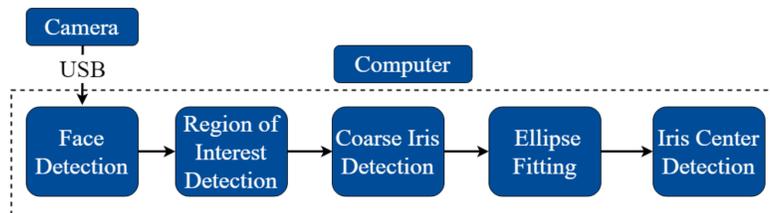
Image Processing: Iris Detection

1. Abstract

The purpose of this project is to use image processing techniques to detect the eye's iris center. A camera with a wide angle lens and near Infrared (IR) sensitivity is used as input. An algorithm processes the input image data and distinguishes features such as face, eye region, and iris.

2. Introduction

A camera is like a computer's eye. When a computer sees the world, using a camera, it sees numbers representing light intensity and wavelength. This project transforms those numbers into coordinates for the center of the iris. This is a complex process, which can be broadly broken down into the sections below.



3. Setup

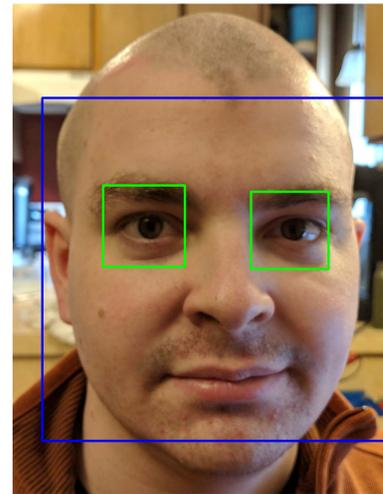
Our setup consists of an inexpensive IR sensitive camera and a laptop.



4. Results

Two important areas are detected in step 1: the face and eye regions. In step 2, the eye regions are used as a bounding box to find the coarse iris center. In step 3, the coordinates of the coarse iris center are used to generate an iris boundary. In step 4, the boundary dots are used to fit an ellipse to the iris. The center of the ellipse is the center of the iris.

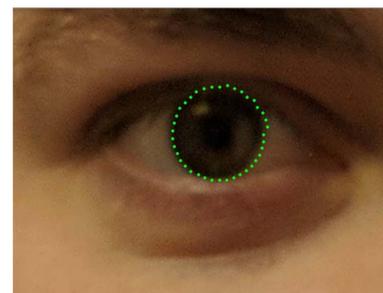
Step 1: Face and Eye Region detection



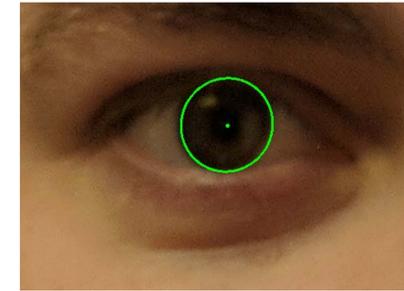
Step 2: Coarse iris center detection



Step 3: Iris boundary detection

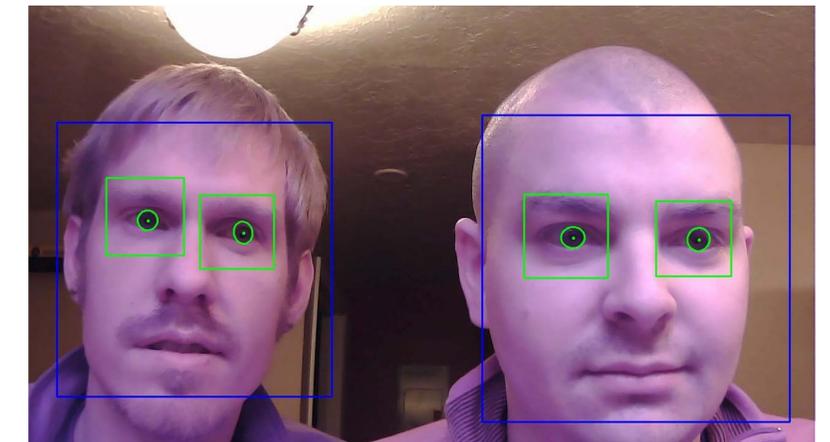


Step 4: Ellipse fitting and final iris detection



5. Conclusion

By locating specific features on the face, the location of the eyes is determined. Using the eye regions, a coarse location for the iris center is calculated. The coarse location is refined using ellipse fitting. The location of the iris center is the center of the ellipse.



6. What's Next

Given more time, this project could be expanded upon to include features such as blink detection, eye corner detection, and even gaze tracking. Optimizations could be made as well. Tracking iris locations from frame to frame would reduce calculation complexity. A GPU could also be utilized to increase performance.

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