CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

35260

Project Title

Face Recognition via Projection into Lower Dimensions Using Ensembles of Fisherfaces and Eigenfaces

Abstract

Objectives/Goals

The objective of this project is to develop a method for identifying faces in situations where a face is angled away from the camera, hidden, or under extreme lighting. Novel recognition of hidden faces is urgently needed in settings of both military security and personal use. Using new methods of dimensionality reduction to significantly increase the density of data and focus on only orthogonal features, this project aims to increase the accuracy and versatility over current facial recognition software as well as run on devices that can be used in daily life.

Methods/Materials

I used parts of the CMU Face Images Dataset as training and testing data and OpenCV libraries to implement some preprocessing steps, as well as Scikits for elements of dimensionality reduction. I processed and filtered pictures in the dataset with Gaussian blurring, high-pas contrasting, and greyscale conversion. To crop the faces, I used a derivative of the rejection cascade of weak classifiers. Principal Component Analysis, Fisher's Linear Discriminant, and pixel patterns were all used simultaneously with individual parameters. After synthesizing individual inferences, I used a novel confidence generating algorithm coupled with a new consensus algorithm to generate a final inference.

Results

Using the complete CMU dataset with both obscured and unobscured faces, the system generated an accuracy of 95.2%, which is comparable to modern use. With only the subset of frontal faces, an accuracy close to 100% was generated. When faced with only obscured faces, the algorithm had an accuracy of 67.5%. Current techniques have proven to be almost completely random when only given hidden faces, which is about a 4.95% accuracy. So, the algorithm presented in this project provides a significant improvement when working with hidden faces.

Conclusions/Discussion

I have successfully created a face recognition system that recognizes obscured faces with a higher accuracy than current techniques. The combination of preprocessing steps and dimensionality reduction synthesis makes it possible to classify faces that are facing away from the camera, wearing sunglasses, or are hidden from view. This is applicable to areas such as biometric security, crime identification, military security, and many other fields. As a result, this project has the potential to make the world a safer place.

Summary Statement

By combining processing and new dimensionality reduction, I created a powerful facial recognition system that accurately recognizes hidden faces under extreme lighting, and is applicable in both military security and personal identity.

Help Received

Thanks to Samvit Ramadurgam for inspiring me and guiding me in my search for the best algorithms and approaches.