Face Recognition
A Project Proposal for CS 395T

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1 Project Description

The basic goal of this project is to implement a face recogniser that would be able to determine if a given test face is present in a previously assembled database or not. There are many approches to this famous problem, based on symmetry, classification, geometry, precise measurements of important features,... We intend to use linear algebra techniques in our face recogniser program. This approach was pioneered by L. Sirovich and M. Kirby in [**?**]. The basic idea is to find an optimal basis to represent a new test image. An image can be represented by a row vector of size n^2, where the original image is stored in grayscale of size $n \times n$ pixels. In [**?**] the authors have found that the eigenbasis of a matrix formed by collecting the row vectors of an initial set of images is an excellent starting point to represent a new image. The authors have found that with a base set of 115 images it took approximately 40 coefficients to get a "good" approximation of an image. The reduction in complexity is enormous!! Initially we have 2^{14} integers to represent an image, finally we have approximately ≈ 40 floats to represent the same image (assuming the eigenpictures have been determined). This technique is simple and popular. It is also called Principal Component Analysis(PCA). This approach is discussed in greater detail in [**?**] and [**?**].

The above approach suffers from some severe restrictions in that the initial database must be quite homogeneous, and lighting conditions, pose, location in image must be quite uniform. There have been various extensions of the eigenfaces approach to overcome these problems. One of them is using Fisher's Linear Discriminant to overcome problems with varying lighting conditions and pose features like spectacles. The main idea here is that the scatter among images is projected out rather than spread out uniformly as in eigenfaces. This approach is discussed in [?]. There are some other approaches based on probability [?], view/modular eigenspaces [?] which we intend to look at.

2 Timeline

The practical aspect of this project is as follows

- Image databases are available in several places on the web, for e.g. the Yale database or the Harvard Face Database.
- We intend to download these images and have the simplest eigenface program ready by spring break (20/3)
- In the second part of the project we will pursue extensions to eigenfaces like fisherfaces or probabilistic approaches.

References

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