**C. Synthesis**

The approach of using eigenfaces for recognition was developed by Sirovich and Kirby (1987) and used by Matthew Turk and Alex Pentland in face classification. The Eigenface Recognition Algorithm has been widely used initially as face recognition and face detection means of a human face image. In order to achieve automatic recognition, a face database is required to build. For each person, several images are taken and stored in the database. A set of eigenfaces can be generated by performing a mathematical process called principal component analysis (PCA) on a large set of images depicting different human faces.

Face recognition scenarios can be classified into two types, Face verification/authentication and Face identification (or recognition). First, Face verification: It is a one-to-one match that compares a query face image against a template face image whose identity is being claimed. To evaluate the verification performance, the verification rate (the rate, at which legitimate users are granted access) vs. false accepts rate (the rate at which imposters are granted access) is plotted, called ROC curve. A good verification system should balance these two rates based on operational needs. 2) Face identification: It is a one-to-many matching process that compares a query face image against all the template images in a face database to determine the identity of the query face.

The identification of the test image is done by locating the image in the database that has the highest similarity with the test image.

Eigenface is a practical approach for face recognition. Due to the simplicity of its algorithm, we could implement an Eigenface recognition system easily. Besides, it is efficient in processing time and storage. PCA reduces the dimension size of an image greatly in a short period of time. The accuracy of Eigenface is also satisfactory with frontal faces. However, a particular disadvantage of PCA is when the dimension number is comparable to, or even larger than the sample size n. Also, one critical problem rises due to several illumination variations. The illumination variation has been widely discussed in many face detection and recognition researches. This variation is caused by various lighting environments and is mentioned to have larger appearance difference than the difference caused by different identities. Under some illumination conditions, we can neither assure the identification nor accurately point out the positions of facial features.