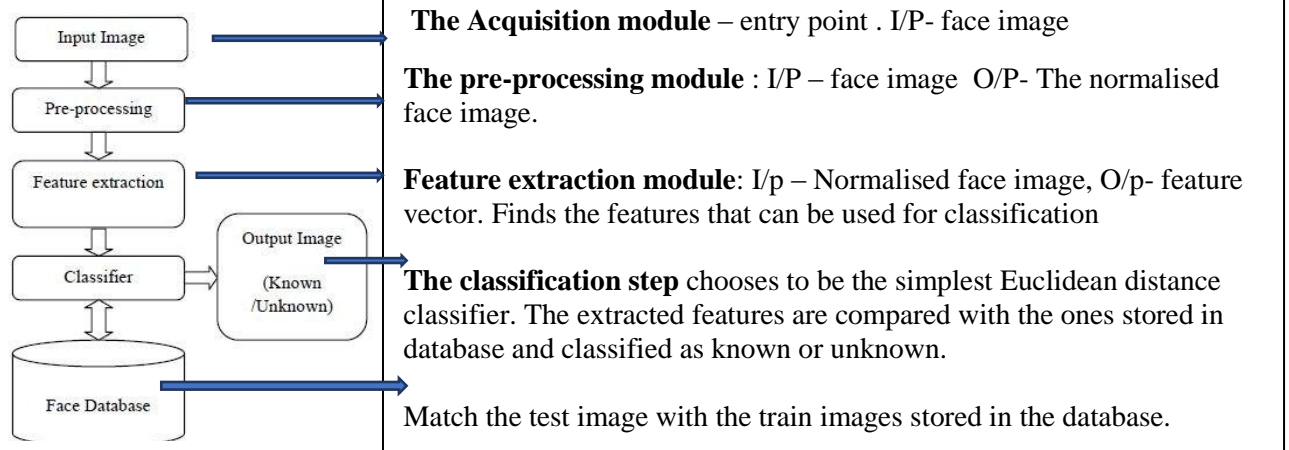


## FACE RECOGNITION MACHINE VISION SYSTEM USING EIGEN FACES

FRS – is a system that has the capability to learn to identify unknown faces. A pattern recognition task performed exclusively on faces is face recognition. It is of two categories:

1. **Identification**- similarity between given face image and all face images in a database is computed, top match is returned as the recognized identity of the subject. Method used: PCA/Eigen faces.
2. **Classification** - take an image, match it with the database of stored known individuals and classify them as known/unknown



### MATHEMATICAL MODELLING:

#### 1. Eigen values and eigen vectors:

2. **Face image representation**- training set of images represented by vectors. Feature vector of a face is stored in  $N \times N$  matrix. 2D changed to 1D

3. **Mean centred images**: Average face image is calculated. Each face differs from average which is called mean centred image.

4. **Covariance Matrix**: Eigen vectors calculated using reduced dimensionality.

5. **Eigen face space**: The eigen vectors of the obtained covariance matrix resembles the facial images

6. **Recognition step**: based on the Euclidean distance.

### FACE RECOGNITION ALGORITHM:

**Problem**: Raw face image may consume a long time to recognize since it suffers from a huge number of pixels.

**Solution**: One needs to reduce the amounts of pixels. This is called dimensionality reduction or feature extraction, to save time for the decision.

**2 steps**: feature extraction and the classification.

**Feature extraction**: Once face space gets converted to the feature space it will have the face database and represented by reduced number of features that retain most of the important information of the original faces.

This is done by the Eigen face algorithm using the PCA.

**Principal component analysis**: It is a dimensionality reduction method that produces the optimal linear square decomposition of a training set. PCA calculates the eigen vectors of the covariance matrix of the input face space which define a new face space.

Advantages of PCA: Reduction in dimensions, removes info that is not useful. Trim down the data required to recognize the entity to  $1/1000^{\text{th}}$  of the data existing.

**Classification**: makes use of Euclidean distance for matching the test and trained images.

#### NORMALIZED PCA(N-PCA):

The main advantage is its efficiency. It follows the below architecture:

Collection of images to make the database, Check whether the images are coloured or grey, calculate the mean and Standard deviation of images, Does normalization, calculate the train centred images, Calculate eigen vectors and values, eigen faces, trained weights, store the trained weights in sink for comparison, Euclidean distance classifier, FACE RECOGNIZED.

**CONCLUSION**: The Eigenface approach for Face Recognition process works well under constrained environment. Instead of searching large database of faces, A small set of likely matches. The face recognition system consists of two important steps, the feature extraction and the classification. This paper investigates the N-PCA function improvement over the principal component analysis (PCA). The experiments carried out to investigate the performance of N-PCA by comparing with PCA, results shows that N-PCA gives a better recognition rate.