PCA (Pricipal Component Analysis)

PCA(Principal Component Analysis) is a useful statistical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding patterns in data of high dimension. This paper explain about mathematical model which is used by PCA.

The PCA which use mathematic technique such as Statistic, Standard Deviation, Varience, Covariance and Matrix Algebra. Statistics is based around the idea that you have this big set of data, and to analyze that set in terms of the relationships between the individual points in that data set.

Standard Deviation of a data set is a measure of how spread out the data is. In definition, standard deviation is the average distance from mean of the data set to a point. In conclusion, We can called standard deviation is how big error in the data set or sometimes standard deviation also called standard error. Variance almost identic with standard deviation which measures of the spread data. Sometimes in statistical data set, there are more than one dimensional and the dimensions have relationship. We can use covariance matrix to solve data set which have more than 2 dimension. This technique is very useful to get all the possible covariance values between all the different dimensions which is to calculate them all and put them in matrix. In this paper, we will use matrix algebra to find eigenvalues and eigenvector.

Because the PCA use linear transformation to get a result, we need to find eigenvalue and eigenvector. Eigenvector is an vector of linear transformation and eigenvalue is the scalar of linear transformation.

PCA is used in Computer Vision. PCA will allow us to do with those images. One of the example of PCA in Computer Vision is face recognition: Eigenface, Elastic matching, and Neutral Nets. Because PCA technique uses matrix method, we must consider the representation of the images. For instance, when the machine detect one face which is original face(reference) and the machine want to detect another different face. The machine will measure with the differences between new face and original face. Another application of PCA in Computer Vision is to compress image which also know as the Hotelling, or Karhunen and Leove, transform.