The publication*, Face Recognition Machine Vision System Using Eigenfaces* by Fares Jalled, mentioned about the machine learning methodologies involved in face recognition. The paper first outlines the issues and complexities with face recognition and how it is becoming a major part of technology identification, such as with applications on mobile phones and security features. The paper outlines how the current methods such as Principal Component Analysis, otherwise known as PCA, has been at the forefront in face identification. The main methodology within PCA that helps in this, is N-PCA, which is a nonlinear methodology of face recognition.

The paper outlines the N-PCA method using a five-step procedure: input, pre-processing, feature extraction, classifier, and database usage. In the first step of the process, the images are inputted into the system. During, the pre-processing section, the images are normalized to the feature location. This allows for more accurate referencing of the images. There are four steps to this which are: image size normalization, background removal, translation normalizations, and illumination normalization. The feature extraction process is used to find the important features that will be used for the classification process. This process yields a feature vector that is used as a model for a face image. The classification process uses the extracted vector to compare with the test faces in the database. The two classes that are utilized are known and unknown. One key component is the face database procedure, in which the unknown images in the classifier are added to the database for future analyzation.

The paper also goes into technical detail about the vectors, matrix, eigen values, and eigen vectors. It practically illustrates how the utilization of these mathematical techniques are used for the face recognition feature extraction. This leads to the face recognition algorithm. This is important because it emphasizes the two primary steps which is feature extraction and classification. The feature reduction deals with reducing the pixels to finding the ones that are valid for recognition. As a result, they are reduced and transformed to a lower dimension of features using the Eigenfaces algorithm called Karhumen-Loeve transformation.

An important facet of the paper is the comparison between PCA and N-PCA. In the paper it illustrates that N-PCA is somewhat better, because it gives more accurate results in terms of efficiently. This is because N-PCA is a more complex form of a linear system, and it takes into considerations lighting variations and background effects that PCA doesn’t accommodate for. The paper illustrates an eleven part architecture for obtaining these advantages over the linear PCA model.

The paper also outlined research experiments on two image databases, which is the ATT database, which contain photos of different facial expressions, illumination, and extra features like glasses and such. The other database is the Indian Face Database (IFD), which contains different poses. The research showed that under various training/testing ratios N-PCA outperformed PCA in accuracy for both databases. For example, N-PCA showed 93.75% accuracy over 92.50% accuracy for PCA for the ATT database for 80/20 ratio. Therefore, the conclusion is that N-PCA is a better face recognition procedure than PCA.

**References**

Jalled, Fares. *Face Recognition machine Vision System Using Eigenfaces.* 8 May 2017.