UNCERTAINTY EVALUATION IN FACE RECOGNITION ALGORITHMS

Giovanni Betta, Domenico Capriglione, Consolatina Liguori, Alfredo Paolillo, Italy

Face Recognition & Uncertainty Causes

Linear Discrimination Analysis (LDA) for Face Recognition

In the training phase the optimum function \( F \) (which minimizes the within-class scatter matrix, \( S_W \), and maximizes the between-class scatter matrix, \( S_B \)) is obtained on the basis of a suitable training set images. A new database is obtained applying \( F \) to the original database of images.

In the classification, the new image is processed by \( F \); the distance between the output data, and database is calculated; the classification is made on the basis of the minimum distance.

Estimation of the Uncertainty Components

Once the sensitivity analysis has led to identify the influence quantities, a model of the uncertainty has to be defined. A “black-box” approach is proposed: the influence of the real conditions of the acquisition is investigated and for each influence quantity a relationship between the parameter and the variability of the LDA outputs, \( u_i \), is evaluated.

The considered influence quantities are: luminosity, defocus, movement, position; repeated measurements are made for each subject changing the influence parameter with respect to reference conditions.

First Experimental Results

From the analyses of these results, the system is more sensitive to the movement defocus and to the horizontal exposure angle: the distances and their variability increase with the defocus and the horizontal angle values more significantly than the Gaussian defocus tests.

Moreover, the influence of the luminosity is significantly lower than the influence of the other quantities.

Conclusions

The conducted analyses allow the reliability of the decision phase to be improved. The estimated variability range can be useful to define a confidence level for \( d \), and then, to the algorithm classification result. In the proposed architecture there are three new modules, the unit for the evaluation of the real acquisition condition and consequently the values of the influence quantities, the unit that implements the uncertainty model and the classification rules. Moreover for each probable classification a confidence level is evaluated.