Coded hierarchical dictionary strategy for face recognition efficiency

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***Abstract*—Face recognition is the most studied topic in the pattern recognition research field. This is probably due to the multiple useful applications which can be developed for important domains like HMC, Forensic, Security, Entertainment etc. Such deployed research efforts produced a huge number of methods, techniques and algorithms with different characteristics according to their simplicity, efficiency, robustness and speed. In the present work, we investigate the performances of a simplified technique using a hierarchical classification scheme based on a constructed multi parts dictionary of elementary blocs obtained by applying sequential classifier to the whole set of features of the working database.**

The elementary features of the different parts of the constructed dictionary were obtained using the well-known and simplest and effective way to depict the similarities between two compared patterns; named cross-correlation operator applied to the original images and their transformed images known as integral images and DCT. Hierarchical classification scheme is used to overcome the fact that this operator has high consumption time cost. The proposed strategy was implemented and tested on the images of the well known ORL and YALE database sets. Practical results demonstrate largely recognizable efficiency and speed characteristics.

***Index Terms*—Face recognition, Cross Correlation, Integral image, DCT, K-means classifier, Hierarchical structure**

I. Introduction

Based on the advancements in both hard and soft technologies in computer sciences and the huge developments in applied mathematics domain, researchers in pattern recognition domain, in general, and face processing, in particular, have succeeded to exploit computer performances and new mathematical models to deploy a large number of methods, techniques, and algorithms to try to solve one of the most challenging problems of pattern recognition field namely the face recognition one.

As a pattern, the face was subject to a particular concern by the researchers according to its importance in day-life applications. Face processing concern can be divided into two principal axes; face analysis and face synthesis. The last one was exploited in applications related to entertainment domain like animated cartoons, special effects in movies, etc. The former one can be subdivided into three principal research subjects namely face detection, facial expression recognition, and face recognition.

Face recognition had already crossed laboratory doors and is on route to be standardized through common applications in security domains like face verification or face authentication for institutions, factories, airports, network applications, etc. Scientific literature is full of methods, techniques, and algorithms developed for this type of face processing. Researchers have exploited different types of mathematical models like time processing, spectral processing, scale processing, statistical models and analysis and also took advantages of new computer technologies like speedy processors, parallel processors, DSP (Digital Signal Processors) and so on to develop more and more efficient but also more complex algorithms. However, despite these advancements and enhancements, important challenges still remain to be overcome.

According to literature and especially review papers [1], [2], face recognition methods can be classified into three approaches; holistic approaches, feature-based approaches, and hybrid approaches. The first type of methods is based on the detection and interpretation of the whole face as a unique component. Different types of information, like spatial information, spectral information, scale information, temporal information etc, are then extracted, characterized and classified to take a decision on the processed face identity. The second one deals with the faces components like eyes, brows, nose, mouth, etc to extract spatial, spectral, scale or temporal information to extract different types of features to be used in characterization and classification phases to take a decision. In such types of methods, one or some components (e.g the eyes and the mouth) can be taken as more valuable against others at the decision phase. By extracting both local and global information, the hybrid approaches try to take advantages of the two former ones to enrich the feature vectors used in classification phase.

In the present work, we try to reuse And exploit the simplest and most effective operator for depicting similarities between two compared patterns; named cross-correlation operator. Indeed, this operator is one of the oldest statistical mean used in signal processing and pattern recognition studies to extract the level of similarity between two studied signals or patterns. However, the time consumption cost involved using this operator still so important that it becomes a real handicap especially for signals or patterns that demand a large amount

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