Multi-Feature Characterization Strategy for Face Recognition Efficiency

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***Abstract*— Face recognition became a daily discipline in human life. At the work, with our PDP and smart phones, for our daily help, our security and many other utilities, face recognition has crossed the laboratory doors and colonized the human quotidian. However, the effectiveness of the developed applications still encounters many challenges. The presented work in this paper tries to deal with these challenges by proposing an advanced characterization way to enrich the feature vectors used by the classifiers to verify or identify faces. This process was done by compiling three types of feature vectors. Each type encapsulates a specific type of face information. At first, we compile a feature vector related to the geometric information of the face using Zernike moments; then spectral components using DCT are extracted to form the second type of feature vectors and finally, the last feature vector type is formed by compiling the texture and luminance information using LBP. The three vector types are then combined to form an enriched feature vector which was post-processed through a feature selection method then presented to the input of a neural network classifier. The validation experiments were realized on the XM2VTS and ORL database and recognition rates of 93.3% and 92.5% were respectively recorded for XM2VTS and ORL database.**

***Keywords*— Face recognition, Zernike moments, DCT, LBP, feature selection, ANN, ANN**

I. INTRODUCTION

Many advanced processing techniques and methods were developed in the three last decades in different pattern recognition domains. Thus was largely enhanced by the tremendous advancements in hard and soft technologies in computer sciences at first and by the multitude of the developed mathematical models which were adapted to solve the faced problems in signal processing, image processing and other domains in applied sciences.

Face, was one of the most studied pattern by the researchers of different domains. At first, it was subject of interest of psychologists [1] which tried to determine its importance in social relations, its perception and representation in mind, the impact of each one of its components (eye, nose, mouth ...) [2] on the communication process. At the beginning of process automation, researchers concerned by pattern recognition perceived a great importance in face processing interests by attempting to decode all possible information brought by it. These information were exploited to perform many application tasks which appear to be useful for human-machine communication, machine auto-control, security enforcement, entertainments, etc.

Among, all the developed techniques, methods and algorithms concerned by face processing, those dedicated to face recognition received the most attention by researchers due to their usefulness in day-life applications like face verification or face authentication for institutions, factories, airports, net applications, etc. Examining scientific literature, we can find that this type of processing was largely studied according to different types of mathematical models like time processing, spectral processing, scale processing, statistical models and analysis and exploiting different types of soft and hard machines compilation performances like speedy processors, parallel processors, DSP (Digital Signal Processors) and so on. Review's papers [3], [4] grant to classify face recognition methods according to three approaches holistic approaches, feature based approaches and hybrid approaches.

However, despite these advancements and enhancements, important challenges still remain to overcome.

II. FACE CHARACTERISATION

Characterization phase is, with no doubt, the most important operation in pattern recognition problems in general and in face processing in particular. Indeed, this phase is used firstly to overcome the problem of dimensionality [5] which rises with almost all the real applications in pattern recognition like signal processing (speech recognition, earthquake prevention, earth resources exploration, etc), image processing (face detection, face recognition, medical images processing, etc), statistical analysis (economic problems, biological problems, etc) etc. Secondly, it permits to extract different types of information, from the raw data source, like temporal evolution information, spectral components information, statistical distribution information, etc; And finally, it permits to simplify and enhance the classification phase by adapting the types of information to the type of classifier. To bring all these advantages, the characterisation phase exploits different types of mathematical models like geometrical models, Fourier analysis, probabilistic analysis, statistical analysis and so on.

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