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ICA-BASED FEATURES FUSION FOR FACE RECOGNITION

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Abstract. *In this paper, we introduced a features fusion method for face recognition based on independent component analysis (ICA). The method extracts features by employed discrete cosine transform (DCT) and Gabor wavelets, and then fuses their independent features which are extracted with ICA respectively. As a holistic feature extraction method, the DCT converts high-dimensional face images into low-dimensional spaces in which more significant facial features such as outline of hair and face, position of eyes, nose and mouth are maintained. On the contrary, the Gabor wavelets transformed face images exhibit strong characteristics of spatial locality, scale and orientation selectivity, which produce salient local features. For this reason, Gabor features are more suitable for face recognition. So, we used Gabor wavelets for the local features and then integrated Gabor features with DCT coefficients. Furthermore, because ICA can reduce redundant features and represent more explicitly the independent features which are most useful for subsequent pattern discrimination and associative recall, ICA has been used for extracting their independent features respectively. And then, the independence property of the independent Gabor features and DCT features is applied to the support vector machine (SVM) for classification. Finally, the computer simulation illustrates the efficiency of this method on Georgia Tech face database and ORL face database.*

Keywords: Discrete cosine transform (DCT), Gabor wavelets, Independent component analysis (ICA), Support vector machine (SVM), Feature extraction, Fusion, Face recognition

1. **Introduction.** Automatic face recognition, as one of the primary biometric technologies, has been started since 1970s and currently becomes an active and important research topic because of its wide potential applications such as preventing unauthorized access or fraudulent use of ATMs, cellular phones, smart cards, and workstations. The wide array of possible applications of face recognition has led to a continuous search for more precise algorithms and techniques. Numerous approaches have been proposed for face recognition and considerable successes have been reported [1, 2]. However, since faces exhibit significant variations due to illuminations, pose and aging variations, a practical performance of automatic face recognition is dissatisfactory.

A mature face recognition process could be divided into two steps: feature representation and classification. The extraction of image features is one of the fundamental tasks in image recognition, and the face recognition result depends highly on features that are extracted to represent the face pattern. Up until now, there have been many kinds of feature extracting methods to be used for the purpose of image recognition as follows: geometric features, algebraic features, statistical features of pixel and transform coefficient features. With the geometric feature-based approach used in the early days [3], facial features such as eyes, nose, mouth, and chin are detected. Properties of relations (e.g., areas, distances, angles) between the features are used as descriptors for face recognition.