A Robust Spatial Feature Extraction Method for Facial Expression Recognition

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Abstract : This paper presents a new spatial feature extraction method based on principle component analysis (PCA) and Fisher Discernment Analysis (FDA) for facial expression recognition. It not only extracts reliable features for classification, but also reduces the feature space dimensions of pattern samples. In this method, first each gray scale image is considered in its entirety as the measurement matrix. Then, principle components (PCs) of row vectors of this matrix and variance of these row vectors along PCs are estimated. Therefore, this method would ensure the preservation of spatial information of the facial image. Afterwards, by incorporating the spectral information of the eigen-filters derived from the PCs, a feature vector was constructed, for a given image. Finally, FDA was used to define a set of basis in a reduced dimension subspace such that the optimal clustering is achieved. The method of FDA defines an inter-class scatter matrix and intra-class scatter matrix to enhance the compactness of each cluster while maximizing the distance between cluster marginal points. In order to matching the test image with the training set, a cosine similarity based Bayesian classification was used. The proposed method was tested on the Cohn-Kanade database and JAFFE database. It was observed that the proposed method which incorporates spatial information to construct an optimal feature space outperforms the standard PCA and FDA based methods.

Keywords : facial expression recognition, principle component analysis (PCA), fisher discernment analysis (FDA), eigen-filter, cosine similarity, bayesian classifier, f-measure