

MACRO FACIAL EXPRESSION RECOGNITION AND ANALYSIS USING SUPERVISED 2D-PCA AND LINEAR SVM

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ABSTRACT

Facial expressions are a convenient way of expressing non-verbal communication effectively. The feasibility of this subject has become a dominant area of research in the field of computer vision and artificial intelligence. The applications of facial expression recognition include but not limited to; Human Computer Interaction (HCI), entertainment, consumer feedback systems, health care systems, transport, security, social emojis, emoticons, and avatars. An efficient macro-expression geometric model known as Two-Dimensional Principal Component Analysis (2D-PCA) to extract facial features is proposed in this paper and it utilizes the linear Support Vector Machine (SVM) classifier to group facial emotions. The proposed 2D-PCA model uses Discrete Wavelet Transform (DWT) for feature extraction to extract eigen values from salient frequency domain regions. The extracted eigen values are projected to low pass and high pass filters and transformed into eigen vectors after which they are forwarded into 2D-PCA for dimensionality reduction and retention of spatial and temporal facial properties. The extracted features are trained and tested using ten folds cross-validation strategy and the SVM classifier finally groups the emotion labels into different expressions. Performance of SVM is evaluated using three kernel functions: linear, Radial Basis Function (RBF), and polynomial kernels. Two benchmark datasets namely, Japanese Female Facial Expression (JAFFE) and Extended Cohn Kanade (CK+) and confidence levels of 97.29% on JAFFE database with six expressions and 90.07% on seven expressions obtained. Using CK+ database confidence level attained were 92.30% on six expressions and 91.1% on 7 expressions. A comparative analysis with other futuristic systems was performed and the proposed 2D-PCA model obtained excellent results.

Keywords: Cross Validation, 2D-PCA, SVM, FER DWT, Kernel Function, CK+, JAFFE