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Virtual Markers based Facial Emotion Recognition using ELM and PNN Classifiers

Absract

Detecting different types of emotional expressions from the subject's face is important for developing intelligent systems for a variety of applications. This present work proposed virtual markers based on Facial emotion expression recognition using the Extreme Learning Machine (ELM) and Probabilistic Neural Network (PNN). A facial emotional expression database is developed with 55 undergraduate university students (male: 35, female: 20) of age range between 20-25 years with a mean age of 23.9 years. A HD webcam is used to capture the facial image and Haar Like features and Ada Boost classifier is used to detect the face and eyes through Open CV. A mathematical model based is used to place ten virtual markers called Action Units (AUs) on subjects face at a defined location. Later, Lucas-kanade optical flow algorithm is used to track the marker movement while the subject expressing different emotions and the distance between the center of the face to each marker is used as a feature for classifying emotions. One way Analysis of Variance (ANOVA) is used to test the statistical significance of the features and five fold cross-validation method is used to input the feature for classifiers. In this work, two non-linear classifiers namely, ELM and PNN are used for emotional expression classification. The experimental results give a maximum mean emotion classification rate of 88% and 92% in ELM and PNN classifiers, respectively. Maximum individual class accuracy of happiness-96%, surprise-94%, anger-92%, sadness-88%, disgust-90% and fear 89% is achieved using PNN. The experimental results confirm that the proposed system is able to distinguish six different emotional expressions and could be used as a potential tool for a variety of applications which include, e-learning, pain assessment, psychological counseling, human-machine interaction-based applications, etc.

Keywords

Extreme Learning Machine; Face emotion recognition; Probabilistic Neural Network; Virtual Markers