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A NEW APPEARANCE-BASED FACIAL EXPRESSION RECOGNITION SYSTEM WITH EXPRESSION TRANSITION MATRICES

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Abstract. *Generally, the facial expression recognition systems can be roughly categorized into feature-based, image-based and model-based methods. However, several problems exist in the above methods. First, most of feature-based methods can not extract the facial features (shape, color and position) robustly because of hair and glasses occlusion, wrinkle or illumination variation. Second, the computation of extracting facial features is complex and costly. Third, most of current researches in the three kinds of methods can't recognize the facial expressions at low-resolution images. To overcome these problems, a novel appearance-based facial expression recognition method called "expression transition" is proposed to identify six kinds of facial expressions (anger, fear, happiness, neutral, sadness and surprise) at low-resolution images efficiently. The boosted tree classifiers, Hough transform and template matching are used to locate and crop the effective facial region that may characterize the facial expressions. Then, the expression transformed images via a set of expression transition matrices are matched with the real facial images to identify the facial expressions. The proposed system can recognize the facial expressions with the speed of 0.24 seconds per frame and accuracy above 86%.*
Keywords: Facial expression recognition, Expression transition, Boosted tree classifiers

1. **Introduction.** Recently, large amount of researches [1-14] addressed on the works of automatic facial expression recognition are widely applied to the human-computer interaction [15], deceit detection [16] and depressed patients surveillance [17]. Generally, facial expressions are classified into six categories (anger, fear, happiness, neutral, sadness and surprise) or described by using the action units (AUs) in the facial action coding system (FACS) [18].

Most of facial expression recognition systems can be roughly categorized into feature-based [1-4], image-based [5-8] and model-based methods [9-10]. The feature-based methods extract the shapes and locations of eyebrows, eyes, nose and mouth to establish the expression feature vectors and then identify the facial expressions. Kotsia et al. [1] place some Candide grid points around the regions of eyes, eyebrows and mouth manually. The grid adaptation process is then applied to generate the deformed Candide grids and the facial expression is then identified by using the changing information of each Candide grid point in the video sequence. Cohn et al. [2] develop an automatic AUs classification system based on the feature point tracking. The displacements of 36 manually located feature points are estimated by using the optic flow method. Trujillo et al. [3] utilize the interest point detection process to localize the facial features. The interest point operator works directly on intensity variations of OTCBVS thermal images [19]. Aleksic et al.