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Performance Analysis of Similarity Coefficient Feature Vector on Facial Expression Recognition

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Abstract

Facial expression is an essential and impressive means of human contact. This is important connection of information for knowing emotional case and motive. A facial expression pursues not only emotions, but other creative action, social cooperation and psychological characteristics. Appearance based facial expression recognition systems are analyzed and have pulled widen application. A new study of bit intensity with coefficient feature vector for facial expression recognition proposed in this paper. All the binary patterns from gray color intensity values are grouped into possible number of attributes according to their similarity. Each attributes count the frequency number of similarity from binary patterns. Each image divided into equal sized blocks and extracts 4-bit binary patterns in two distinct directions for a pixel by measuring the gray color intensity values with its neighbouring pixels. For evaluation the proposed descriptors, JAFFE dataset and Support Vector Machine were applied. Proposed method has achieved excellent achievement in terms of efficiency, robustness and lessens execution time.

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Keywords: Feature descriptor, coefficient feature vector, similarity index, JAFFE.

1. Introduction

A vital component of human to human communication is facial expression. Facial expression is recognized to be the most meaningful indication. Signalling system composes primary seven candidate emotions [1]. Automatic recognition of facial expression is used for interaction of human to computer in divers area e.g. emotion analysis

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with static or dynamic facial state, indexing and retrieval of video or image information, animation with image sequence etc. as the human faces pick outstanding information about emotion and instinct state of every individual human [2], [3].The 'Mehrabian’s theory' (7%/38%/55%) was practiced in different positions where there was incongruence between speech and emotions. In human communication, only 7% is contributed by the verbal part, 38% by facial movement but 55% by facial expression. This means that facial expression analysis is a necessary part in human-human as well as human to machine interaction [4].Taking facial points from both forward and sideward view points are considered as essential facial features (e.g., face, lip, view, nose) [5]. In [6], face detection process is complex which is based on face and non-faced detection algorithm. Most of researches have been done on dynamic textures [7] – [13]. Advantages of these approaches include less local processing time for validity to monotonic grey-scale changes and simple computation. [14] Paper aimed to admit fine grained diversity in facial expression on the basis of Facial Action Coding System (FACS) and action units (AUs). It was gained that muscle movement of facial expression was bounded with 44 facial Action Units (AUs), every units were different from others. In [15], for making a model of human facial expressions from video arrangements as input image Hidden Markov Models (HMMs) was used and Naïve-Bayes was used to admit the facial emotion. In [16], the local features were considered as vital image features found around the regions of eyes, nose and mouth. [17] A real moment based model is built to detect the facial expression recognition and Support Vector Machine was used for classifier. Along with facial expression recognition both space and time was considered in model [18]. A large set of human facial states were shown in [19]. Rule base reasoning and facial features were used to identify 20 AUs. In [20], proposed candied grid nodes were used to create facial wire frame model for facial emotions detection. All the above papers used geometry-based feature extraction methods. In [21] Facial representation method based on Local Binary Pattern (LBP) was proposed which is on still images. The extension of LBP model was implemented as LBP_{RIU2}, was proposed in [22].It was rotated-invariant system and here feature vector length was reduced. LBP is justified to be an impressive texture descriptor and practiced by many researchers for pattern recognition e.g. facial expression recognition [23], [24]. In [25] proposed a new texture descriptor LPQ (Local Phase Quantization). In [26], both local binary pattern and local phase quantization method were applied but system took more time to build a facial expression recognition system. Facial recognition process includes invariant under shifting and altering [27]. In [28], it was established on the basis of four prototypic expressions. [29], Local Distinctive Gradient Pattern (LDGP) established a pixel relation among the separated blocks in whole image, creates feature vector with decimal number from two binary patterns in each block. The image is divided on equal size 81 blocks.

Proposed feature representation method can capture more texture information from local 5x3 pixels area. It presents unique relations of the referenced pixel (‘c’) with four pixels at level one (‘a1’,‘a2’,‘a3’and‘a4’) and different four pixels at level two (‘b1’,’b2’,’b3’,’b4’) using LDGP (Local Distinctive Gradient Pattern) model for boosting the facial expression recognition. New similarity based feature vector is applied on which the histogram for all features vector in each block is connected to form the global feature vector for the whole image. In LDGP the all the features of binary patterns are converted in decimal number and create feature vector. But gray color intensity does not change more rapidly as like in decimal number, that is not matched with real practice. We proposed a new Jaccard similarity coefficient based feature vector in this paper. All the binary patterns from gray color intensity values are grouped into possible number of attributes according to their similarity. Each attributes count the frequency number of similarity from binary patterns. And each block, for two patterns level require only 32 bins for feature histogram. So feature dimension is less than other geometry or template based facial expression recognition process.

2. System implementation:

At first, The pattern is computed from the 5x3 pixels region as shown in Fig.1is used to calculate binary code for a pixel .Where ,’C’ is the referenced pixel. The gray color intensity values of the pixels are a1, a2, a3, a4, b1, b2, b3 and b4 are used to formulate the binary patterns as shown table 1. A detailed example is given in table 1, where (a) gray color image, (b) gray color intensity value in two levels, (c) represents a(1-4) the corresponding gray color value of the pixels at level 1 and (b) represents b(1-4) the corresponding gray color value of the pixels at level 2.