

A Survey of Facial Expression Recognition

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Abstract

The main research of facial expression recognition is seven Basic expression include: Joy, anger, disgust, fear, surprise, sadness , the precondition of realizing human-computer interaction intelligence. Because the change of facial expression is very small, so it is difficult to identify, this will affect the timeliness and experience of human-computer interaction, so facial expression feature extraction is an important step in facial expression recognition. This paper summarizes the methods and progress of facial expression recognition at home and abroad, mainly summarizes the facial expression feature extraction and expression classification methods, and analyzes the deficiencies in their methods. This paper studies the practical problems in the application of facial expression recognition at home and abroad, and presents the challenges and deficiencies in facial expression recognition.

Keywords

Facial expression recognition, feature extraction, expression classification.

1. Facial Expression Recognition Step

The study of facial expression has been opened years ago.1872, a famous biologist, Darwin ,the expression of human and animal was studied, and the facial expression was universal and uniform, which did not change with the change of race, sex, age and culture [1]. 1972,Ekman P, by summarizing the expressions of human beings from different regions and cultures, the basic six expressions are presented: delight, anger, disgust. , fear, surprise, sadness, as shown in Figure 1-1 [2]. This basic classification has finally been recognized by people, the basic six kinds of expression classification has been extended to the present. 1978 Year Ekman P, presents a facial motion coding system based on facial muscles and movement characteristics (facial Action Coding System, FACS),FACS the human face into a dynamic unit, including Yintang, nasal roots, eyelids and other parts of the movement[3]. FACS identifies different expressions by describing the subtle movements of the human face muscles.

After the development of recent years, facial expression recognition has formed a relatively complete system, the identification steps are mainly composed of four steps: Image acquisition, face detection and recognition, feature extraction, facial expression classification. As shown in Figure 1.

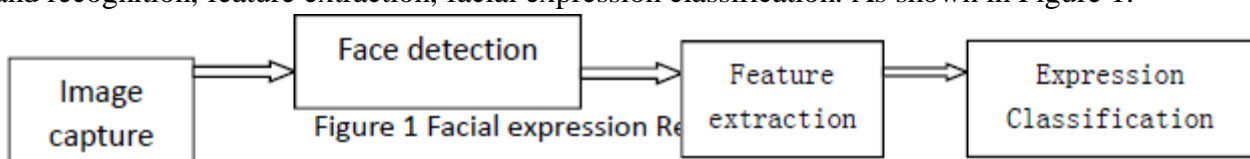


Figure 1. Facial expression Recognition step

2. Facial Expression Feature Extraction

Feature extraction is a very important part of facial expression recognition, the quality of feature extraction is directly related to the accuracy of facial expression classification, and the result of a good feature extraction should meet the following conditions [4]:

- (1) The most essential feature of facial expression is expressed completely.
- (2) to remove noise, light and other disturbing information unrelated to the expression.
- (3) reduces the image dimension, has the suitable data structure, reduces the storage capacity.
- (4) different types of expressions can be very good areas of separation.

The image used for facial expression recognition usually includes two kinds: one is static image, the other is dynamic image sequence, and different feature extraction methods are needed for two different images. For static image, the method of feature extraction and appearance feature extraction are commonly used. For dynamic image sequences, there are commonly used optical flow, the method based on feature point tracking, the method based on model tracking, the elastic graph matching method and so on. The above methods are described in detail below.

In 1995 years, Cootes, Take the lead in proposing the active shape model (ASM), this is a typical method of geometric feature extraction. ASM is based on the statistical model, the First step of ASM is to extract the initial expression profile from the target image, and then do a loop until the loop is closed[5]. Cyclic operation includes: Every feature point of current shape, every point in neighborhood, calculating local texture, correcting shape with global model, etc. After a cycle, the expression shape is constantly approaching the actual shape, eventually we can get the shape of a face image.

Scale invariant feature conversion (SIFT) is a kind of local characteristic, We need to find the extreme point in the space scale, and then get the information of its position, scale and rotation invariants. the SIFT Feature extraction method is based on some local appearance concerns, which are not affected by image size and image rotation, and have high tolerance to light and noise[6].

3. Human Face Expression Classification Method

Facial Expression Classification is a step followed by facial feature extraction, which uses various classifiers to divide the facial features we extract into seven a certain kind of basic expression. According to the different feature extraction methods, different classifiers are used, and only the appropriate classifier can achieve the ideal classification effect. The common classification methods are based on the expression space distribution method, based on the expression of the spatial domain method two categories.

Support Vector Machines (SVM) is a classifier based on small samples, the core idea is to separate the data, construct the segmentation surface, and then classify. linearly separable svm needs to achieve the maximum hard interval, when we try to use a split surface, the two data separation, there is at least one split surface, you can use linear segmentation SVM . Linear SVM is the case that the segmentation plane cannot completely divide all the data, but it can find a segmentation surface that can segment most of the data. non-linear SVM is a nonlinear SVM for the first two kinds of SVM plus one kernel function . . Varanya,presents a novel facial expression recognition based on LBP , The facial position markers are used to extract some active patches, and the facial expressions are classified using fusion SVM and ANN classifier[7].

Artificial Neural Network (ANN) is a nonlinear classifier, which can be used in the case of linear classifier which cannot be divided into linear space. Ann simulates the structure of human neural network and forms an artificial neural network with neuron as the basic unit, such as graph 1-5 is a simple artificial neural network structure. The artificial neural network takes the neuron as the basic unit, the W is the neuron 's weight value to represent the connection strength between the neurons, uses the activation function to control the mutual connection between the neurons, by changing these parameters can obtain the classifier which we want. The artificial neural network can solve the

complex classification problem, the recognition rate is high, the only disadvantage is that the model training time is longer. As shown in Figure 2, a simple artificial neural network.

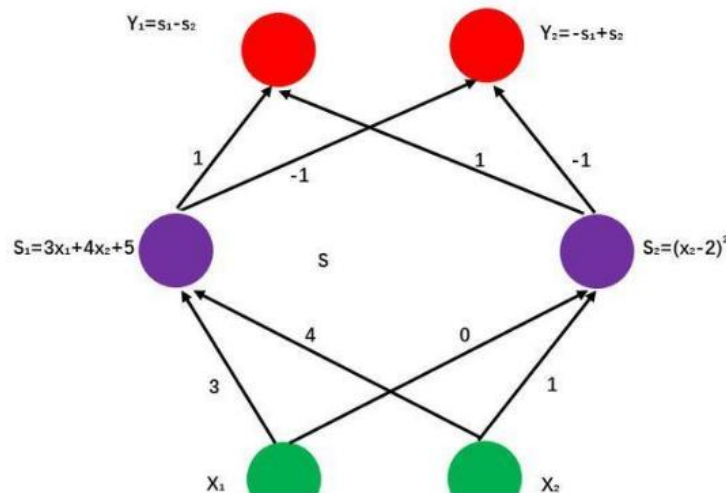


Figure 2. Simple Artificial Neural network

4. The Prospect and Challenge of Facial Expression Recognition

Facial expression recognition has made great progress in recent years, and now the research focuses on the application of deep learning in expression recognition. such as convolution neural network recognition expression, depth confidence network recognition, migration learning expression recognition.

Although the theory and technology of facial expression recognition have made great progress, there are still problems to be solved and optimized:

- (1) because of each person's difference, the face appearance, the expression, the skin color and so on may be different, has the pattern variability.
- (2) all kinds of algorithms often need to put the artificial expression on human face as the foreground to play a role, practicality is not very big.
- (3) even if the hand extracts the face as the foreground, but the human face still may exist the eye, beard and other appendages of the influence can not be excluded, the robustness is poor.
- (4) he human face in the three-dimensional real-life space is often exposed to light and produces gray-scale changes.
- (5) expression is not exquisite enough, the human expression is not limited to 6 Basic study of cognitive psychology such as visual cognitive processing of facial expressions.
- (6) most of the papers are based on the existing algorithms to improve the research level, the lack of new algorithm proposed. Facial expression recognition is difficult, the main difficulty in human face is plastic deformation, whether for detection positioning or recognition, how to use all kinds of information to the maximum and organically, is an effective way to improve the efficiency of facial expression recognition system.

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