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An Emotion Recognition Model Based on Facial Recognition in Virtual Learning Environment

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Abstract

The purpose of this study is to introduce a method based on facial recognition to identify students' understanding of the entire distance learning process. This study proposes a learning emotion recognition model, which consists of three stages: Feature extraction, subset feature and emotion classifier. A Haar Cascades method is used to detect the input image, a face, as the basis for the extraction of eyes and mouth, and then through the Sobel edge detection to obtain the characteristic value. Through Neural Network classifier training, six kinds of different emotional categories are obtained. Experiments using JAFF database show that the proposed method has high classification performance. Experimental results show that the model proposed in this paper is consistent with the expressions from the learning situation of students in virtual learning environments. This paper demonstrates that emotion recognition based on facial expressions is feasible in distance education, permitting identification of a student's learning status in real time. Therefore, it can help teachers to change teaching strategies in virtual learning environments according to the student's emotions.

Keyword: facial expression, facial recognition, emotion recognition, distance education

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1. Introduction

In the field of education, existing virtual learning environments successfully simulate interaction at a cognitive level during traditional teaching processes [1]. In the process of human-computer interaction, teachers naturally expect a facial recognition system to have the ability to detect, analyze and process emotions in order to get good teaching effect, such as perception, understanding and expressing emotions [2] If in virtual learning environments, students show different expressions in videos, teachers can identify whether the students understand their teaching content according to students' different expressions, and can adjust their teaching programs.

In virtual environments, students' emotional data can be obtained from a series of video frames. Therefore, to achieve real time understanding of students' emotions, accuracy and time needs to be balanced. To improve accuracy, more video frames are required, increasing computation time. On the other hand, in pursuit of efficiency, we would reduce the accuracy which means collection less feature data. Experimental results from current solutions show that in some cases accuracy is higher, but time spent is also high, such as Salman et al [3] who used Decision Trees to identify Facial Expressions. Other solutions have different limitations; for example, Chu et al [4] provided low-cost facial expressions on a mobile platform by just extracting lip features, spending less time but achieving less accuracy.

To find the best solution for emotion recognition in learning virtual environment, both accuracy and efficiency needs to be achieved. Optimization of recognition of emotional changes in the facial features of online learners, will allow teachers to adjust teaching strategies and methods, give real-time feedback to students, and achieve the best teaching quality.

The goal is to find the best solution for emotion recognition based on facial recognition in virtual learning environments, in real time. To achieve this goal, it is necessary to improve the accuracy and efficiency of facial recognition systems.

2. Literature Review

The goal of emotion recognition is to gather data and analyse feelings of subjects, to make appropriate responses possible. Such data may be obtained from different physical features such as face voice, body movements, and other biological physical signals. However, learners' emotions are expressed first through facial expressions which can be divided into six kinds of categories: sadness, happiness, surprise, fear, anger and disgust. Fig 1 lists the emotion recognition process.

The facial recognition process consists of three main stages: acquisition, feature extraction, and emotion classification. This paper is organised along the three stages.

Facial acquisition

Facial localization is the process of determining whether a face is included in an image, and its location and size [5]. Due to the use of different features, the facial localization has a variety of methods.

The face edge can be used to complete the facial localization [6]. In addition, facial texture information is often used for facial localization; Dai et al [7] proved facial localization using facial grey scale. Skin colour has special properties; it is in a relatively independent position in the colour space, so skin colour information is often used to carry out facial localization [8].

2.1   *Facial feature extraction*

Facial feature extraction methods are mainly dependent on the classification method and the application environment. Different classification methods need different characteristics, and the different methods can be applied to different environments. Thus, Durmusoglu [9] used the 19 possible 153 key landmarks and distance between the candidates.