Human Emotions Estimation by Adaboost Based on User's Facial Expression and Average Face from Different Directions

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Abstract

Emotion recognition is an active subject in the area of biometrical recognition technology, and lots of achievements have been obtained. Our research combines the three-dimensional average face (3DAF) with Adaboost[1], to improve the correct recognition rate and cut down the processing time.

1. Introduction

Adaboost is a basic method widely used in face feature extraction and recognition. The method is operated easily, and its classification quality is quite precise, while it is sensitive to the noisy data and outliers. What's more, it is not good at processing the event that is lack of previous trained data. So it needs to be used in conjunction with the other algorithms to improve the performance.

In this paper, we combine the three-dimensional average face (3DAF) with Adaboost, to improve the result of human emotions Estimation by Adaboost

2. Features Extraction

We consider the emotion features extracted from eyes and mouth. Large number of samples are trained by AdaBoost based on Haar-like [2] features. Finally, we'll obtain the strong classifier, which is able to be described as

$$H_i(x) = sign(\sum_{t=1}^{T} w_t h_t(x)) \qquad (1)$$

Here, *H* is a classifier of the emotion feature, *w* is weight factor which is updated by each time of boosting iteration, *h* is weak classifier.

4. Proposed method

The original face data is recovered as 3D model to get more features points. After obtaining the 3D features, the 3D coordinates *S* and RGB value *T* are gotten easily.

Suppose, $\bar{S}_i, \bar{T}_i$ are previous i-th iteration average value, α_j, β_j are adjustment factors, *N* is the total number of elements, the average face model can be expressed by 3D coordinates *S* and RGB value *T* as follows,

$$S_{model} = \frac{\bar{S}_i + \sum_{j}^{m-1} \alpha_j S_{ij}}{N}, T_{model} = \frac{\bar{T}_i + \sum_{j}^{m-1} \beta_j S_{ij}}{N} \qquad (2)$$

In order to cut down the processing cost, the 3D features are projected into the 8-bit gray image, which densely covers entire features. These concentrated features can be used to estimate emotions.

5. Experiment

In the paper, the trained samples include 3 types of face expressions, each type having 20 photos taken from 12 persons. Fig.5.1 indicates the comparison of differences between 2D and 3D face models, Fig.5.2 the recognition rate of the proposed method (AF boost) is compared with conventional method's(boost).

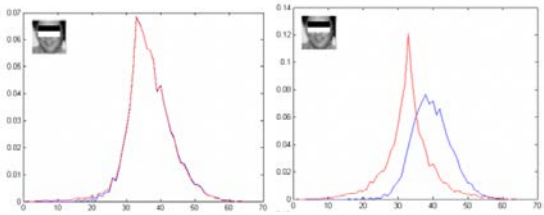

Figure5.1 **Classification effect of 2 D and 3D Figures:** The red lines indicate happy features data, the blue ones are non-happy features. Left figure shows 2D features classification effect and the right is 3D's.

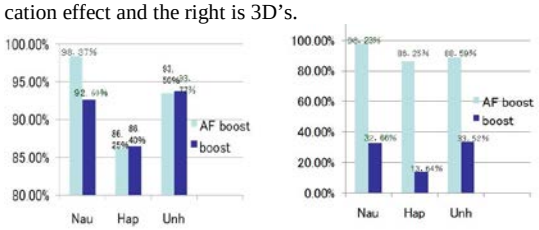

Figure5.2**Recognition rate for static head and head rotating**

6. Conclusion

In this paper, we proposed a novel method for improving emotions estimation. Our experiments have shown that our approach improved the emotions classification rate, specifically the head was freely rotating.

References

[1] Yoav Freund, Robert E. Schapire. "A Decision-Theoretic Generalization of on-Line Learning and an Application to Boosting",1995

[2] Papageorgiou, Oren and Poggio "A general framework for object detection", ICCV, 1998.