Lie Detecting and Emotion Extraction via Eulerian Motion Magnification

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Main Objective

The purpose of this diploma thesis is to create a system that will detect the seven primary emotions of a subject. For this purpose, an Artificial Neural Network (ANN) is constructed and trained with appropriate databases in order to be able to recognize the emotion that dominates in a sample video depicting a person.

Introduction

Emotions play a very prominent and important role in everyday life. This new study serves as a tool for deciphering a person's emotional state with ease. Emotions are much harder to fake, therefore they are more reliable in lie detection.

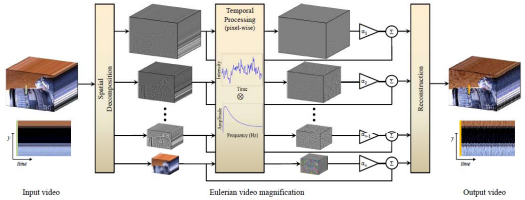
The Method

The extended Cohn-Kanade Database (CK+) is used in order to train a Neural Network. CK+ consists of image sequences in which different subjects demonstrate the seven primary emotions.

From each peak image, only the face is extracted via the Viola-Jones algorithm. The image is resized in order to keep a standard size for all images. Then the HOG features are extracted and they are given to the ANN in order to be trained to detect the emotions in different samples.

Eulerian Video Motion Magnification

EVM is used in order to enhance the subtle motions in video samples that are impossible to detect with naked eye.



The system first decomposes the input video sequence into different spatial frequency bands, and applies the same temporal filter to all bands. The filtered spatial bands are then amplified by a given factor α, added back to the original signal, and collapsed to generate the output video. The choice of temporal filter and amplification factors can be tuned to support different applications.

References

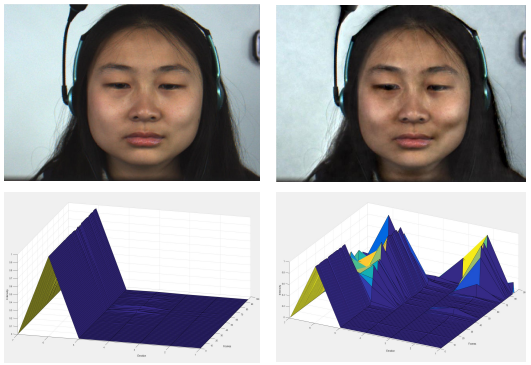
[1] Wu, H. Y., Rubinstein, M., Shih, E., Guttag, J., Durand, F., and Freeman, W. Eulerian video magnification for revealing subtle changes in the world. *ACM Trans. Graph.*, 31(4):65:1–65:8, July 2012.

[2] Yan, W. J., Wu, Q., Liu, Y. J., Wang, S. J., and Fu, X. CASME Database: A Dataset of Spontaneous Micro- Expressions Collected from Neutralized Faces. *The 10th IEEE Conference on Automatic Face and Gesture Recognition*, Shanghai, China,2013.

Results

CASME database was used in order to test the ANN. It consists of 195 micro-expressions which were amplified by the EVM method and then given to the ANN as inputs. Only the emotions of disgust, happiness and surprise were we able to test, which resulted in not so satisfactory success rates. Hence, we would like to at least exhibit the benefits and the crucial role that EVM played in the detection.

Therefore, we demonstrate some examples of videos that, although they did not get the expected emotion as the primary one, they nevertheless gave a stronger indication of it when the video had received the EVM pre-processing. Below, we demonstrate two representative frames of a video sample, one of the original and one of the EVM-enhanced video that are accompanied by diagrams showing the intensity (percentage) of each emotion for each frame of the video.



Although the expected emotion should be happiness (number 5), they both give sadness (number 6) as the dominant emotion. However, as it shown in Figure 3, the magnified video (on the right) includes several frames that indicate "happiness" as the main emotion. More samples were tested in order to validate this.

Conclusion

This system is capable of detecting emotions in photos depicting a person with certain expressions , but faces certain difficulties with micro-expressions where faces are more static. A better and expanded dataset for training is a major step in developing this method.