AffectiveWear: Toward Recognizing Facial Expression

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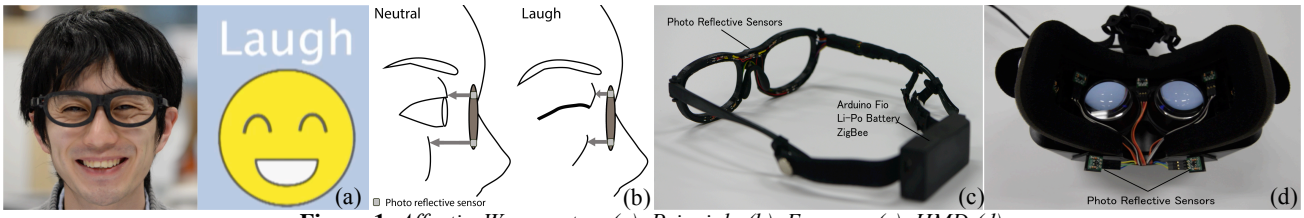

Figure 1: *AffectiveWear system (a), Principle (b), Eyewear (c), HMD (d)*

Introduction

Facial expression is a powerful way for us to exchange information nonverbally. They can give us insights into how people feel and think. There are a number of works related to facial expression detection in computer vision. However, most works focus on camera-based systems installed in the environment. With this method, it is difficult to track user's face if user moves constantly. Moreover, user's facial expression can be recognized at only a limited place.

We present the eyewear that can detect facial expression anytime, anywhere (Figure 1 a). This eyewear can categorize 7 facial expressions by measuring the distance between an eyewear frame and a skin surface of a person's face with 8 photo reflective sensors. Recognizable states are as follows: neutral, smile, laugh, disgust, angry, sad and surprise. With our method, an individual difference can be ignored with user-dependent training. Several works show the wearable systems that can recognize facial expression. Yet, these works focus on detecting only one specific facial expression. Our contribution is detecting 7 facial expression states in daily life. With our device, user can better understand their mind, and computing systems can tap into the rich set of information provided by nonverbal communication.

Implementation

HARDWARE. We have developed the AffectiveWear (Figure 1 c) to detect 7 facial expressions. (Figure 2) This system includes 8 photo reflective sensors (SG-105), 160 - 270 ohm resistors for LED and 62k ohm resistors for transistor, Arduino Fio, Li-Po Battery and ZigBee. The sensors measure the distance between the eyewear and skin surface on face from 8 points. This distance changes according to the movement of the facial muscles (Figure 1 b). The placement of the sensors is chosen to pick up facial changes in the action units related to the facial expressions we want to recognize. We also implemented HMD type with 7 sensors (Figure 1 d).

SOFTWARE. We implemented a Support Vector Machine (SVM) model for the categorization in Java/Processing.

1) The standard of sensor data is set when user wears our device and makes neutral facial expression.

Figure 2: *Variation of recognizable facial expressions*

2) User normalizes the range of the movement of facial muscles by dynamically moving facial muscles.

3) The dataset for each facial expression is created while user makes the same facial expression as the one our user interface displays. These dataset is used as training data of SVM model.

4) User checks if facial expression is categorized correctly. If not, more training is employed.

User Experience

Our system lets the user gain insights about their facial expressions over days (How often did I smile this week versus last?). Tracking these changes enables users to understand more about their frequent unintentional non-verbal clues, helping them to improve their communication skills. Users suffering from depression or other mental disorders might get indications if their state is improving using our system.

With our device, user can put emoticon or change their typography of text messages according to facial expression while they are texting. Since typography has the power to change the impression of messages, this can enrich the communication with texts.

Straightforward application also includes tagging the facial expressions to images or movies captured using a life-logging system, e.g. the Narrative Clip or a GoPro.

Regarding business aspect, we expect that a cinema 3d glasses with our technology could record the facial expression of the audience estimating if specific scenes evoke the wanted effects.

With HMD equipped with our technology, user can reflect their facial expression on their avatar in virtual world. With Kinect, user also can reflect their movement. People can enjoy more natural, subtle ways of communication in virtual world.

Acknowledgements

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References

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