Automated Detection of Human Emotion
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Abstract

An automated method to identify human emotions using electronic visual data has been pursued in hopes of advancing human-computer interaction and various other commercial needs. While previous ventures into this area have proven successful, the majority of them require high-end equipment which keeps this technology out of reach for most casual uses. By utilizing an easily accessible web camera and python, an inexpensive alternative can be created with hopefully the same level of accuracy as more expensive attempts.

Keywords: Emotion recognition, Human-Computer Interaction (HCI), visual

1 Introduction

This project will explore the limitations of using low-end equipment to accurately track facial movement to identify emotions. By researching previous expensive attempts, a variety of tracking techniques can be found and utilized. The results of this project can then be used to expand human-computer interaction, or expand the commercial use of this technology, possibly in the standard household.

2 Objective

The purpose of this project is to analyze human emotions using a cheap low quality camera (standard webcam) that can be used in various interactive applications.

3 Background

3.1 Past Work

The ability to read human emotions automatically and efficiently has been a goal for both computer scientists and commercial entities. Human-Computer interaction is a quickly expanding field where this infor-

mation is vital. Commercial uses include advancing automated product testing, and various uses in the entertainment industry. However, various different approaches have been previously used in previous experiments. Some rely on both visual and auditory data while others rely on one or the other. Visually based experiments also utilize different techniques such as tracking placed markers and analyzing shadow placement. However, most of these experiments utilized high end equipment while I am attempting to recreate the same results at a much cheaper price.

3.2 Facial Action Coding System

The Facial Action Coding System (FACS) was developed by Paul Ekman and Wallace Friesen in 1976 and is used as the standard for determining emotions by psychologists and animators. FACS works by identifying action units that are associated with certain muscle movements. When a certain combination of action units are seen together, emotions can be narrowed down and identified.

4 Development

4.1 Markers

Prior to use, markers must be placed on the face to allow the program to identify the action units. Additional markers must be used to identify the center line of the face. These markers move very minimally and are used to realigning the face after tilt and repositioning.

4.2 Tracking

Tracking involves locating markers on the webcam images and creating a tracking image showing the results of the movement. The tracking algorithm also takes into account facial tilt and shift and realigns the tracking data as necessary. Development of tracking began with tracking the entirety of the marker which produced extremely fuzzy results. The more detailed tracking, however, uses the midpoint of each marker reducing the markers to a single dot which gives very precise data. The program can then use this data to determine the distance the marker has moved and at what angle it moved. This data can then used for emotion classification.

4.3 Emotion Recognition

Emotion recognition uses FACS classifications of angry, happy, sad, and neutral expressions. (Other emotions such as surprise and disgust are also classified, but are not planned to be explored.) The tracking data will be used to identify significant movement of action units which can be used to narrow down the possible emotions being expressed. There is also a planned options to add data to the software which allows the program to learn when it makes an incorrect classification.

Emotion	Description
Anger	Nostrils raised, Mouth Compressed, Furrowed Brow, Eyes wide Open, Head Erect
Sadness	Corner Mouth Depressed, Inner Corner Eyebrows Raised
Joy	Upper Lip Raised, Eyes Open, Eyebrows Raised
Neutral	No particular movement

Figure 1: Basic emotions currently being tested.

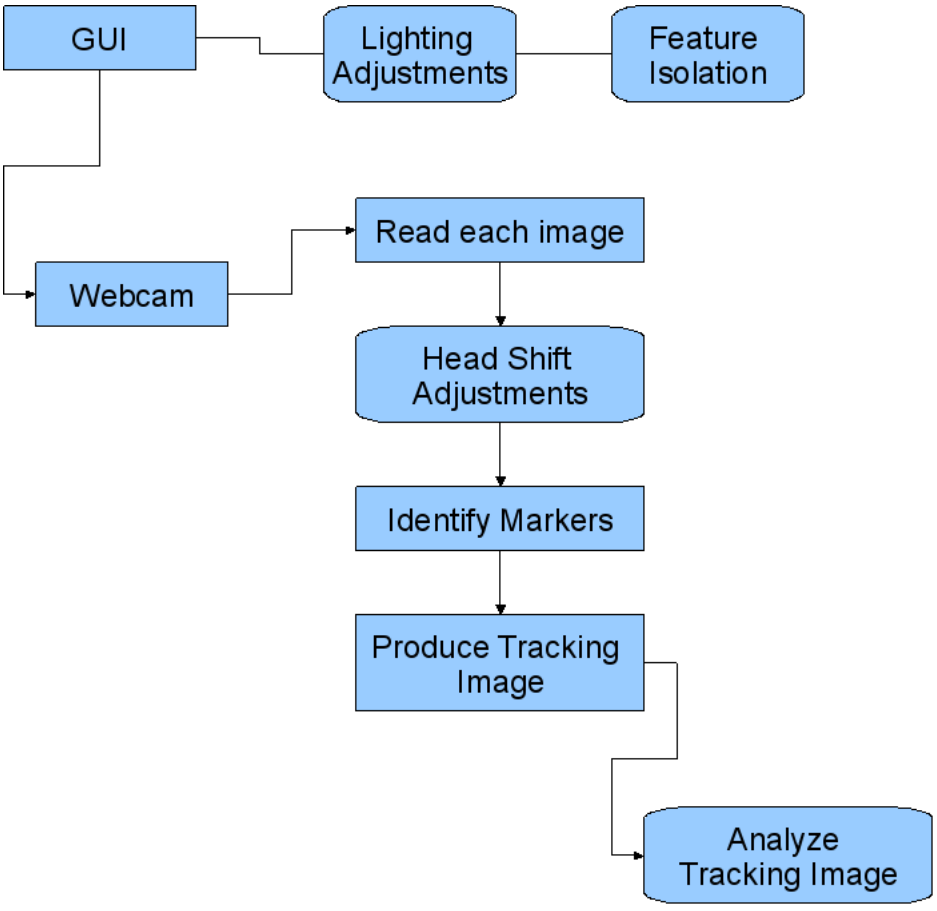

Figure 2: The basic structure of the program.

4.4 Software

Python was used to code this project using the OpenCV package to receive webcam information and the PIL package to analyze the visual data.

4.5 Procedure

This project was completed over the past school year and followed the basic steps of tracking, emotion recognition, and GUI development. The basic process involved coding a simple version of each step, testing with webcam data, and creating a more advanced version of the code.

4.6 Testing

Testing was first heavily controlled by repeatedly using sample data to test various tracking techniques. In later stages of the testing, real time data was used to analyze the performance of the program and make appropriate changes.

5 Discussion

The results of the program are currently varied. While the tracking is very accurate, the emotion classification has a low rate of success. This is most likely caused by the loose classifications of emotions currently being used and I predict that after further testing, the results will greatly improve.

References

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