582 Project Proposal
Video Based Gesture Recognition and Tracking

A Proposal Prepared for the
Final Project of the Graduate Course
ECE 582: Computer Vision & Digital Image Processing

October 20, 2009

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Abstract

The goal of this project will be to implement a program capable of tracking a hand motion and deciphering a hand gesture. The user will utilize its hand to perform a specific gesture in front of a video camera linked to a computer. The hand’s motion will be tracked by the computer program which will map the hand to the computer’s cursor on the monitor screen. A specific gesture will indicate a left click of the cursor while a second gesture will indicate a right click of the computer’s cursor. Therefore, the user’s hand will be a fully functional pointer for navigating and controlling the computer’s graphical user interface. The user will not have to perform the hand gestures at an exact distance from the video camera. The sections below will present the project’s implementation in greater detail.
2.1 Research Question or Problem

Video-based hand gesture recognition and tracking is a powerful tool as it can provide a more natural interface to the computer than a traditional mouse. Certain applications range from allowing people to point at objects on the screen in an effort to utilize them, rotating objects or models by rotating their hands, or zooming in and out by way of certain hand gestures. The project presented could be advantageous to bedridden hospital patients, or other handicapped individuals with limited range or motion that are unable to get out of bed to operate a computer. Using this product, the individual could now easily operate a PC through the simple motion and gesture of their hands. The video game industry is already exploring implementations of this gesture recognition and tracking system to control the in-game play of video games through developments such as Project NATAL for Microsoft’s Xbox 360 gaming system.

There are a number of problems to consider when implementing the hand tracking and gesture recognition project. The first is extracting the user’s hand from the input video for image processing. A second problem is handling the fact that the user’s input hand gestures will not always be placed in the same area of the picture nor will they always be the same distance from the camera. Knowing this, a solution cannot be based on clipping the margins of the picture around the gesture or through the use of size evaluation applied through pixel counting. A final problem to consider is handling the fact that a hand gesture can be presented at any degree of rotation in the x-y direction.

2.2 Research Goals and Objectives

The overall goal of this project is to develop a program implementing hand tracking and gesture recognition. The program will map the user’s hand motion to the computer’s mouse cursor. The hand gesture will determine the state or action of the cursor. A left click will be implemented according to one hand gesture and a right click resulting from a second hand
gesture. The user will not always have to be an exact distance from the camera. The user will also be to present the hand gesture at any degree of rotation in the x-y direction.

The computer program will decipher between three distinct hand gestures. A closed fist will be used to control the motion of the cursor, while a hand gesture consisting of one finger displayed will implement a left click of the mouse, and a two finger hand gesture will implement a right click of the mouse. Additional hand gestures may be added pending adequate amount of time. The additional hand gestures could include a three finger gesture for scrolling up and a four finger gesture for scrolling down.

2.3 Research Design and Methods

The design and method for the project will be carried out in two stages. The first will be to develop an algorithm for tracking the movement of the hand. The second stage will be the development of an algorithm to recognize the specific hand gestures. Both of these algorithms will be implemented in MATLAB. The mapping of the hand motion to the computer’s cursor and the corresponding mouse click controls will be implemented using the java.awt Class Robot in MATLAB. In order to allow the hand gesture to be presented at any degree of rotation in the x-y direction, the Fast-Fourier transform will be implemented on each gesture in the hand gesture recognition algorithm.

2.4 Staffing Plan

Because the project is an individual assignment, the entire project implementation will be carried out independently.
2.5 Timeline

October 20 – November 27: Algorithm Development/Project Implementation/Coding

November 28 – December 2: Final Presentation Preparation

December 3: Final Presentation

References

