A Camera-based Eyebrow Tracker for Computer Control via a Binary Switch

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Extended Abstract

We created the Eyebrow-Clicker, a camera-based human computer interface system for hands-free computer control. The Eyebrow-Clicker detects and tracks the user’s eyes and eyebrows. When the user raises his eyebrows, the Eyebrow-Clicker issues a mouse click and thereby sends a selection command to the computer.

The Eyebrow-Clicker’s selection functionality can be found in other modern switch technologies. An advantage of our switch is the lack of special or intrusive devices, such as electrodes or a suck-blow straw. The only equipment needed is a video camera, which can be discreetly placed away from the user. Other advantages of the Eyebrow-Clicker are its self-initializing and self-correcting properties. The system functions in real-time on a Microsoft Windows NT workstation and uses a Sony EVI-D30 color video CCD camera with a Matrox capture card.

The Eyebrow-Clicker continues a long line of projects designed to better aid humans and their computers to communicate more effectively and intelligently. Here we can only mention a few camera-based projects, for example, [1, 2, 3]. Black and Yacoob describe a system that uses facial tracking and cues from motions of features, including eyebrows, to determine the user’s emotional state [2]. In our group, a mouse replacement system for people with severe disabilities was developed that tracks body features [1]. Another system was designed to detect prolonged blinks as a means of making selections [3].

The Eyebrow-Clicker begins with searching for the user’s eyes. If the user does not move except for blinking his or her eyes, image differencing can be used to detect the location of the eyes. Once the eyes are isolated, the eyebrows are found located directly above the eyes. Next, for each subsequent frame, the eyes and eyebrows are relocated. If they cannot be found, the tracker is restarted. Otherwise, the distance between the eyes and eyebrows is measured. If it has grown, then the user has raised his eyebrows, as shown in Figure 1.

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Figure 1: A user of the Eyebrow-Clicker in the middle of a click.

![Diagram of Eyebrow-Clicker algorithm]

Figure 2: Flowchart of the Eyebrow-Clicker algorithm.

and a simulated mouse click is sent to the computer. Figure 2 shows a flowchart of the algorithm. Five subjects tested the system. The system successfully determined 93% of the time when a user attempted to issue a mouse-click using his or her eyebrows.

References

