Menu Selection by Facial Aspect

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Abstract

A non-intrusive real-time program detects the face and face features of a moving workstation user at a rate of between 10 and 30 Hertz. Based on the face pose, it determines where on the display the subject is looking. Button selection can be done by opening the mouth. The long term goal is to provide a system for controlling a computer using head movements and gaze direction. A skin color model is used along with geometric knowledge about the face and weak assumptions about the lighting. Good results are reported with various subjects and conditions, including facial hair, 3D motion, and use of eyeglasses.

Keywords: HCI, face tracking, face recognition, menu selection

1 Introduction

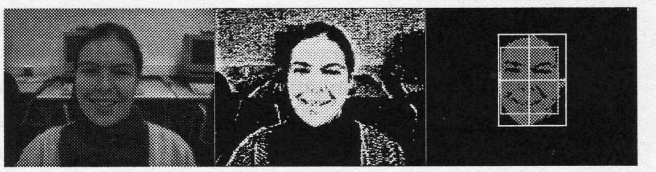
Recently, there has been a great deal of interest and progress in the analysis of faces. Potential applications are many, including recognition [14, 15, 13], gesture recognition [2, 16], face-spotting in images [11, 10, 6, 17], and gaze detection and HCI [9, 1].

The work described here is directed toward a general capability to detect and track a human face as it moves in a 3D workspace. Having achieved this capability, it can then be used to enable others. For example, knowing the approximate 3D head pose allows normalization for face recognition or for reduction of database search in the eigenface approaches to recognition [14, 13]. Or, 3D pose can be used directly for HCI or for evaluation of how humans explore computer displays or virtual environments.

At the higher level, ours is a programmed feature-based approach. A set of sample faces was studied to produce a skin color model that is used within a connected-components algorithm to extract a region that is likely to be a face. Various heuristics are used to eliminate false regions and to frame a real face; finally, additional heuristics use knowledge of faces and lighting to locate the eyes, eyebrows and nose. Location of these features determines gaze direction, and the user can move the screen pointer using just head movements and gaze direction. Button selection can be done by opening the mouth while the user is not moving. Section 2 describes the method for detecting the face features in real time, and location of the eyes, eyebrows and nose. Section 3 describes the overall architecture of the real-time face tracking program and reports results which show that the algorithm performs well with moderate control of the environment. Section 4 describes gaze direction determination. Section 5 describes one possible application of the system—menu selection using head orientation and gaze direction.

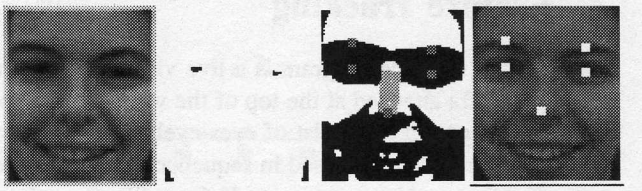
2 Feature Location

Our feature location algorithm consists of two main parts, described in the following subsections.



Original image Skin color class. Face region bound.

(a) Isolated face region in a sample image



Original Best threshold. Nose line Feature points

(b) Eyes, eyebrows and nose detection

Figure 1: Face and eyes/eyebrows/nose location