

Abstract

With the increased interest in human-computer interaction (HCI), there has been rapid growth of research related to gesture recognition in recent years. Hand gesture recognition from visual images forms an important part of this research. This thesis reports on our research on recognition of dynamic hand gestures having different spatio-temporal characteristics. We develop methods to recognize dynamic hand gestures with (1) local hand motion only where only the fingers and the palm move without any movement of the whole hand, (2) global motion only where the hand as a whole moves in space to make different gestures, and (3) both local and global motions where the fingers and palm create different hand poses as the arm traverses along a trajectory in space.

We use the concept of object-based video abstraction for segmenting the frames into video object planes (VOPs) with each VOP corresponding to one semantically meaningful hand pose or position in space. A gesture is represented as a sequence of key video object planes (key VOPs) that correspond to significantly different VOPs in the video sequence. A local-motion gesture is modelled as a sequence of states, each state corresponding to the hand shape in each of the key VOPs. The state along with the temporal information in terms of the number of VOPs between two consecutive key VOPs forms a finite state machine (FSM) for the gesture. Recognition of this type of gesture is performed on the basis of FSM matching. For gestures with global motion only, gesture trajectories obtained from the key VOPs are used for recognition via trajectory matching under time normalized condition. To accomplish trajectory guided recognition, we propose to use some basic static and dynamic trajectory features. In case of gestures having both local and global motions, recognition is accomplished by combining trajectory matching with the FSM-based hand pose matching. For recognition of a continuous stream of gestures, a gesture is discriminated from the movement epenthesis. A movement epenthesis phase due to local hand motion is modelled using the FSM-based representation and that due global hand motion is represented by fuzzy modelling of hand motion parameters. Experimental results show that the proposed gesture recognition methods perform well in recognizing dynamic hand gestures suitable for HCI applications.