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Gesture Based Window Menu Activation System

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ABSTRACT: In this paper, a new method is proposed using the Hidden Markov Model based technique. To handle nongesture patterns, we introduce the concept of a threshold model that calculates the likelihood threshold of an input pattern and provides a confirmation mechanism for the provisionally matched gesture patterns.

KEYWORDS: Hidden Markov Model, threshold model, likelihood threshold, gesture patterns

1. INTRODUCTION

Hand gestures recognition provides a natural way to interact and communicate with computers of different kinds. Compared to the currently used Human Computer Interaction (HCI) such as a keyboard or a remote control, static hand gesture recognition does without any supplementary devices which are used to give instructions to a machine. In a process, which is generally known and referred to as static hand gesture recognition, a person instructs the machine using his bare hands, whereas images of the persons hand gestures are captured and analyzed in order to determine the meaning of the hand gesture. Sign language recognition from hand motion or hand posture is an active area in gesture recognition research for Human Computer Interaction (HCI). Because human-computer interaction studies a human and a machine in conjunction, it draws from supporting knowledge on both the machine and the human side. On the machine side, techniques in computer graphics, operating systems, programming languages, and development environments are relevant. On the human side, communication theory, graphic and industrial design disciplines and human factors such as computer user satisfaction are relevant. A gesture is spatiotemporal pattern, which may be static or dynamic or both. Static morphs of the hands are called postures and hand movements are called gestures.

Human gestures constitute a space of motion expressed by the body, face, and/or hands. Among a variety of gestures, the hand gesture is the most expressive and the most frequently used one. Here, we define a gesture as a meaningful part of the hand motion to communicate with a computer. The goal of gesture interpretation is to push the advanced human-machine communication to bring the performance of human machine interaction close to human-human interaction. This is due to the existing complexities in hand tracking such as hand appearance illumination variation, and inters hands occlusion.

The task of locating meaningful patterns from a stream of input signal is called pattern spotting. Gesture spotting is an instance of pattern spotting where it is critical to locate the start point and the end point of a gesture pattern. It has been regarded as a highly difficult task mainly due to two aspects of signal characteristics: segmentation ambiguity and spatio temporal variability. The segmentation ambiguity problem concerns how to determine when a gesture starts and when it

ends in a continuous hand trajectory. As the motion switches from one gesture to another, the hand makes an intermediate movement between the two gestures.

In this course, transitional motions may be mistaken as meaningful ones. The other difficulty of gesture spotting comes from the fact that the same gesture varies dynamically in shape and duration, even for the same gesturer. An ideal recognizer will extract gesture segments from the continuous input signal and match them with reference patterns allowing a wide range of spatio-temporal variability. Recently, the HMM has attracted the attention of many researchers as a useful tool for modeling the spatiotemporal variability of gestures. However, it has some limitation in representing nongesture patterns. In the study of pattern spotting, each reference pattern is defined by a keyword model

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and all the other patterns are modeled by a single HMM called a garbage model or a filler model.

II. GESTURE BASED WINDOW MENU ACTIVATION SYSTEM

Automatic gesture recognition is highly challenging due to the presence of unpredictable and ambiguous non gesture hand motions. We find a new method is developed using the Hidden Markov Model based technique. To handle non gesture patterns, we introduce the concept of a threshold model that calculates the likelihood threshold of an input pattern and provides a confirmation mechanism for the provisionally matched gesture patterns. The threshold model is a weak model for all trained gestures in the sense that its likelihood is smaller than that of the dedicated gesture model for a given gesture. For this, we can use gesture spotting procedure which can be illustrated in figure 1. The task of locating meaningful patterns from a stream of input signal is called pattern spotting. Gesture spotting is an instance of pattern spotting where it is critical to locate the start point and the end point of a gesture pattern.

A hand location is detected whenever a new image frame is grabbed and is used to build up a hand trajectory. Here, the hand trajectory is automatically projected into a 2D-plane because the location is expressed by x- and y-coordinates of the center of the hand in a frame. In short, the problem is how to locate predefined gesture patterns from the 2D projected hand trajectory that extends at each time step. The task of locating meaningful patterns from a stream of input signal is called pattern spotting.

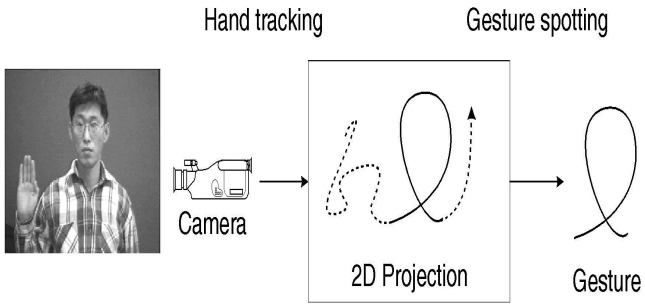

Fig. 1. Gesture spotting procedure

Gesture spotting is an instance of pattern spotting where it is critical to locate the start point and the end point of a gesture pattern. For correct gesture spotting, the likelihood of a gesture model for a given pattern should be distinct enough. Unfortunately, although the HMM recognizer chooses a model with the best likelihood, we cannot guarantee that the pattern is really similar to the reference gesture unless the likelihood value is high enough. A simple thresholding for the likelihood often does not work. Therefore, we propose a new concept, called threshold model that yields the likelihood value to be used as a threshold. A gesture is recognized only if the likelihood of the best gesture model is higher than that of the threshold model.Window menu activation system is continuous process in which we detect gesture spotting problem from continuous hand motion. We propose an automatic system that recognizes isolated gesture for Alphabets (A-Z) and numbers (0-9) in real-time from stereo color image sequences by the motion trajectory of a single hand using HMMs. In particular, the proposed system consists of three main stages; an automatic hand segmentation and tracking, feature extraction and classification are illustrated in fig.2.

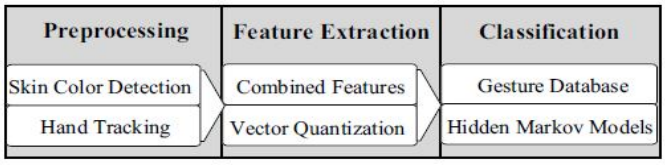

Figure 2: Schematic view of gesture recognition system

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A. Automatic Hand Segmentation and Tracking

We know that automatic hand segmentation and tracking is a part of preprocessing in which it localize and track the hand to generate its motion trajectory (gesture path). A method for detection and segmentation of a hand in stereo color images with complex background is described where the hand segmentation takes place using 3D depth map and color information. Segmentation of skin colored regions becomes robust if only the chrominance is used in analysis. Therefore, *Y CbCr* color space is used in our system where *Y* channel represents brightness and (*Cb, Cr*) channels refer to chrominance. We ignore *Y* channel to reduce the effect of brightness variation and use only the chrominance channels that fully represent the color information.

The task of this phase is to acquire an image, or a sequence of images (video), which is then processed in the next phases. The capturing is mostly done using a single camera with a frontal view of the person's hand, which performs the gestures.

B. Feature Extraction

There is no doubt that selecting good features to recognize the hand gesture path plays significant role in system performance. Here, gesture is described as a spatio-temporal sequence of feature vectors that consist of the direction of hand movement, as shown in Fig. 3a. A feature vector should be converted to one of the 16 directional code words (Fig. 3b) by a vector quantizer because we make use of the discrete HMM-based approach.

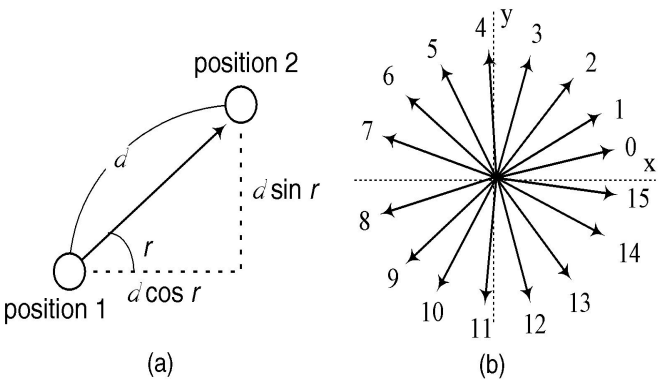

Fig.3 Feature vector and directional code words. A feature vector is a unit vector (cos θ, sin θ) which consists of normalized elements in x and y directions. (a) Feature vector. (b) Directional code words.

There are three basic features; location, orientation and velocity. We analyze the effectiveness of these features that are extracted from a hand trajectory and also combine them to test their recognition rate. A gesture path is spatio-temporal pattern that consists of hand centroid points (xhand, yhand). The coordinates in the Cartesian space can be extracted from gesture frames directly. We consider two types of location features. The first location feature is that measures the distance from the centroid point to all points of the gesture path because different location features are generated for the same gesture according to different starting points. The second basic feature is the orientation, which gives the direction along that the hand when traverses in space during the gesture making process. The third basic feature is the velocity, which plays an important role during gesture recognition phase particularly at some critical situations. The velocity is based on the fact that each gesture is made at different speeds where the velocity of the hand decreases at the corner point of a gesture path.

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C. Classification

The final stage in our system is classification. In which the gesture path is recognized using discrete vector and Left-Right Banded topology. And HMMs parameter to construct gesture database, HMM is useful tool for modeling the spatiotemporal variability of gesture. However, it has some limitation in representing nongesture patterns. In the study of pattern spotting, each reference pattern is defined by a keyword model and all the other patterns are modeled by a single HMM called a garbage model or a filler model.
The Hidden Markov Model (HMM) classifiers belong to the class of trainable classifiers. It represents a statistical model, in which the most probable matching gesture-class is determined for a given feature vector, based on the training data. In HMMs were successfully used to distinguish up to 40 different hand gestures with an accuracy of up to 91.9%. In order to train the HMM, a Baum-Welch re-estimation algorithm, which adapts the internal states of the HMM according to some feedback concerning the accuracy, is used.

III. SIGNIFICANCE

Hand gesture is a very natural form of human interaction and can be used effectively in Human Computer Interaction (HCI). Hand gesture recognition finds applications in varied domains including virtual environments, smart surveillance, sign language translation, medical systems etc. For achieving natural human computer interaction for virtual environments, integrated controlling gestures into the virtual environment Battle-Field. In this system hand gestures are used not only for navigating the VE, but also as an interactive device to select and move the virtual objects in the Battle-Field.

We can make use HCI for handicapped person who so ever are on wheel-chair and not able to move, they can make use of this by providing gesture and make work as they want. This technique we can make use in space gaming center, no doubt this is used by high perform peoples they made a space gaming room in their home in which child can play game without any equipment only by making gestures with the technique of Human Computer Interaction (HCI).Even we can operate heavy machines with gestures because most of machines are computer are organized and by providing gestures to make on the computer. And we can use same concept to operate window menu interface in any computer by using gestures. It can also used for human control interface in which user can control home appliances by moving through menus.

The main applications of gesture recognition are communicative and manipulative. First is gesture recognition are communicative that means sign language recognition. Sign language recognition from hand motion or hand posture is an active area in gesture recognition research for Human Computer Interaction (HCI). Second is gesture recognition are manipulative that means controlling robots without any physical contact between human and computer.

IV. CONCLUSION AND FUTURE WORK

In this paper, the proposed technique investigated the problem of spotting and recognition of meaningful gestures which are embedded in the input video stream. One of such problems which arise in hand gesture recognition is to spot meaningful gestures from the continuous sequence of hand motions. Another problem is due to the variability in the same gesture, even for the same person. Most of the approaches have used the backward spotting technique which causes inescapable time delay between the meaningful gesture spotting and recognition tasks. The aim of the work is to propose a forward gesture spotting system to handle hand gesture segmentation and recognition at the same time. This system modeled gesture patterns discriminately and non-gesture patterns effectively. An HMM based gesture spotting system with a threshold model calculates the threshold likelihood, given an input pattern. The threshold model approves or rejects the pattern as a gesture. For gesture segmentation, it detects the reliable end point of a gesture and finds the start point by back tracking the Viterbi path from the end point. The meaningful gesture spotting from the continuous sequence of hand motion can be implemented on window menu system.

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