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Opening an Application Using Hand Gesture

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Abstract—

Hand gesture is a powerful means of communications among humans. Hand gesture recognition has been an exciting research area. Hand gesture recognition can have tremendous applications in Human Computer interface and other robotic machineries. Currently the keyboard and mouse are the main interfaces between human and computer. The system is able to detect the presence of gestures, to identify the number of fingers, and to recognize the meanings of gestures in a pre-defined Popular Gesture scenario. Hand Gesture Recognition techniques results in developing a low cost interface device for interacting with objects in virtual environment using hand gestures.

Keywords— Hand Gesture Recognition, Human Computer Interaction, virtual environment.

I. INTRODUCTION

Hand Gesture Recognition recognize meaningful expression of motion by a hand. We use hand as an input device rather than the devices such as keyboards and mouse. To facilitate this process of gesture recognition, we use the uniquely coloured gloves. In addition, using a controlled background makes it possible to localize the hand efficiently and even in real-time.

We are using OpenCv image processing library to perform the process of pre-processing, detection, tracking, feature extraction and finally training. It makes easier to create the system due to the amount of in-built functions of various image processing tasks like edge detection, feature tracking etc. It makes the systems compatibility for real time applications quite high with a fast processing speed.

II. OVERVIEW OF GESTURE RECOGNITION

Gesture recognition is an area of active current research in computer vision. We are considering single-handed gestures, which are sequences of distinct hand shapes and hand region. A Gesture is defined as a motion of the hand to communicate with a computer. Human-computer interaction using hand gestures has been studied by a number of researcher. The basic idea lies in the real-time generation of gesture model for hand gesture recognition in the content analysis of video sequence from camera. The recognition process involves tracking of the hand. The algorithm proposed for gesture recognition is show in figure:

1. Choose initial search window size and location.
2. While hand is in view,

(a) Track and extract the hand from an image sequence.
(b) Verify the extracted hand region.

3. Recognize the gesture, which gives the maximum probability.

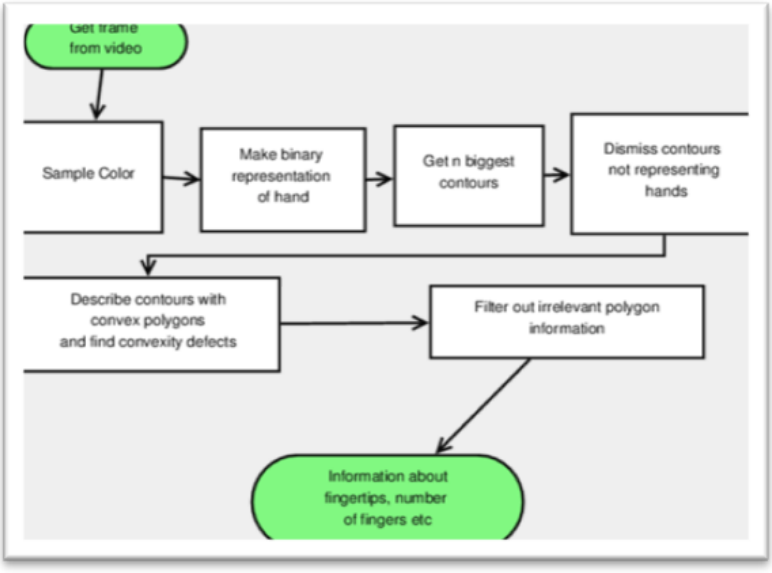

Fig. 1 Hand Tracking and Recognition

The system has three important components:

1.Hand Detection :The first step is to separate the hands from the background. Depth thresholds are set manually in advance to specify the depth range where gestures must appear to be recognized. [1]

2. Finger Identification:

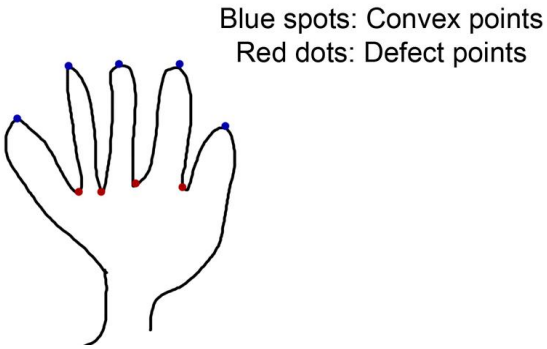

Fig.2 convex and defect points of hand

Initially we find convex points and defect points. Then from the observations convex hull points are most likely to be on the fingers and hence this can be used to detect number of fingers. But we are using our full arm, there can be other points of convexity. So we find the convex defects. convex defects are present between each arm of the hull, we will try to find the deepest point of deviation on the contour. Thus the defect points are most likely to be the center of the finger valleys as pointed out by the picture.

3. Gesture Recognition: Once the fingers are identified with their names, we are ready for gesture recognition.[1]

III. DETECTION AND TRACKING

In our system, we are taking hand gesture image as an input with the common web camera. The image fetching speed is 20 frames per second. The distance between user and the camera is about 50-100cm. Firstly video input is taken from the camera and then stored as frame by frame into a matrix. This matrix is marked by indexes. Thus this matrix is actual sequential storage of frames which consists of the entire video. For simplicity and quickness, we use skin color to detect hand area. Hand gesture is nothing but continuous sequence composed of hand's action. It has two points namely start point and an end point. The image sequences are captured by the web camera. These sequences contain garbage gestures which have to be removed. We have to divide image sequences into hand gestures. The system uses a contour tracing algorithm to deal with this problem.

MHI PHASE

The input to this phase is the matrix in which the original frames of the video are stored. This matrix consist of frames some of which contain the movement of the object and some which do not contain the movement of the object. There may be some frames that not even contain the object itself. These frames are useless hence garbage and therefore these frames rejected. For this purpose we use the concept of MHI and silhouettes. The MHI stands for Motion History Image. This phase gives the motion properties of the object. In this phase we are actually converting the frames stored in the matrix into gray scale to get the eligible frames. The concept of silhouettes brings in the property of extracting motion properties. Initially all the frames are converted into gray scale. Then with the help OpenCv libraries we convert the frames into their respective silhouettes. Once it is converted to silhouettes it becomes very easy to identify the garbage frames, which are to be removed. Removal of these garbage frames helps in reducing the space requirement.

IV. FEATURE EXTRACTION

Motion Recognition Phase

This is the most important phase of the project. In this phase we derive gesture motion made by the user. The main features of this phase are to obtain the object that is making the movement and also to derive the movement properties or characteristics. This Phase has three main stages: Frame descriptor bundle, Rotation descriptor and gesture signature.

Frame descriptor bundle: Last, we are going to delete areas which are lying on the image edge and choose the biggest one as the hand area. For this purpose we pan the input frames to get the actual object. Dynamic Hand Gesture Recognition Using Real Time Motion Template Gradients For panning we set the left and right boundaries. This reduces the frame to show only the object. This simplifies our job. Also this helps in finding the motion properties.

Rotation descriptor: The purpose of this stage is to derive the motion of the object in the frame. The motion can be in one direction, multi direction or in curve path. Here we determine the motion of the object by considering the coordinate axes of the screen. The coordinates of the object keep changing during its motion. These coordinates are used to calculate the slope and alignment of the object. Based on this calculation the objects path of motion can be determined.

Gesture signature: After the motion for the gesture is determined, the main job is to perform the job assigned to it. Here we use a rather dynamic approach of assigning a particular signature to each of the gesture. It is having an unique signature which is totally based on the motion of the gesture. This signature helps in proper and exquisite mapping if the actions.

Recognition With OpenCV

The hand tracking is based on recognition of color. This program is therefore initialized by sampling the color from the hand. Then by using a threshold using the sampled color profile, the hand is extracted from the background. Each color in the profile produces a binary image. Then all binary images are summed together. For getting a smooth and noise free binary representation of hand, a nonlinear median filter is applied.

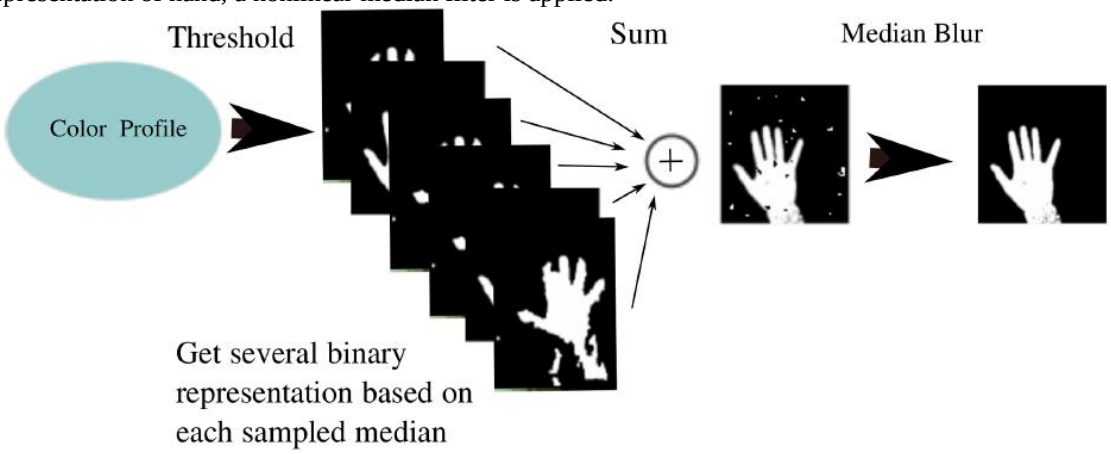

Fig.3 Binary representation of hand

When the binary representation is generated the hand is processed in the following way:

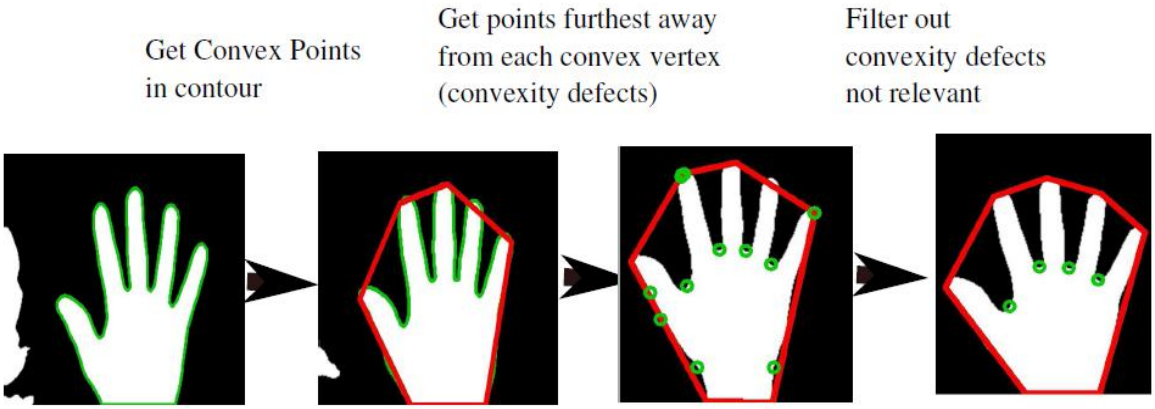

Fig.4 The processing of binary representation of hand.

The properties that determines whether a convexity defect is to be rejected is the angle between the lines going from the defect to the neighbouring convex polygon vertices

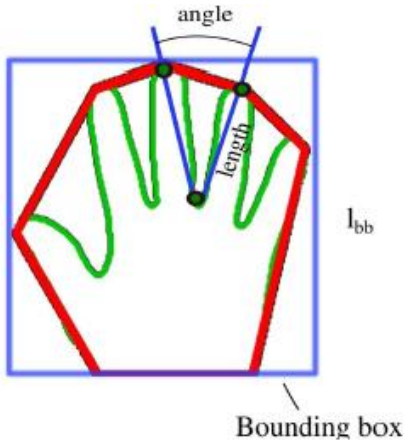

Fig.5 Removal of convexity defects

V. TECHNOLOGIES USED

OPEN CV:

Open CV (Open Source Computer Vision Library) is a library which focuses at real-time computer vision. It is used For both academic and commercial , it is free. It has C++, C and supports Windows, Linux (ubuntu). Open CV was designed and has a strong focus on real-time applications. The library has more than 2500 algorithms, which includes both classic computer vision and machine learning algorithms. It provides basic data structures for image processing with optimization.[5]

VI. CONCLUSION

The system is motivated by the importance of real-time communication under specific situations like chatting with speech and hearing challenged people. We have developed a gesture recognition system that is shown to be robust for ASL gestures. The system is fully automatic and it works in real-time. The advantage of the system lies in the use of experiments on a single hand database have been carried out and recognition accuracy of up to 98percent has been achieved. We plan to extend our system into 3D tracking. Currently, our tracking method is limited to 2D. We will therefore investigate a practice 3D hand tracking technique using multiple cameras. Focus will also be given to further improve our system.

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