PROJECT PROPOSAL

Hand Gesture and Sign Recognition

(Project ID - 14)

 htthttps://github.com/AstitvaSri/Hand-Gesture-Recognition

Team Members-

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Main goal of the project -

The primary goal of the project is to present a novel method for hand gesture recognition, using finger segmentation.

Problem Definition -

Recognizing hand gestures is very significant for human-computer interaction. Traditional hardware-based methods of hand gesture recognition make use of sophisticated devices like *'Kinect Sensor',* and/or involve complex classifiers for recognition purpose, like *Support Vector Machine (SVM)* or *Hidden Markov Model (HMM).* These methods are costly in terms of time and resources.

The proposed method intends to use only a normal camera to detect hand in the images and use simple rule classifier to recognize gestures efficiently, thus it will be suitable for real-time applications.

The whole problem of recognizing hand gestures can be divided into three sub-problems :

1. **<u>Hand Detection</u> -** The first task is to detect and extract hand from the input images. These images are taken under the same condition, i.e. background of these images is identical. So,the **background subtraction** method is an effective way of extracting hand from the images. In case, there are some moving objects in the background, then the HSV model can be used to differentiate between hand and other objects. The **HSV (Hue, Saturation, Value)** for skin colour is **315, 94, 37**. All the detected hand images are resize down to the same scale in order to make gesture recognition invariant to image size. One important point to note that these extracted images are **binary images.**

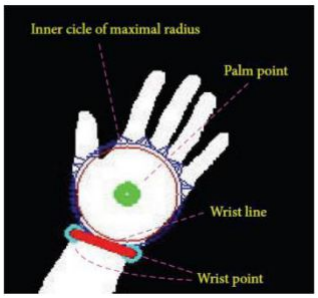
Input Image

Background Subtraction

Binary Image of hand

2. **<u>Fingers and Palm Segmentation</u> -** Second and most important task is to differentiate between palm and fingers and perform segmentation to analyse them separately for recognizing gestures. In order to perform this segmentation, first palm mask is extracted. To extract palm mask, the **distance transformation** of the resultant binary image (from the previous step) is taken to identify **palm point** and to further determine **maximal inner circle.** This maximal inner circle is then extended a bit to produce a more accurate **palm-mask.** Then the **wrist line** is detected by searching for maximum distance between mask points. Once palm-mask and wrist line are obtained, rotation is applied on the image before

examining further, to get a common alignment for all the images.
After that, fingers are separated from palm using **labelling algorithm.**



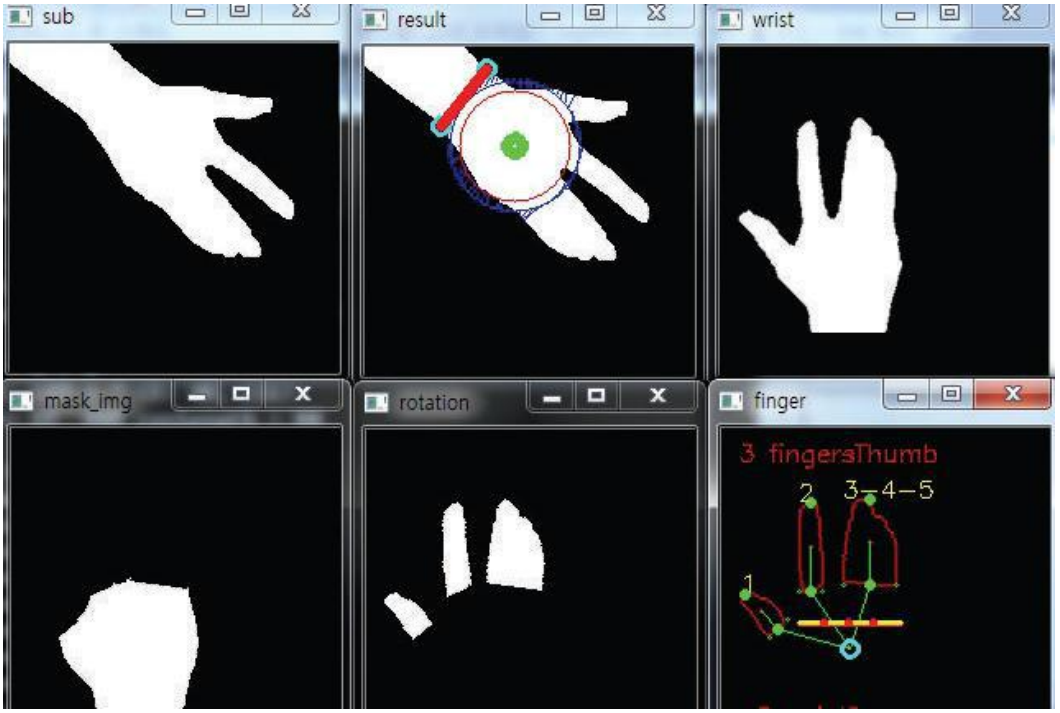

Each finger is enclosed within a boundary box. The centre point of each Boundary box is determined to differentiate thumb from fingers, using the criterion that if the line from the centre point of a boundary box makes an angle less than 50°then it is a thumb. Using suitable criteria, index finger, middle finger, ring finger and little finger can be identified.

3. **<u>Recognition of Hand Gestures</u> -** When the fingers are detected and recognized, the hand gesture can be recognized using a simple rule classifier. In the rule classifier, the hand gesture is predicted according to the number and content of fingers detected. The content of the fingers means what fingers are detected. The simple rule classifier is very effective and efficient.

<u>Results of the project</u> -

We want our proposed method to take input images with variations in hand orientation, scale, articulation and so forth, and classify the images according to recognized gestures.

The system should take an input image, extract the binary image of hand from it, perform segmentation to determine palm, thumb and fingers, label all the fingers and finally recognize the gesture accurately.
Another expected result is that we need the proposed method to perform with high accuracy and efficiency.



<u>Project milestones and timeline</u> -

Hand Detection: It will take around **one week** to set up the dataset and implement hand detection using background subtraction method. This step will give binary images of extracted hand from the input images.

Fingers and Palm Segmentation : It will take around **two weeks** to implement logic to analyse the binary images of the hand and perform segmentation. This step will give labelled fingers which will be further used to determine gestures.

Recognizing Hand Gestures: It will take around **one week** to build a simple rule classifier which will be used to recognize gestures based on the result of the previous step. This is the final step in the implementation process of the proposed method.

Performance Evaluation and Improvements : It will take another **week** to conduct the evaluation of the proposed method and to further optimize the performance if needed.

This project will take about **a month and a week** to get the final deliverables ready.