Hand Segmentation for Hand Gesture Recognition

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Abstract- Hand gesture recognition system has received great attention in the recent few years because of its manifoldness applications and the ability to interact with machine efficiently through human computer interaction. In this work Hand segmentation using color models is introduced for obtaining hand gestures or detecting user’s hand by color segmentation technique for faster, better, robust, accurate and real-time applications. There are many such color models available for human hand and human skin detection with relative advantages and disadvantages in the field of Image Processing. For the purpose of hand Segmentation mix model approach has been adopted for best results. For detection of Hand from an image. The proposed approach is found to be accurate and effective for multiple conditions.

Keywords: Human computer interaction (HCI), Hand segmentation, Image processing, Clutter, Color model.

I. INTRODUCTION

Natural Human Computer Interaction (HCI) is the demand of today’s technology oriented world. Survey and Sign language study shows that from various gesture communications modality, the hand gesture is the most easy, accurate and natural way of communication. We have to design such a system which can detect particular hand gestures and use them to pass on the information. At any time, a user can exhibit his/her hand performing a specific gesture in front of a web camera that is connected to a computer. At first, we captured the hand gesture of a user and stored it in disk. A hand gesture recognition system provides a natural, innovative way of non verbal communication. [1] The goal of gesture recognition [2] is to create a system which understand the human hand gestures and use them to convey the information. The [3] work is done for the vision based hand gesture recognition for natural human computer Interface. In this Hand segmentation we consider as the basic steps for any hand gesture recognition system. Real-time Vision-based hand gesture recognition is considered to be more and more feasible and accurate for Human-Computer Interaction with the help of latest advances in the field of computer vision and pattern recognition. The motive of presenting this paper is to develop an efficient hand Segmentation algorithm where three color models (YCBCR,HSV,LAB) for hand segmentation using different color spaces with required morphological processing were utilized. Hand segmentation algorithm is found to be most efficient and accurate to handle the problem of vision based system such as skin color identification, complex background removal and changing lighting condition. Hand gestures are a powerful human communication channel between human, which forms a major part of information transfer in our daily life. Hand gestures are natural and an easy to use way of interaction. Using hands as a device can effectively help people communicate with computers in a more innovative, intuitive and natural way. When we interact with other people, our hand movement plays an important role and the information they convey is very rich in many ways. Hand movements are thus a mean of non-verbal communication, ranging from simple actions to more complex ones. Various applications designed for gesture recognition require restricted background, set of gesture command and a good camera for capturing images. [4] Hand segmentation is one of the basis key technologies for gesture recognition and is based on complexion segmentation accordingly. One of the commonly helpful cues for hand segmenting is skin color since human skin is consistent and different from other objects which produce good results under well constrained environments. [5] In Real-time Vision based Hand Gesture recognition system, hand segmentation is most important and challenging step towards gesture recognition. Uncontrolled environment, lighting condition, rapid hand motion, skin color detection, and self-occlusions are the challenges need to be considered while capturing the hand gesture. Various researchers are still working on hand segmentation to make it robust to achieve natural interface with machine. [6]

COLOR MODELS

The aim of this project is to overcome the challenge of skin color detection for natural interface between user and the machine. So, to detect the skin color under dynamic background the study of different color models was done for pixel based skin detection. The 3 color spaces have been chosen which are commonly used in computer vision applications. A color model is an abstract mathematical model which can be represented as tuples of no., typically as three or four values or color components. When this model is associated with a brief description of how the components are to be interpreted the resulting set of colors is called color space.
Types of color model:

**RGB**: The RGB color model is an additive color model in which green, red, and blue light are added together in various ways to reproduce a broad array of colors.

**HSV**: HSV (Hue, Saturation, And Value): It expresses Hue with dominant color (such as green, red, purple and yellow) of an area. The Saturation measures the colorfulness of an area in proportion to its brightness. The “intensity”, “lightness”, or “Values” is related to the color luminance. This model shows discrimination of luminance from chrominance. This is a more accurate method for describing colors, and because the intensity is independent of the color information this is very feasible and useful model for computer vision. This model gives poor result where the brightness is very low.

**CIE –Lab**: It was defined by the International Commission on Illumination (CIE). It separates a luminance variable L from two perceptually uniform chromaticity variables (a, b)

### II. MODEL FOR HAND SEGMENTATION

In any Hand Segmentation system using color model, one of the most important problems in any color image analysis is problem of segmentation process. The basic block diagram for the proposed Model is shown below:- This shows the research work for the purpose of hand segmentation using color model

**Pre-processing**: Pre-processing is the step in which we get the required output in form of an image. After the process of Hand Segmentation using YCbCr model, a Mix Model Approach is used for skin modeling of segmented Hand used. Finally the result of Feature extraction using Region of Interest (ROI) properties is helpful for the purpose of the tracking with color.

![Fig.1 Proposed Model Diagram](image-url)

### III. PROBLEM STATEMENT

Design and Development of hand Segmentation techniques using mix model approach (combination of the color models) for skin modeling of the human Hand. These techniques are studied for the images of Clutter backgrounds. Based on color segmentation technique can be done through one of the most appropriate mix coloring model.

![Fig. 1 Hand Segmented Output](image-url)
Table 1. MATLAB specifications

<table>
<thead>
<tr>
<th>Methodology Adopted: Tool/Software used</th>
<th>Version</th>
</tr>
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<tbody>
<tr>
<td>MATLAB</td>
<td>MatlabR2010a</td>
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A. Steps of Implemented Algorithm

1. Start Acquisition
2. Input: Image using RGB
3. Convert the RGB image into color space. (Eg. YCbCr, LAB, HSV)
4. Extract the hand from an image using the color Models by applying thresholding.
5. Apply mix model approach for skin modeling (RGB + HSV), (YCbCr + HSV).
6. Color Based Segmentation using ROI properties.

IV. RESULT

Hand Sample with Clutter Background-
Fig. 3 RGB Converts to LAB Color Model.

Fig. 4 Mix Modeling RGB to YCbCr.

a) Original captured image
b) Hand is detected using YCbCr model and fill Hand Pixels with in blue color
c) Hand is segment out from the image
d) Removing Illumination Effect
e) Result of mix model approach (RGB+HSV)
f) Result of mix model approach (YCbCr+HSV)

Fig. 5 Mix Modeling RGB to HSV
a). Original captured image,
b). Hand is detected using YCbCr model and fill Hand Pixels with in blue color,
c). Hand is segment out from the image
d). Result of mix model approach (RGB+HSV)
e). Result of mix model approach (YCbCr+HSV)

V. CONCLUSION

All color spaces have some luminance effect due to real time Illumination. While working on Real time data of hand, background is treated as noise and luminance effect which effect the proper detection of human Hand. To overcome this problem of luminance effect and background noise a mix model approach is used, where combination of the color spaces is used. In mix model approach the image is captured for default and further processing is done on hand image. After doing the Hand Segmentation using mix model approach, hand is better segmented by using RGB and HSV for dynamic background and for default background YCbCr and HSV color space is performed well.

VI. Future Work

Like explained above color space can also be performed by applying different color combination and this segment can be used in future for hand gesture recognition.

ACKNOWLEDGEMENT

We would like to sincerely thankful to respected Dr. C.S.Satsangi, (Head of Department Information Technology) for his contribution and help in writing this Paper. We would also thankful to our team-mates and all my friends who involved in the discussions and Deliberations during the implementation and Development aspect.

REFERENCES


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