# Hand Gesture Recognition Using LAB Thresholding Technique

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***Abstract*—Aim of this paper is to develop an automatic gesture recognition scheme in real time which handles the noisy hand shapes obtained from the camera. We propose a circular profiling approach for recognizing the hand gesture. In this paper, instead of using the colour glove or data glove, bare hand gestures are used for recognition. Due to the effect of lighting and complex background, most visual hand gesture recognition systems work only under restricted environment. LAB skin color model is used to detect skin color regions like hands. It is efficient color model than any other color model. It will be very convenient to utilize hand gesture as a kind of "mouse" for retrieving the information.**

***Keywords- thresholding; blob detection; LAB color model; preprocessing; segmentation***

## I. INTRODUCTION

Normally to access any type of information people use keyboard and mouse. Using gestures of hand, face we can access the information. Keyboard and mouse have been replaced by gestures of hand and face. Nowadays lots of development are done in the field of gesture recognition. This paper mainly focuses on hand gesture recognition. Hand gesture acts as a natural interaction between computer and human [1]. Hand gesture is one of the significant way for the population that not familiar with computer. It will very helpful for the novice user. Hence use of gesture recognition increases. Natural input devices like hand gestures attract more attention because it is powerful and more effective and does not require extra connection [2] than any other devices. Hand gesture can be classified as static and dynamic [3]. In static movement, hand is held with a specific pose [1] for example thumbs up, a victory sign. Static hand gesture recognition requires training and it has less computational complexity than dynamic hand gesture. Whereas dynamic hand gesture requires no training, it recognizes the hand gesture dynamically [2]. Dynamic hand gesture is more complex but it is more useful than static hand gesture. Hand gesture recognition is used in robot control, human computer interaction (HCI), daily information retrieval, TV controlling etc.

This paper mainly focuses on recognition of hand gesture without using external devices like gloves, depth camera. Once the bare hand is detected, using finger count performs certain actions. Flow of proposed work is explained in this paper. Then we explain the concept of blob detection. In this paper the mathematical model and the experimental comparison of different color models are given.

This paper presents an algorithm on hand gesture recognition. Hand gesture recognition is a vast topic although a lot of work has been done on hand gesture recognition method. Also focuses on the advancement of gesture recognition system. It is up to date and represents a good point for investigators in hand gesture recognition area.

## II.PREVIOUS WORK

In [4] this paper for controlling the TV, author proposes an automatic user state recognition scheme to recognize the TV user's state. User state is decided according to finite state machine. Absent, OtherAction, Controlling, and Watching these are the four states, depends on these states activate the camera. The prototype based on an ultrasonic distance sensor array, a red-green-blue (RGB) camera, and a depth camera are implemented. In this paper for recognizing the gesture, author used depth camera.

In [5] this paper, for retrieving the daily information author gives some flow for recognizing the gesture. This system is particularly developed for family environment. In a typical family, since each member has different requirements and needs, system utilizes face recognition to identify each user, bringing up personalized services to each user. For recognizing the face and hand gesture, PCA method is used and YCbCr color model is used for detecting the skin region. In this paper main drawback is for Principle Component Analysis method because PCA is easily affected by light.

In [6] this paper for recognizing the static and dynamic hand gestures, author used adaptive skin color model. In this method, firstly face skin color is detected using Gaussian distribution analysis. Depending on skin color static hand gesture is recognized for dynamic hand gesture recognition motion history updating is required. For efficient result author can use other color model rather than Gaussian distribution.

In earlier time for hand gesture recognition author used color glove, data glove and depth camera [7].

But that method also has some limitations. In data glove and color glove every time author wears the glove .So it is inconvenient method.

## III. PROPOSED WORK

Aim of this paper is to recognize the hand gesture and to find the count of finger in real time. We are recognizing the bare hand gesture. Images that we taken for recognition that are dynamic images not static images.

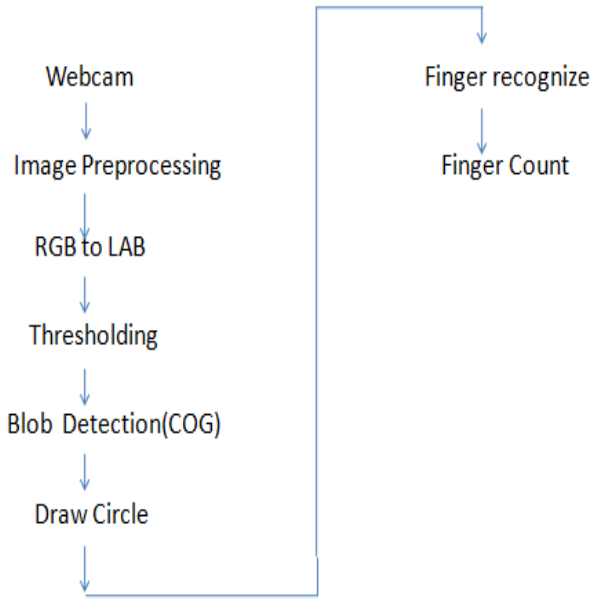


Fig. 1. Flow of proposed work

(1) Images (hand gestures) are captured using inbuilt webcam or external webcam. Not specific requirement for resolution of webcam.

(2).After getting the image pre-processing algorithm is applied. In pre-processing, noise is removed, blurring the image and converted into normalized image for effective recognition of image. Blurring means each pixel in the source image gets spread over and mixed into surrounding pixels. Blurring an image reduces the sharpening effect. This makes the detection more accurate. Color blur algorithm is used for blurring. Blurring is done by calculating the average of surrounding 8 pixels that is 3*3 window. To increase the blur effect we can scan surrounding 24 pixels that is 5*5 window. Figure 2 shows before blur image and after blur image.


Fig. 2. Apply Blur Algorithm

(3).Pre-processing is applied then RGB image is converted into LAB color image. RGB is additive mixture of red, green and blue color. For conversion we have to separate the red, green and blur color from RGB image. In LAB color model L channel is for lightness it has no color (L), plus two channels with a dual color combination that have no contrast (a+b) is used.

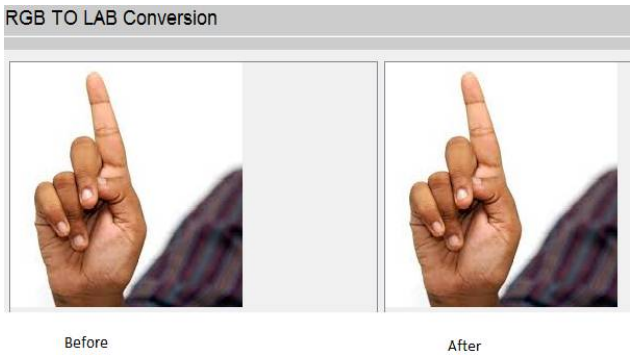


Fig. 3. RGB to LAB Conversion

(4).After that, thresholding on LAB color image is applied. In binary thresholding individual pixels in an image are marked as "object" pixels if their value is greater than some threshold value (assuming an object to be brighter than the background) and as "background" pixels otherwise. Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0."Finally, a binary image is created by coloring each pixel white or black, depending on a pixel's labels.

(5).Once the thresholding is applied the image is obtained which is in only 2 colors - black or white. Hand gesture image is in black (or white) color and background image is in white (or black) color. Using segmentation hand gesture image is extracted from background image.

(6). Blob detection method is applied. Blob detection refers to visual modules that are aimed at detecting points and/or regions in the image that differ in properties like brightness or color compared to the surrounding. In blob detection method, one large image which is connected to each other that image is in one blob. If two images on screen and these images are not connected to each other then these two images are in separate blob. In our case hand gesture image is one blob.
Figure 4 shows that hand gesture is in one blob.

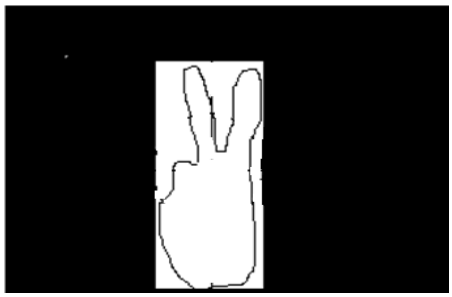

Fig. 4. Blob Detection

(7). After blob detection then we have to draw the circle. While drawing the circle try to find the center. Center is calculated using

$$(x,y) = \left( \frac{(x1+x2)}{2} , \frac{(y1+y2)}{2} \right)$$

Using this formula center of circle (x, y) can be obtained.

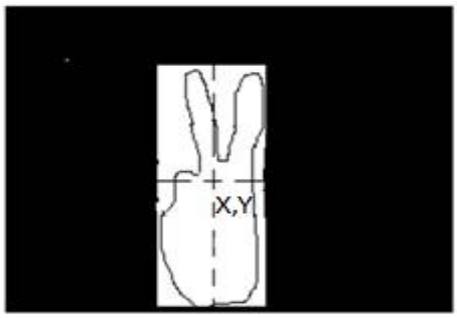


Fig. 5. Calculate the center

Circle can be drawn once the center is obtained. Figure 6 shows that after getting the center we draw the circle.

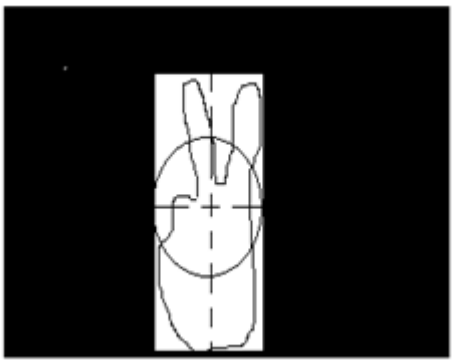

Fig. 6. Draw the circle

8. Once the circle is drawn, fingers are intersected to circle. Figure 6 shows two fingers are intersecting to circle. So we easily count the fingers.

## IV. MATHEMATICAL MODEL

Let S be a set which contains users, images, and algorithms.

S= {U, I, Ith, Iblur, ILab, Grab(), Blur(), RTH(), TH()}
Where,

U= {u1, u2, u3,……..un}
Where U is a set of infinite users.

I= {I1, I2, I3,……In}
Where I is an infinite set of input images (24 bit image)

**SET THEORY**

I ⟵ Grab ()
Iblur ⟵ Blur (I)
ILab ⟵ RTH (Iblur)
Ith ⟵ TH(ILab,THvalue)

**INPUT:**
I= {I1, I2, I3,…….In}

**FUNCTIONS**
Grab () = Grab the input image
Blur () = Color Blur function
RTH () = Conversion of RGB to LAB.
TH () = Convert the image into binary image.

Step 1: Using webcam we capture the image that input image is in Grab() function.

Step 2: After capturing the image we apply pre-processing algorithm .In Blur () functions we take the input image and apply color blur function. In that noise is removed and normalized the image. In color blur we used 5X5 matrix for blurring.

Step 3: After preprocessing we convert the RGB image to LAB image. RTH() function is used for conversion for RGB to LAB image. In that we take the input parameter as Iblur image.

```
b = col & 0xff;
g = (col >> 8) & 0xff
r = (col >> 16) & 0xff;
lab = rgbToLab(r, g, b);
```

Step 4: Convert the LAB image into binary thresholding image. In thresholding we convert object pixel as black and background pixel as white. In TH () we take two parameters as ILab and THvalue.

```
if (gs< th) {
        r = g = b= 0;   //white
      }
   else {
        r = g = b= 255;
      }  //black
```

## V. COMPARISON OF RESULTS

We have implemented Blur algorithm, RGB to LAB conversion, and thresholding algorithm. These 3 algorithms we are implemented.

In thresholding 3 types of algorithms –

[1] Image Processing Thresholding
[2] Image Processing Thresholding Using HSV
[3] Image Processing Thresholding Using LAB

In this paper, we are comparing the results of these 3 thresholding algorithms.

In first algorithm we convert the RGB image into binary image. RGB image is not giving robust result because of additive combination of red, green, and blue color. Results are not as clear. Figure 7 shows the result after thresholding the image.


Fig. 7. Thresholding

In second algorithm we convert the RGB image into HSV image. Then we convert HSV image into thresholding image. HSV is the combination of hue, saturation and value. Hue is the color, saturation is shade of color, and value is the darkness of color. RGB is the mixture of red, green and blue color. HSV gives the separation of all these color and gives robust result than RGB.

Thresholding using RGB image does not give efficient results as compared to thresholding using HSV image. Figure 8 show that thresholding using HSV gives more robust result than thresholding using RGB.

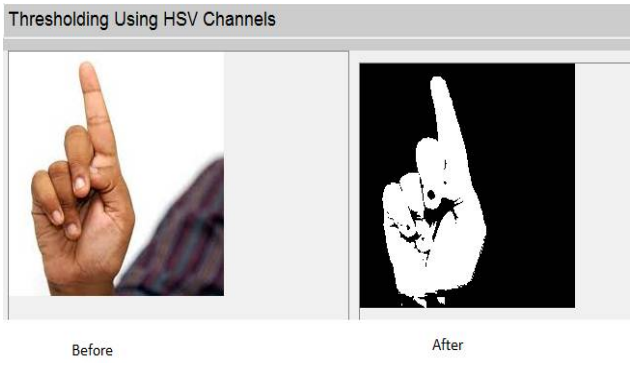


Fig. 8. Thresholding using HSV

In third algorithm we convert RGB image to LAB color image. Then LAB color image is converted into binary (thresholding) image. Basically it pronounced 'L-A-B' not LAB. "L" in LAB stands for "Lightness". The color in the image are split into channels named "A" and "B", which stands for nothing more than "A" and "B". So lightness plus two color channel A and B gives LAB color model.

Figure 9 shows the results after LAB thresholding is applied. Thresholding using LAB gives more robust result than any two algorithms.

So we are using LAB thresholding.


Fig. 9. Thresholding using LAB

## V. CONCLUSION

This paper implements a scheme that provides easy interface to computer. Using this scheme we can provide actions using finger count. Proposed algorithm removes the drawback of existing scheme. We are recognizing the bare hand without extra requirement of hardware. This scheme is also suitable for the populations which are not familiar with computer. Novice users only learn how to posture the hand gesture. Hand gesture recognition for run time application is very challenging because of its requirement on accuracy and efficiency. Taking both efficiency and accuracy into consideration, we use LAB thresholding decomposition for finger detection.

As future work, we will add two hands gesture or add mechanism of operation by two hands. It will make control diversity.

## VI. REFERENCES

[1] Rafiqul Zaman Khan and Noor Adnan Ibraheem "Survey on Gesture Recognition for Hand Image Postures" Computer and Information Science Vol.5, No.3,2012.

[2] Rafiqul Zaman Khan and Noor Adnan Ibraheem "Hand Gesture Recognition: A Literature Review" International Journal of Artificial Intelligence & Applications (IJAIA), Vol.3, No.4, July 2012.

[3]Bertsch,F.A.,an Hafner, "Real-time Dynamic Visual Gesture Recognition in Human-Robot Interaction"IEEE 9th International Conference on Humanoid Robots,pp 447-453.

[4]Shiguo Lian,Kai Wang "Automatic User State Recognition for Hand Gesture Based Low-Cost Television Control System "IEEE published on 2014

[5] Sheng-Yu Peng , Kanoksak , Hwei-Jen Lin and Kuan-Ching Li "A Real-Time Hand Gesture Recognition System for Daily Information

Retrieval from Internet" IEEE 4th International Conference on Ubi-Media Computing 2011

[6] Chen-Chiung Hsieh and Dung-Hua Liou , David Lee "A Real Time Hand Gesture Recognition System Using Motion History Image" in proceeding of IEEE Conference on Signal Processing Systems 2010

[7] Jungong Han,Ling Shao,Jamic Shotton "Enhanced Computer Vision with Microsoft Kinect Sensor" IEEE Transaction on Cybernetics Vol.43,No.5,2013.

[8] Ching-Hao Lai "A Fast Gesture Recognition Scheme for Real-Time Human-Machine Interaction Systems" IEEE Conference on Technologies and Applications of Artificial Intelligence 2011

[9]P.Garg, N.Aggarwal &S.Sofat "Vision based hand Gesture Recognition" World Academy of Science Vol.49, pp 972-977, 2009.

[10]Rafiqul Zaman Khan and Noor Adnan Ibraheem "Comparative Study of Hand Gesture Recognition System" Department of Computer Science, 2012.

[11] Kui Liu,Chen Chen,Roozbeh and Nasser "Fusion of Inertial and depth Sensor Data for Robust hand Gesture Recognition" IEEE sensor Journal,Vol.14,No.6,2014.

[12] Mo, S, Cheng, S., & Xing, X, "Hand gesture segmentation based on improved kalman filter and TSL skin color model", International Conference on Multimedia Technology, Hangzhou.2011.

[13] Kim, J., & Song, M, " Three dimensional gesture recognition using PCA of stereo images and modified matching algorithm", IEEE Fifth International Conference on Fuzzy Systems and Knowledge Discovery, FSKD, pp. 116 –120,2008.

[14] Jinhua Zeng , Yaoru Sun , Fang Wang, "A Natural Hand Gesture System for Intelligent Human-Computer Interaction and Medical Assistance", Intelligent Systems (GCIS), 2012 .

[15] Starner, T., Weaver, J. & Pentland, "A Real-Time American Sign Language Recognition using Desk and Wearable Computer Based Video", PAMI, 2012.

[16]Kouichi Murakami and Hitomi Taguchi, "Gesture Recognition using Recurrent Neural Networks", ACM, pp.237-242., 1999.

[17] S. Sidney Fels, Geoffrey E. Hinton, "A Neural Network Interface between a Data-Glove and a Speech Synthesizer", IEEE transaction on Neural Networks, vol.4, pp. 2-8.

[18]Bilal,S,Akmeliawati,Shafie, "Vision-Based Hand Posture Detection and Recognition for Sign Language"IEEE 4th Conference on Mechatronice0 ,pp.1-6.

[19] Jinhua Zeng , Yaoru Sun , Fang Wang, "A Natural Hand Gesture System for Intelligent Human-Computer Interaction and Medical Assistance", Intelligent Systems (GCIS), 2012 .

[20] Starner, T., Weaver, J. & Pentland, "A Real-Time American Sign Language Recognition using Desk and Wearable Computer Based Video", PAMI, 2012.

[21] Ashwini Shivatare, Poonam wagh, Mayuri Pisal,Varsha Khedkar,"Hand Gesture Recognition System for Image Process Gaming", International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 3, 2013.