# Hand Gesture Identification and Recognition using Modern Deep Learning Algorithms

**M Lakshmi, G Sree Sahithi, J Lakshmi Pravallika, Kolla Bhanu Prakash**

***Abstract*: In this paper, we proposed an approach towards the real-time hand gesture recognition using the Gaussian Mixture-based Background / Foreground Segmentation Algorithm. We proposed a method for feature extraction by using measurements on joints of the extracted skeletons. The proposed algorithm will build a background subtract model to get the foreground image. We applied Gaussian blur to the foreground image and threshold for binary images. The contour hull and convexity are used to build a 3D image of the hand gesture recognition. We constructed a dataset and defined the gestures. We trained them by gesture classifiers by some assumptions such that those can be easily understood. Experimental results proved the effectiveness and potential of our modern deep learning approach.***

***Keywords* : Hand gesture recognition, Gaussian Mixture, Deep learning, Clustering, Segmentation, Threshold.**

## I. INTRODUCTION

The development of human-computer interaction technology in recent decades is rapidly increasing and the hand gesture recognition technology has been widely used in smart office, hospital monitoring, intelligent education and other fields. It bridges the gap of communication between equipment and people. Recently, gesture-based human-computer interaction technology has become an important direction for future development, providing an intelligent and natural way for human-computer interaction. From medical rehabilitation to electronic management, gesture interaction has been widely used. Gesture recognition is the basis of gesture interaction and is becoming hotspot research in the field of computer science and engineering. As the thought of gesture recognition, there are two main problems in computer gesture recognition technique - hand segmentation and gesture classification.

Hand segmentation is one of the premises of gesture recognition and quality of the gesture area will directly affect the accuracy of hand gesture recognition. Skin color is a discriminative feature of the hand. However, the varied gestures, complex background environments, different light sources and color shift in the practical application will lead to changes in skin color. And distortion in the shape of the hand including bending and reversing can also make the shadow and the angle of light source change, which makes the skin color of the complete hand space might not be consistent, or perhaps an excellent deal of distinction and this will be overcome by the foreground segmentation algorithm.

The facial expression also plays an important role in the recognition of emotions of people and used in the process of nonverbal communication. They are very important in daily emotional communication, just next to the tone of the voice . It is an indicator of feelings for a person expressed in a state. People, will straight off acknowledge associate degree spirit of someone. In a consequence, information on the facial expressions is often used in automatic systems of emotion re cognition. The aim of the research is to recognize five basic emotional states as neutral, sad, fear, and most exposed part of the body which allows the use of a computer vision syste m to analyze the image of the face for recognizing emotions . The analyzed image will be estimated with some probability value to detect an emotional state of the image.

## II. RELATED WORK

*(A) RELATED WORK OF SEGMENTATION:*

In the paper [1], hand segmentation task is considered as depth clustering problem, and the pixels are grouped at different depth levels. By analyzing the human gesture dimension, a threshold is determined, which corresponds to the depth of hand. Lee [2] uses the K-means clustering algorithm and the predefined threshold to perform hand detection, and the opponent pattern is analyzed by the convex hull to locate the finger. Both of these two methods assume that the hand is closest to the sensor, and the effect of the algorithm is greatly affected by the accuracy of Kinect depth data. Manuel Caputo [3] uses Kinect generated skeletal data to determine hand positions and determines the size of the human hand at different depths by looking up tables storing standard hand information. Marin [4] uses the inter-frame difference method and the skin color model to calibrate the dynamic gesture area, which is small in computation, fast in speed and can overcome the influence of shape change to a certain extent.

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Oikonomidis [5] integrates the color information for hand detection and converts the hand detection problem to the labeling problem of hand pixels or non-hand pixels. The skin detection operator of the RGB image and the clustering operator of depth image are two conditions for confirming the hand pixel, and the hand region is the intersection of two-pixel sets.

*(B) RELATED WORK ON HAND CLASSIFICATION:*

In classification Bilal[6] uses the skin color feature to detect the palm and finger. Bjom [7] uses skin color and motion features to track hand and uses the nearest neighbor classifier for hand gesture classification. Pei Xu[8] uses the convolution neural network to recognize the gesture by using the monocular camera. [9], or other features that can be extracted directly from the contour information of the hand image. P. Pudi[10] uses the floating search method to feature the skeleton.11] Uses an easy artificial neural network to spot gestures supported a group of combined contour options. [11,12]

## III. METHODOLOGY

Here we use the Gaussian mixture model to detect the background and foreground in the image. [13,14] The Gaussian mixture method technique offers the probabilistic model that assumes all information points area unit generated from a combination of a finite variety of statistical distribution with unknown parameters. [15]

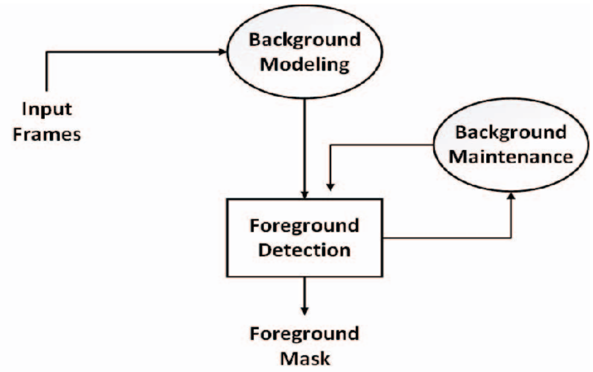
This approach employs the finite mixture method to estimate the background model. Infinite mixture method,

$$f(i)= \{i|i = 1, ...n\}$$

Can be estimated as the sum of c weighted kernels as below

$$f(x)= \sum_{i}^{c} pig(x; \sigma i)$$

In this, we different the image into 2 segmentation background and foreground in bellow flowchart detail explain




The presented algorithm presents an on-line clustering algorithm. [16] Usually, the intrusive foreground objects are going to be drawn by some extra clusters with little weights π^m. [17] Therefore, we will approximate the background model by the primary B largest clusters:

p(~x|YT , BG) ~ X B m=1 π^dN (~x; bμ~ddσ 2 dI)

If the elements area unit sorted to own downhill we have a tendency to π^m we have:

B = arg min b X b m=1 π^m > (1 − ag ) !

where 'ag' is a measure of the maximum portion of the data that can belong to foreground objects without influencing the background model. [18, 19]
For example, if a brand new object comes into a scene and remains static for a few time it'll most likely generate a further stabile cluster.Since the previous background is occluded the load πB+1 of the new cluster are going to be perpetually increasing. [20, 21,22]
If the object remains static long enough, its weight becomes larger than ag and it can beconsidered to be part of the background. [23, 24] If we look at (4) we can conclude that the object should be static for approximate log(1 − ag)/ log(1 − α) frames. [25, 26] For example for ag = 0.1 and α = 0.001 we get 105 frames. [27, 28, 29, 30]

## IV. RESULTS AND DISCUSSION

Process:

1.) Build a background subtractor model.

2.) Apply the model to a frame.

3.) Get the foreground (hand) image.

4.) Apply Gaussian blur and thresholding as above and finally the contour and hull.

*A)Convex Hull:*

Finding the hand contour from the binary image we created before and detect fingers Convex hull finds in edges of images.


Fig. 1 Convex Hull


Fig. 2 Convex Hull

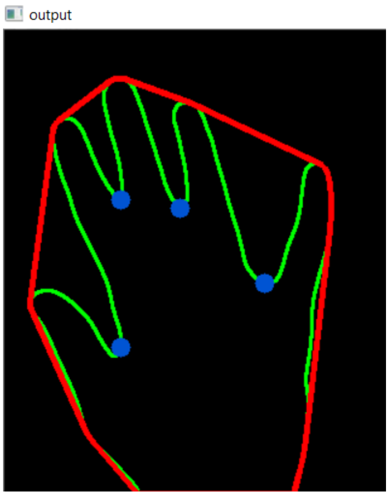



Fig. 3 Convex Hull

*B) Foreground after detecting from background:*

We produce binary images from grayscale images by using thresholds.


Fig. 4 Foreground

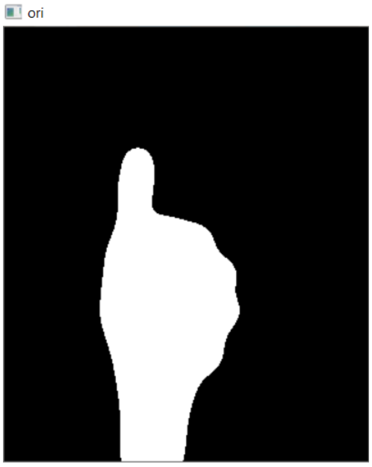



Fig. 5 Foreground

*C) Gaussian blur:*

By Gaussian blurring, we can create the transition from one color to others and in order to reduce the edge content.


Fig. 6 Blur


Fig. 7 Blur


Fig. 8 Blur

## V. CONCLUSION

In this paper we constructed the model using the Gaussian Mixture based segmentation algorithm. [31, 32] In this method initially we separated background from foreground to detect the hand by using the grayscale thresholding. [33, 34] We applied Gaussian blur method to remove the noise in the image, lastly we applied convex hull to know the depth of the image. [35] In future we are planning to work on modern deep learning algorithms like CNN, RNN, GRU, LSTM, Auto encoder concepts on the basis of illumination, shape, color, light and removing the additional noise present even after applying Gaussian blur.

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