

# Image Processing Approach For Recognize Numeric Sign from Single Hand Gesture Image Using Neural Network

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**ABSTRACTION**-This paper describes proposed methodology to recognize Indian Sign Language Numeric signs from 0 to 9. Such kind of numeric sign recognition system is very useful for mute person to express his gesture in front of normal people. Proposed methodology mentioned in research paper which automatically recognizes numeric sign from static single hand gesture image. Proposed approach first applied image processing techniques on gesture image then features like number of fingers, direction of fingers etc. has been extracted and sent to Neural Network algorithm to recognize numeric sign. Average accuracy of proposed methodology is 94% where 100 different hand gesture images have been tested.

**KEYWORDS:** *Indian Sign Language, American Sign Language, Neural Network, Matlab, Feature Extraction*

## 1. INTRODUCTION

Sign language is used by deaf & dumb people to communicate with each other. Sign language is very difficult language include various body movement, facial expression, hand gesture. Different countries have different type of sign language like American Sign Language (ASL), Indian Sign Language (ISL) etc.

These sign languages are very difficult to understand for normal people. So, computerized application very useful for mute people which automatically converted sign language into normal human language in the form of voice or text.

Since last few years, sign language recognition is become very interesting and challenging research field in computer science [1]. In this paper, proposed research paper is describe as numeric sign recognition system which read ISL numeric sign from image & convert it into English language text. We used ISL in our proposed research. Proposed research paper describe various image processing techniques to read and processed on hand gesture images & recognition is done by Neural Network (NN) algorithm.

## 2. OBJECTIVE

- Proposed method uses images of static single hand gesture and converts the sign shown in hand gesture image into English Language.
- Presented research methodology converts the ISL numeric signs into English numbers (0 to 9).

## 3. LITERATURE REVIEW

Kyriakos Sgouropoulos, Ekaterini Stergiopoulou, Nikos Papamarkos presents “A Dynamic Gesture and Posture Recognition System “, which is a real time dynamic hand gesture recognition system based on a neural network and a Hidden Markov Model. For skin color segmentation an adaptive online trained skin color model is used, while the hand posture recognition is accomplished through a likelihood-based classification technique of geometric features [1].

Yikai Fang et al. proposed a real time hand gesture recognition method. In this method, they reduced the computation expense by detect multi scale feature across binary image and make hand gesture interface more practical by combine this feature detection with hand tracking and segmentation. Altogether this method combines fast hand tracking, hand segmentation and multi-scale feature extraction to develop an accurate and robust hand gesture recognition method [2].

Tasnuva Ahmed presented a neural network based real time hand gesture recognition system. They have explained the whole system of hand gesture recognition in four phases. Image acquisition; Image processing, Feature Extraction and HGR. Feature extraction method can recognize hand gestures captured in different angle or orientation or size. As Artificial Neural Network is used to recognize the hand gesture [3].

Mithun G Jacob et al. presented a method for surgical instrument handling and retrieval in Operating Room with a multimodal Robotic assistant. They have used a Microsoft Kinect sensor to acquire depth information used to segment the hand and localize the fingertips. 3D trajectory of the fingertips is used to classify the dynamic gesture, smoothed

with Kalman filters and then quantized for classification with a set of Hidden Markov Models (HMM) and they have used a microphone with the CMU Sphnix to recognize speech commands. The command is sent to robotic arm across the network to deliver the instrument[4].

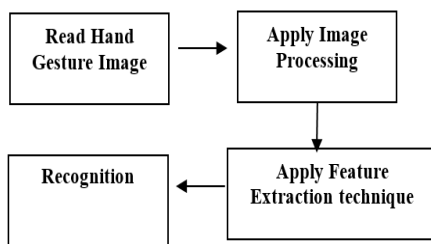
Vision-Based Approach for American Sign Language Recognition has been developed by Jayshree R. Pansare, Maya Ingle [5], using Edge Orientation Histogram feature vector methods. They identified signs of A to Z alphabets from Images using KCluster EOH-Match algorithm with accuracy of 88.26%.

Ananya Choudhury, Anjan Kumar Talukdar and Kandarpa Kumar Sarma developed A Conditional Random Field based Indian Sign Language Recognition System under Complex

Background [6]. They used both one hand gesture and two hand gestures. They applied Skin Color Segmentation, Frame Differencing for image processing, and Contour Matching algorithm, Calculation of centroids for feature extraction. Classification of signs has been done using conditional random filed algorithm and achieved 90% for one hand and 86% for two hand gestures.

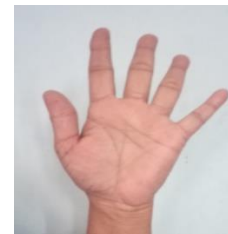
**4. PROPOSED METHODOLOGY**

Proposed method first read the hand gesture image then apply image processing techniques to processed and smooth the image, after that feature extraction method will be applied to find various features like number of fingers, direction of fingers etc. Founded features will be sent to recognition algorithm to recognize numeric sign. Our methodology has been implemented on Matlab version 2018. Following figure 1 shows basic model of research methodology:



**Fig 1: Basic Model of Proposed research methodology**

Our proposed method applied on single hand gesture images to recognize gesture is based on static image. Difficulty with this is that to collect qualitative data so our classifier can be easily recognize number form gesture image. We had created our own database of numeric sign of ISL which can include 100 images, where 10 images per one numeric gesture. To reduce the difficulty we had remove unwanted data from image and only hand part is shown in image as following figure 2. So that we can easily segment the required part [1].



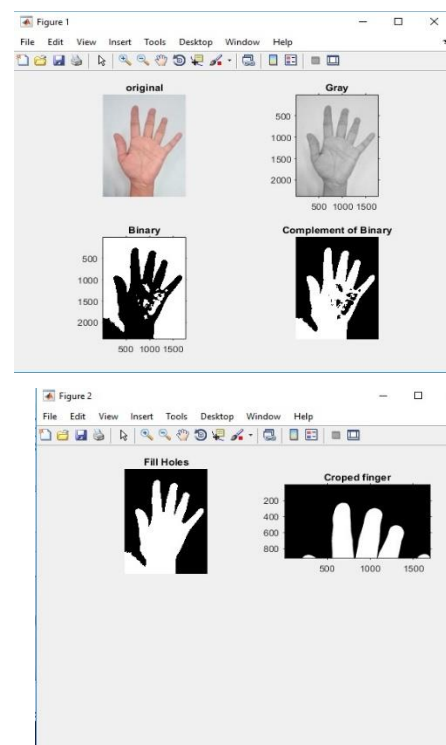
**Fig 2: Image of Numeric sign hand gesture “5”**

**4.1 IMAGE PROCESSING**

This Paper describe proposed segmentation algorithm. Algorithm first read the image of hand gesture then performs various image processing techniques to smooth the image and also segment the part from the image. Following are the steps of proposed segmentation algorithm to perform Image Processing on Image.

- Step 1: Read Image
- Step 2: Convert color image into Gray scale image.
- Step 3: Smooth the gray Image to reduce the noise.
- Step 4: Convert Smooth image into Binary Image.
- Step 5: Make the complement of Binary Image
- Step 6: Fill the holes into Complement Image to remove unwanted noise.
- Step 7: Segment the finger part using cropping method

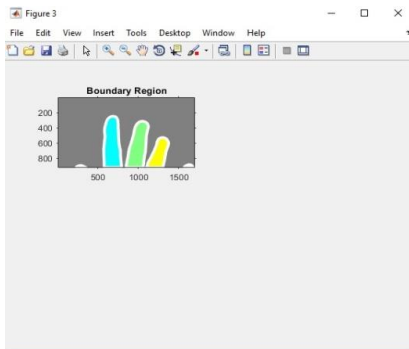
Following figure 3 shows various stages of Hand gesture Image:



**Fig 3: Sample Image of Hand Gesture “5” at various stages**

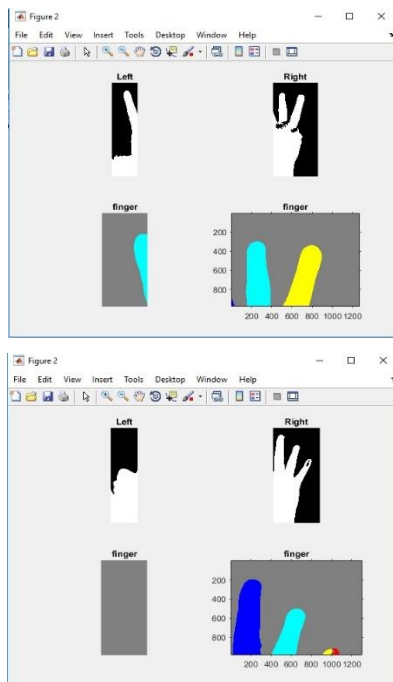
### 4.2 FEATURE EXTRACTION

Our Proposed approach used Boundary Method to extract various features from the Hand Gesture Image. Cropped image contain only fingers and individual fingers consider as distinct object. Boundary method traces the region of the each object on cropped image and count number of boundaries [7]. Number of Boundaries taken as feature. Boundary region on image shown in following figure 4:



**Fig 4: Tracing Boundary on Cropped image of Hand Gesture “5”**

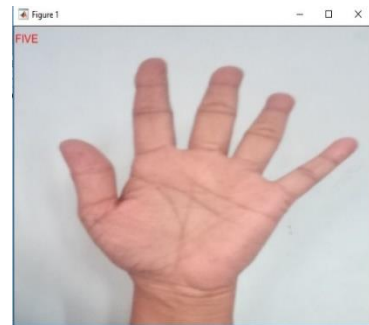
Above methodology can be applicable for numeric sign two, four, five, nine, zero. But there will be ambiguity in case of numeric signs one, six, three, seven and eight. To overcome this problem hand gesture image of numeric sign 1, 6,3,7,8 have been divide into two parts left part & right part. After that boundary method will applied on both left and right part & find the direction side of number of boundaries as shown in following figure 5. Then direction and number of boundaries will be sending to recognition algorithm.



**Fig 5: Solved ambiguity of Hand Gesture Image of numeric sign “7” & “3” respectively**

### 4.3 RECOGNITION

Proposed methodology used Neural Network (NN) algorithm with feed forward technique as recognition algorithm [9]. According to above 4.2 section, number of boundaries and direction of boundaries taken as extracted features. These features has been applied to NN algorithm and output will be shown as recognized numeric sign which is shown in following figure 6:



**Fig 6: Recognized numeric sign “5” of hand gesture image**

### 5. EXPERIMENT & RESULT

To evaluate proposed methodology we have created database of 100 different images of hand gesture of ISL numeric signs 0 to 9. Images captured by smart phone camera. Database contains .Jpeg formatted images used for evaluation of proposed methodology. Proposed Image Processing techniques and Recognition algorithm implemented & tested on Matlab version 2018. As per evaluation of proposed methodology, accuracy of numeric sign 0 is 70%, numeric sign 6 is 80%, numeric sign 7 is 90%. And remaining numeric signs got 100% accuracy. Total average accuracy of the proposed research method is 94%. Following table shows overall result of different images as correct numeric sign & incorrect numeric sign.

**TABLE 1. EVALUATION OF PROPOSED METHODOLOGY**

Hand Gesture Images Type	Total Testing Images	Total correct sign	Total Incorrect sign	Correct sign Rate%
0	10	7	3	70%
1	10	10	0	100%
2	10	10	0	100%
3	10	10	0	100%
4	10	10	0	100%
5	10	10	0	100%
6	10	8	2	80%
7	10	9	1	90%
8	10	10	0	100%
9	10	10	0	100%
<b>Total Gesture</b>	<b>100</b>	<b>94</b>	<b>6</b>	

## 6. CONCLUSION

Sign language recognition system is very useful for deaf and dumb people to communicate easily with each other. Proposed research methodology developed research based numeric sign recognition system. The research based system read static single hand gesture images of numeric

signs from the database. Database includes 100 different ISL numeric signs (0 to 9) sample images. After that system perform various image processing techniques to remove unwanted noise, and then Boundary method has been applied to extract features which have been sent to Neural Network (NN) algorithm for recognition of numeric sign. System has been implemented and tested on Matlab Version 2018. We have tested 100 different images where each sign contain 10 images. Average result of proposed research based system is 94%.

## 7. FUTURE WORK

Proposed methodology is progressive. In future we can edit this system with different image processing techniques and classification algorithms to make it more efficient. One can also improve this methodology to make recognition system in real time. Real time Sign language recognition system will be very useful in future for deaf & dumb people to easily express their thoughts in front of normal people.

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