

## Sign Language Illustrator

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**Abstract**— *The understanding of hand movements is very important for interaction between humans and computers. In this work, we reviewed some method for recognizing hand movements in real time. Hand gestures is used as an input to our system instead of mouse or keyboard. The key target is to use high resolution cameras to interpret and identify the hand gestures and process the images using some techniques.*

**Keywords:** *Hand gesture Recognition*

### 1.0 Introduction

Around five percent of the population suffers from hearing loss, as we know. Deaf and dumb people use sign language as their main way of communicating their feelings and emotions to the people around them and there are only 250 trained sign language illustrators in India to support these deaf and dumb people. A sign language is a language that use visual-manual mode of communication to convey meaning. This may involve incorporating hand forms, arms or body orientation and movement, and facial expressions to communicate the thoughts of a speaker fluently. So, it becomes the main language for people with disabilities. The technique of monitoring disabled people uses image processing and computer vision to create a sign of understanding. It keeps track of various parameters of the hands and provides data for analysis and monitoring system. It depends on the person's gesture language interpreter. This utility system has a general facility because it focuses on observing people in different regions. If a person asks for food or something else, the system will help him achieve what he wants, even if this request is not within reach. Thus, this system is used to express the user's wishes. A value-added service for consumers has been provided by recent advances in computer applications and associated hardware technologies. Physical movements in daily life are a powerful form of communicating. Economically, they will articulate a rich collection of facts and emotions.

### 2.0 Procedure

The ability to use HG for general applications targeted at normal human-computer interaction is a core objective of Hand Gesture Recognition (HGR).

#### 2.1. Hand gesture recognition

**2.1.1.) Detection:** The location of a hand is related to the detection of the hand in a still picture or sequence of photographs, i.e. moving photographs. Tracking of the hand in the scene may be seen in the case of moving scenes, although this is more important with

applications such as sign language. The core theory of hand detection is that human eyes are capable of identifying objects that cannot be as sensitive as a human device. From a computer standpoint, locating an object is just like a man fumbling about with his senses. [1]

The factors, which make the hand detection task difficult to solve, are:

- Variations in image plane and pose

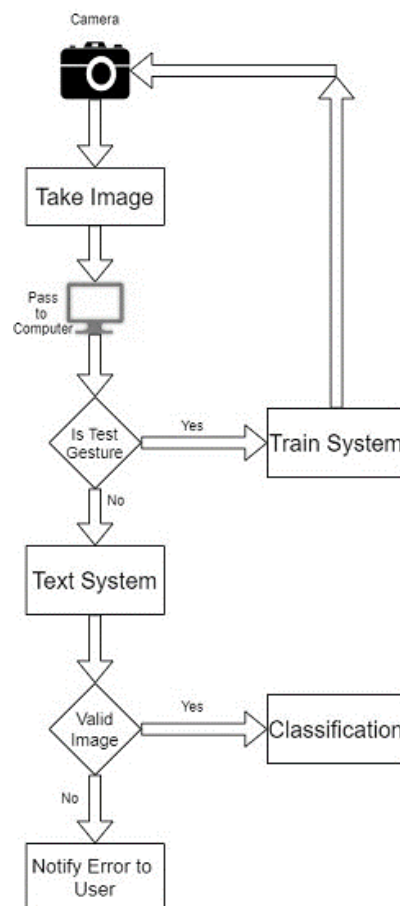
Owing to rotation, adjustment and scaling of the camera pose or the hand itself, the hands in the image differ. In and out of the plane, the rotation can be both.

- Skin Colour and Other Structure Components

The appearance of a hand is primarily determined by skin colour, height, and also adds to this complexity by the existence or absence of additional features such as hairs on the palm.

- Lighting Condition and Background

The properties of the light source control the hand's appearance. The context, which explains the profile of the hand, is also significant and cannot be overlooked.[2]



*Figure 1 Hand Gesture Recognition*

**2.1.2) Recognition:** During the past 30 years, hand identification and recognition have been important topics in the area of computer vision and image processing. In these areas, substantial advances have been made and various methods have been suggested. [3]

### 3.0 Review Analysis

*Text generation using hand gesture recognition- by Payal Kapakar[IJIFR, PAPER ID: IJIFR/V4/ E7/013, ISSN: 2347-1697]*

Sign Language Recognition Technology is developed and applied in the "Speech generation using hand gesture recognition" system to identify 26 gestures that identify 26 Indian sign language gestures; the characters are filmed using a web cam. These signs are processed for extraction of characteristics using a certain colour model. Using any algorithm, the features obtained are compared. Comparing captured symbol characteristics with the test database to measure the identification of signals. Finally, recognised gesture is converted into format for text and voice. [4]

*Hand Gesture Detection and Conversion to Speech and Text- by Kaliyamoorthi, Manikandan Patidar, Ayush Walia, Pallav Barman Roy, Aneek. (2018).*

Using OpenCV with a properly built and easy to use gui, this proposal was developed. The current use of computers depends on their performance and their advanced architecture. Latest modules require the use of cameras, i.e. Gloves, pointers in contact applications to aid hand movement. The approach suggested falls between visually dependent interfaces. The image of the hand is taken by the camera and transformed into a binary image. Essentially, the binary image is monochromatic and processable.

This optimises and uses the OpenCV library for such actions.

- Image Creation
- Using contour to find the outline of the image
- The convex hull calculation and the defects
- Letter identification;
- Examine the features of contour
- Conversion of address of the identified letter [5]

*Kajal B. Borole [ISSN – 2394-0573, IJEETE]*

Picture acquisition is the first method of which the root of visual images has been proposed. Compression of image data and pyramidal representation, where images are successively subdivided into smaller areas. Morphological processing works with image component extraction methods that are helpful in form representation and definition. Image preservation is a field that often addresses the enhancement of an image's presentation. Image compression deals with methods to minimise the storage used to save an image and to separate an image into its component parts or objects. The method of manipulating an image is image enhancement, which initially determines that enhancement methods are problem oriented. HSVThreshold is a colour space clustering tool for colour-based separation for HSV (Hue, Saturation, and Value) colour space issues. Camshift is an implementation for object tracking of the Mean Shift algorithm that is intended for a perceptual user interface as a step towards head and face tracking. The class functions on three HSV value scales. In the result image, points within the user-specified ranges are displayed, both as RGB and HSV images. To create a foreground mask, BS is a popular and widely used technique. The foreground mask is determined by doing a subtraction between the current frame and the background model. An initial model of the history is computed in the first step, while that model is revised in the second step. [6]

*Hand gesture recognition: a literature review – by Rafiqul Zaman Khan and Noor Adnan Ibraheem*

Rafiqul Zaman Khan and Noor Adnan Ibraheem have written a report on a review of recent hand signal comprehension programmes. Different approaches to gesture recognition are discussed in this article. These methods include clustering from Neural Network, HMM, fuzzy c-means, HMM tools are suitable for dynamic motions and have proved their utility primarily for robot control in addition to using histogram of orientation for representation of features. NNs are used as a classifier and for hand form identification. It requires certain methods and algorithms to catch even the form of the palm. Advantages and disadvantages of the schemes in consideration are explained.[7]

*A systematic review on hand gesture recognition techniques, challenges and applications- by Mais Yasen and Shaidah Jusoh*

Yet Yasen and Shaidah Jusoh successfully introduced the most influential methods, implementations and difficulties in the identification of movements in hand. The most acquisition techniques used in the works analysed were the surface electromyography (sEMG) sensors for embedded hand motion instruments. The prevailing surrounding environmental element influencing the precision was the backdrop colour. The common problem found in many of the studies was overfitting in the datasets.[8]

*Hand Gesture Recognition- by Jay Prakash and Uma Kantt Gautam*

The goal of creating a hand gesture recognition system is to enable natural human-computer interaction. Jay Prakash and Uma Kantt Gautam have done a wonderful job, where they used the Hidden Markov Model (HMM) for their research. This initiative focuses primarily on paralytic individuals and people with disabilities as it can help them understand their messages. In the last few years, a number of hand recognition technologies have been developed. The problem they faced was modified in lighting as luminous change can influence their motion feedback as it can alter the area of the extracted skin. They have used YUZ colour space and Camshift algorithm to discriminate between backdrop and skin colour.[9]

*Hand gesture recognition of dumb person using one against all neural network- by Lan Hong, Sajjad Ahmed, Muhammad Asim Khan*

Lan Hong, Sajjad Ahmed, Muhammad Asim Khan suggested a new strategy for detecting the stupid hand gesture of the individual in the real-world setting. Hand image comprising the symbol is pre-processed, and then the area of the hand is segmented into Lab colour space by converging the RGB colour file. Using just a few statistical attributes, the segmented image is divided into various groups. Artificial Neural Network is trained in sequential manner using one against all. [10]

*Conversion of Sign language into text- by Mahesh Kumar*

Mahesh Kumar has done yet another fascinating job. The paper shows the sign language which uses MATLAB to understand 26 hand signals in Indian sign language. The proposed framework involves four modules such as: pre-processing and segmentation by hand, extraction of symbols, identification of signs and signing to text. The technique

Linear Discriminant Analysis (LDA) has been used to interpret gestures, and understood gestures are translated into text and speech formats. This initiative will be improved in the future by deciding the numbers which will be represented in English. [11]

*Recognition of Hand Gesture for a Paralytic Person Using Convolutional Neural Network- by A.Naga Harshita, Azhagiri M, G.Sri Krishna Priya, Khadijah S Sabu*

For human-computer interaction, hand signal recognition is very critical. In this article, we present a new Realtime approach for identifying hand signals and what the various approaches used for recognising images. Some of the methods are Neural network, which utilises basic pixel counting analysis. It acknowledges the number of fingers and conducts analysis counting in front of the web camera. Second, the neural network is categorised by a learning algorithm for back propagation and edge detection. By using back-generating learning computation, the neural system is based on order. Third, there is a framework that consists of three stages - image processing, retrieval and identification. For a neural network, the software is built in MAT LAB to identify the number of fingers in front of a web camera. It depended closely on division, ongoing signal recognition, neural system shape fitting, and separation of the finger earth mover in the fourth case. This technique provides a basis for continuous hand motion identification. Hand Motion Recognition Through Neural Network, which will speed up application automation, and this technique will solve the communication challenge for people with disabilities enormously. This approach includes an inquiry into four distinct techniques near to the available division based on motion recognition, ongoing motion recognition, neural system form configuration, and isolation of finger earth mover. Next, there are some steps such as noise reduction, non-maximum suppression, double thresholds and the last is, edge detection, and eventually, after all this process, we do the pattern recognition of the pattern. Using the Gaussian philtre, the image is then improved. In the shot, the Gaussian philtre eliminates the noise and blurs the edges. [12]

*Hand Gestures Detection and Recognition Building System for Stroke Patients using Supervised Neural Networks- by Azmi Shawkat Abdalbaki*

In this paper we see how sign language can be helpful to the paralytic or patients who cannot speak. We create a database where there are different images of such type of gestures so we will then detect the image. We will provide the input to the ANN (Advance neural network) which similar to the way human brain works. The updating of the Image database is continuous, followed by the supervised training of the neural network on various image forms. This method is a normal and quick way to touch a computer (simulation) where the user does not need the training process. This technique can be used as a wireless technique and there is no need of pre-requisite knowledge. The project aims to minimize the work of people and to help the patients and researchers with work to help certain people do their everyday jobs. It is open source and can be downloaded as an open source project.[13]

*DYNAMIC HAND GESTURE RECOGNITION- by Dr. Rajeshree Rokade-Shinde, Jayashree Sonawane*

An algorithm for defining and classifying complex hand movements was suggested in the paper. Recognition is completely focused on the scale of the hand and the colour of the

hand. In this algorithm, the HAND FLOW DETECTION USING CHAIN CODE is used, and a spatiotemporal volume curve in 3D is generated by the corresponding motion curve. In relation to time, spatiotemporal volume deals with the two-dimensional rotation of the hand. Almost all hand movements are only vertical, especially in digital video movements, so spatiotemporal volume is not useful. Therefore, the fingers go up or down in such motions, we noticed just the finger movement. Extraction of the function is easy but successful relative to other mentioned algorithms. This algorithm performance is high compared to a certain algorithm. The vector size of the equation is very tiny. So essentially, the identification of hand flow using chain code is performed in this for recognition so that we can analyse the picture from this result to what the consumer wants.[14]

*Hand Gesture Recognition for Human Computer Interaction- by Aashni Hariaa ,Archanasri Subramaniana, Nivedhitha Asokkumara, Shristi Poddara , Jyothi S Nayaka*

In this article, we see the various approaches that can be introduced and applied to achieve hand gesture recognition. The primary emphasis is on complex gesture recognition. It also helps to consider the benefits and risks involved with the different approaches. The literature survey is divided into two main stages, namely the module of the camera and the module of detection. The detector module deals with image and attribute extraction pre-processing. There are two methodologies that are first applied here, where the ultimate system consists of two parts, the back end and the front end. The hand signal recognition system is proposed. The backend system consists of three modules: the camera module, the tracking module and the interface module, and the other system, which uses a very powerful approach, is a marker less gesture recognition system.[15]

*A real time alphabets sign language Recognition System using hands tracking. - by Sulfoyanti, Dewiani, Armin Lawi*

This research paper explores the design and development of a paradigm (the recognition of alphabet sign language through device gestures) that helps to interpret and recognise gestures with the assistance and use of Kinect Camera technology to track finger and hand motions. The aspiring recognition system to be built is done through two processes that are, the first process is to get inputs that will be used as reference data. The second process involves gesture recognition process which is completed by calculating Euclid distance between two vectors. Euclid distance and the vector angles when combined together gives results which are compared to the dataset which contains reference data for alphabets with characteristic expend 2 and expend 3 fingers in order to identify the alphabet represented using the finger/hand gesture. This research paper uses the Kinect camera and is further developed using Candescent NUI as a method for tracking fingers or paws. To identify alphabets and signals, it uses depth data and the Sequential Pattern Tree (SP-TREE) algorithm. The above method can therefore recognise movements with finger spread characteristics and can recognise 12 characters, namely: C, D, F, G, H, I, K, L, V, W, X, Y. This system recognises the language of alphabet signs with an average accuracy of 69.79, which varies with each alphabet.[16]

*Sign language recognition based on hand and body skeleton data- by Dimitrios Konstantinidis, Kosmas Dimitropoulos and Petros Daras*

The research paper suggests a rigorous and precise approach focused on deep learning for the detection of sign language (SLR) from video sequences. Their technique is based on hand and body skeletal movements taken from RGB videos and, as a result, it has a very



high potential for discrimination to identify gesture skeletal data without the requirement for additional equipment such as data gloves etc. This paper focuses on the proposed vision based SLR approach that relies on the extraction of RGB videos or photographs from discriminatory spatial and temporal movements or functions. This paper also analyses the proposed public data set approach and contrasts itself to an SLR methodology based on HMM (Hidden-Markov Models). This paper therefore proposes a new SLR model that, by using the extraction phenomenon, overcomes the limitations encountered in previous vision-based models.[17]

#### 4.0 Challenges

Hand gesture recognition system faces many problems as discussed in these problems are:

- Variance in lighting conditions: Where some improvement in illumination condition is badly affecting the area in extracted hand skin.
- Rotation problem: This issue occurs when the area of the hand was moving in some direction in the scene.
- Context issue: Applies to the dynamic history where the hand objects contain other items in the scene and these items which have skin-like colour that will create a problem of misclassification.
- Scale problem: This difficulty occurs where the positions of the hand in the picture of the gesture have different scales.
- The issue of translation: The inconsistency of hand locations in multiple images often contributes to an incorrect depiction of the features. As also Multi-touch and mid-air movements are harder to demonstrate than single-touch movements are.

The location and action of multiple fingers or even the whole hand becomes important.[18]

#### 5.0 Conclusion

In addition to using the orientation histogram for feature representation, different methods for gesture recognition are explored in this paper, including Neural Network, HMM, fuzzy c-means clustering. HMM devices are suitable for dynamic interactions and have explicitly demonstrated their utility for robot control. NNs are used as a classifier and for the capture of hand form. NNs are used as a classifier and for the capture of hand form. For extraction of features, some methods and algorithms are also needed to capture the form of the hand as in the Gaussian bivariate function applied to match the segmented hand which used to reduce the affection of rotation. Choosing a specific recognition algorithm depends on the application required. Application areas for the gesture method are discussed in this job. Explanation of problems of gesture recognition, as well as thorough discussion of recent recognition systems are presented.

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