*https://dx.doi.org/10.22161/ijaers.5.4.7* *ISSN: 2349-6495(P) | 2456-1908(O)*

# Support Vector Machine based Image Classification for Deaf and Mute People

Mr. J. Jijin Godwin, Pavithra S, Nandini S, Shree Shankari R

Department of Electronics and Communication Engineering, Velammal Institute of Technology, Chennai, India

***Abstract***—*A hand gesture recognition system provides a natural, innovative and modern way of nonverbal communication. It has a wide area of application in human computer interaction and sign language. The whole system consists of three components: hand detection, gesture recognition and human-computer interaction (HCI) based on recognition; in the existing technique, ANFIS(adaptive neuro-fuzzy interface system) to recognize gestures and makes it attainable to identify relatively complex gestures were used. But the complexity is high and performance is low. To achieve high accuracy and high performance with less complexity, a gray illumination technique is introduced in the proposed Hand gesture recognition. Here, live video is converted into frames and resize the frame, then apply gray illumination algorithm for color balancing in order to separate the skin separately. Then morphological feature extraction operation is carried out. After that support vector machine (SVM) train and testing process are carried out for gesture recognition. Finally, the character sound is played as audio output.*

***Keywords—-Sign language, SVM (support vector machine), gesture recognition, feature extraction, gray illumination algorithm.***

## I. INTRODUCTION

There are only about 250 certified sign languages interpreters in India, translating for a deaf population of between 1.8 million and 7 million.(the wide range in population estimates exist because the Indian in 2017 census does not track the member of deaf people instead, it documents an aggregate member of people in disabilities)[1].There are about 70million deaf people who use sign languages as the first language and mother tongue to many hearing people and some deaf blind people (tactile sign language).Each country has one or sometimes two or more sign language, although different sign language can share the same linguistic root in the same way as the spoken languages do[2]. As per the research done in sign languages, data glove using sensor and vision based these are the common primary approach which has been used to recognize sign languages. In this sensor based approach, the user has to put on the gloves on the hand which contain the load of cables that is connected to the system. These gloves are found with high-price and this glove is difficult to get everywhere. Thus, vision based approach basically works on dataset containing the sign hand gestures images that are captured by camera. This vision based method gives a basic environment to the user and this reduces the problems as such in the glove based method. The pre-eminent feature of persons hand gesture has been summarized by their dynamic property and multi-attribute property [3].

The previous method used was the ANFIS (adaptive neuro-fuzzy interface system), this provides the high complexity and their performance is low. Thus we have used the new technique called gray illumination method and in this method we reduce the complexity and increase the performance. This consist of skin filtering, morphological feature extraction method, suitable vector machine and the trained hand gestures in order to strongly develop the hand gesture recognition for the physically challenged people (deaf and dumb).As we know that the way of living for the normal person and physically challenged person has become arduous and the only reason for this is the language understanding between two person. This physically challenged people's one of the most difficult way for surviving is that they cannot work with the normal society people because the proper communication between them is strenuous. These inability people are not able to do their basic schooling properly along with the normal people. Thus this becomes the main reason to have a different world for them and they are not able to mingle with the normal society people so can happily promise them an independent and happy life without the help of human translator to translate between the normal and physically challenged person.

https://dx.doi.org/10.22161/ijaers.5.4.7 ISSN: 2349-6495(P) | 2456-1908(O)

## II. LITERATURE SURVEY

The formation of sign language is by the combination of hand gesture, facial expression and body language together, the performance of the sign gesture mostly depends on the hand and henceforth most of the research work is working on extracting the hand gestures [4]. But, when compared to other sign language immensely less research work has been done on our Indian sign language and this is because of lack of standard dataset.

Jyoeeta Singha [5] propounded a method for ceaseless video string of the signs. In this they have used segmentation, in which first skin filtering is used that gives the skin terrain i.e. it will take the only skin image of the hand from the image and then they have used histogram matching algorithm. For the future feature extraction Eigen values and the Eigen vectors technique is used. Thus in order to classify the signs properly this Eigen value weighted Euclidean distance technique is been used. This system gives 86.25% recollection rate for the future use.

P. V. V. kishore [6] has proposed a Discrete Wavelet transform which is based on the fusion algorithm. In this the edges of the hand province has been detected from video surge and for this they took the fusion of discrete wavelet transform method and prudent edge detection technique. Further the hand and head shape features are been extricate from the videos by using Elliptical Fourier descriptors. In the end, the fuzzy inference system was used to train the network that gives 84% accuracy.

Anup Nandy [7] posit a real time categorization of Indian Sign Language. Here in this paper, they have straightly used segmented frames, then they have used extracted features of hand region by using direction histogram and these features are used for classification stretch. Using feature vector in enactment phase they have used two classifiers- Euclidean distance and K nearest neighbor for gesture recognition. They have achieved superior results from K nearest neighbor metrics. The posit system [8], uses ANFIS (Adaptive neuro inference system), PDIST (Pair wise distance) and Neural networks are used for classification. ANFIS gives more appropriate outcome as juxtaposed to other two techniques. The propound system [9], transforms the RGB image into gray scale image and apply thresholding algorithm on gray scale image. Image accommodate black color for backdrop and white for forepart that culmination the wanted features. They performed on edge detection. For recognition, they used if-then law.

To attempt to break the obstacle of communication blockade between normal and deaf-mute people; the system proffer a communication application which helps both normal and deaf-mute people explicitly commune with each other without any help of other human transcriber. This paper is further constructed into the following segments.

## III. EXISTING SYSTEM

In the existing work, develop a real-time gesture-based HCI system that recognizes gestures only using one monocular camera and extend the system to the HRI case. The developed system relies on a ANFIS classifier to learn features and to recognize gestures. We employ a series of steps to process the image and to segment the hand region before feeding it to the ANFIS classifier in order to improve the performance of the classifier. Gesture images are collected to test and demonstrate that the ANFIS classifier combined with our image processing steps can recognize gestures with low accuracy. The usage of the ANFIS frees us from extracting the gesture features manually and improves the recognition accuracy. Besides, the Kalman filter is used to smooth the motion of the mouse cursor controlled by the hand[9].

Disadvantages:

- High complexity
- Low performance
- Low accuracy

## IV. PROPOSED SYSTEM

Live video is given as input for both training and testing phases. After that the video is converted into frames and resized the frame individually. After that filter the skin by using gray illumination algorithm. Then Morphological feature extraction is performed for both train and test frames. The matching between train and test features are find to recognize the gesture. Support vector machine is used for gesture recognition. Finally, the character sound (gesture recognition output) is given as audio output.

Advantages:

- Low complexity
- High performance
- High accuracy
- False recognition rate is low

### *A. SOFTWARE REQUIREMENT*

1. Mat lab R2015b

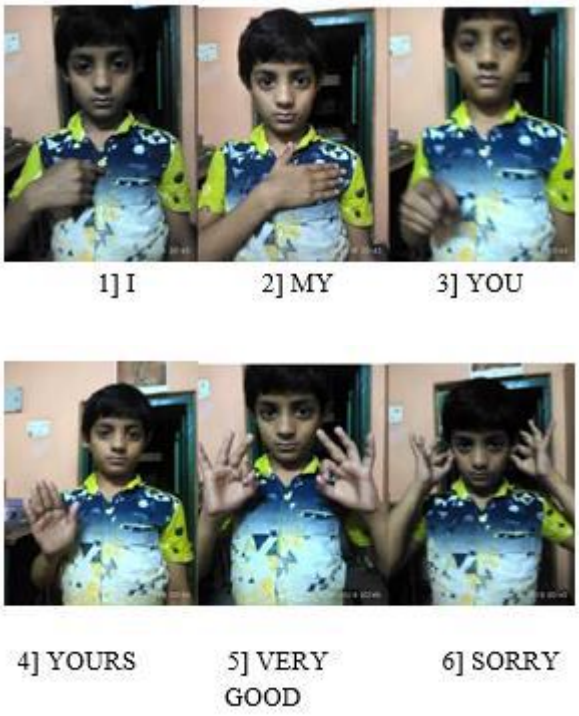
### *B. HARDWARE SYSTEM CONFIGURATION*

*https://dx.doi.org/10.22161/ijaers.5.4.7* *ISSN: 2349-6495(P) | 2456-1908(O)*

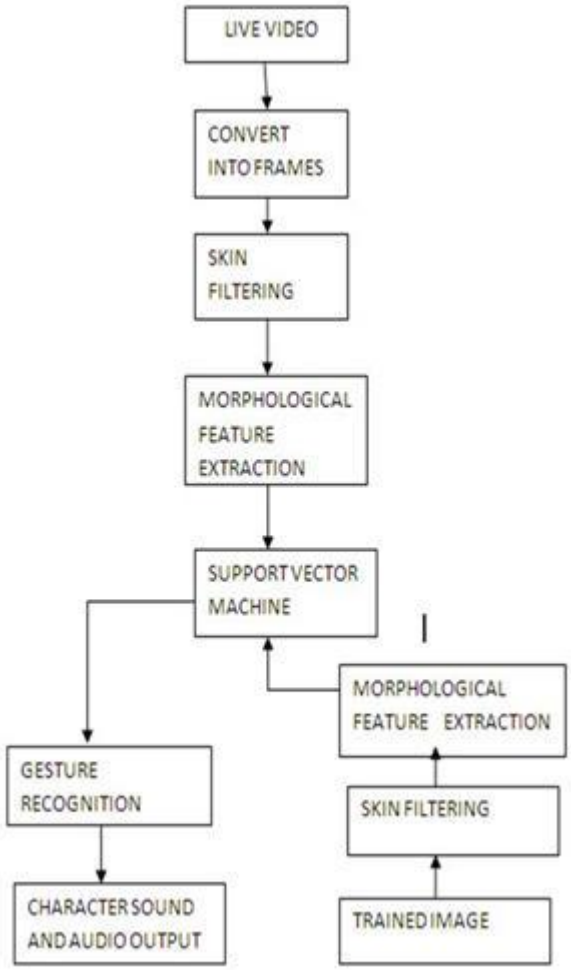
1. Processor - Pentium –III
2. Speed - 1.1 GHz
3. RAM - 256 MB (min)
4. Hard Disk - 20 GB
5. Floppy Drive - 1.44 MB
6. Key Board - Standard Windows

Keyboard

For showing particular gesture as given below diagram




*Dia.1: Different sign language using one or both of the hands*




*Dia.2: Block Diagram*

## I. SYSTEM DESCRIPTION

The Indian Sign Language is very essential for deaf and dumb people because using these gesture language impaired people can convey their feelings and thinking as like normal people, and for this reason the posit system delivered a pre-recorded video frames of Indian Sign Language words by using one or both of the hands

### A. SYSTEM DESCRIPTION

As shown in below diagram 2 here the Posit system delivers four main pace- Video pre-processing, Segmentation, Morphological feature extraction, and Support vector machine.

### B. VIDEO PRE PROCESSING

Preprocessing is not a obligatory step. This process is used only when the image is distorted.it consists of a number of

*https://dx.doi.org/10.22161/ijaers.5.4.7* *ISSN: 2349-6495(P) | 2456-1908(O)*

strides to make the raw features which is used for recognizer.

It is mainly used for eviction of noise, deblurr, reshape and resize the image.

In this preprocessing stage, each frame are given as the input and this each frames come from the convertion of video. Now the pre-processing technique has been applied to this frames which are further parted into two divisions which are named as segmentation and filtering. In order to filter the skin we have used a technique called gray illumission algorithm. Generally, skin filtering technique has applied in input video frames in order to detect the gesture from the framework of the image. Therefore, skin color filtering technique segregate skin color sector from non-skin color sector [10].

C. SEGMENTATION

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics [11]

D. MORPHOLOGICAL FEATURE

The arithmetic morphological analysis has been performed to reduce noise signal. However, the improper selection of length of the structure element (SE) will have considerable influence on effectiveness of fault feature extraction. Besides, the classification of fault type is a remarkable step in intelligent unsatisfactory diagnosis, and many approaches have already been prospered, such as support vector machine (SVM). This study prefers an intelligent fault diagnosis plan that unites the extraction of morphological feature and support vector regression (SVR) classifier. The vibration signal is first performed using variant scales of morphological analysis, where the size of SE is determined robustly. Thence, nine statistical features are extracted from the progressed signal [12].

E. MORPHOLOGICAL ANALYSIS

Serra initially established morphological analysis in 1982 and used SEs to accumulate the information or disfigure the shape of an image. Morphological analysis has been endorsed to exhibit a superlative execution in denoising. This method performs with two basic operators as given below:

Erosion

$$(f\Theta g)(n) = \min\left[f(n+m) - g(m)\right],\ m = 0,1,2,\ldots,M-1,\ n = 0,1,2,\ldots,N-1$$

Dilation

$$(f \oplus g)(n) = \max\left[f(n-m) + g(m)\right],\ m = 0,1,2,\ldots,M-1,\ n = 0,1,2,\ldots,N-1,$$

Where(n) is the original one-dimensional vibration signal, and g(n) is the SE, are the operators of erosion and dilation, separately Erosion computation is used to smooth and suppress the negative and positive impacts, respectively. By contrast, dilation calculation is used to flatten and suppress the positive and negative impacts, respectively.

Opening

$$(f \circ g)(n) = (f\Theta g \oplus g)(n),\quad n = 0,1,2,\ldots,N-1$$

Closing

$$(f \bullet g)(n) = (f \oplus g\Theta g)(n),\quad n = 0,1,2,\ldots,N-1,$$

of which all gadgets are GREEN and to the left part where all the objects are RED. Any new object like the white circle which falls to the right side which is labeled as GREEN (or classified as RED should it fall to the left of the separating line) [13] .

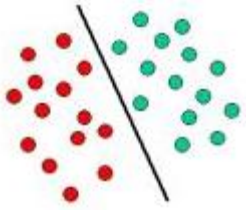


*Fig: 3*

The above is a classic example of a linear classifier, i.e., a classifier that separates a set of objects into their respective groups (GREEN and RED in this case) with a line. Most classification tasks, however, are not that simple, and often more complex structures are needed in order to make an

*https://dx.doi.org/10.22161/ijaers.5.4.7* *ISSN: 2349-6495(P) | 2456-1908(O)*

optimal separation, i.e., correctly classify new objects (test cases) on the basis of the examples that are available(Dia: 4) (train cases). This situation is depicted in the illustration below. Compared to the previous schematic, it is clear that a full separation of the GREEN and RED objects would require a curve (which is more complex than a line). Classification tasks based on drawing separating lines to distinguish between objects of different class memberships are known as hyper plane classifiers. Support Vector Machines are particularly suited to handle such tasks.

Where and represent the opening and closing functions, respectively. The opening operator suppresses and preserves the positive and negative impacts, respectively. By contrast, the closing operator suppresses and preserves the negative and positive impacts, respectively.

### F. SUPPORT VECTOR MACHINE

Support Vector Machines (SVM) is based on the abstraction of decision planes those interpret decision boundaries. The resolution plane is one that separates the set of objects which have non identical class memberships. A formulaic example is shown in the illustration below. This example (Dig: 3), describes the objects belonging either to category RED or GREEN. The partition line defines the frontier on the right part

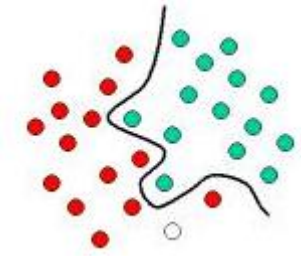


*Fig: 4*

Application:

- SVMs can be used to solve various real world problems:
- SVMs are helpful in text and hypertext categorization as their application can significantly reduce the need for labeled training instances in both the standard inductive and transductive settings.
- Classification of images can also be performed using SVMs. Experimental results show that SVMs achieve significantly higher search accuracy than traditional query refinement schemes after just three to four rounds of relevance feedback.
- This is also true of image segmentation systems, including those using a modified version SVM that uses the privileged approach as suggested by Vapnik.
- Hand-written characters can be recognized using SVM.
- The SVM algorithm has been widely applied in the biological and other sciences. They have been used to classify proteins with up to 90% of the compounds classified correctly.
- Permutation tests based on SVM weights have been suggested as a mechanism for interpretation of SVM models. Support vector machine weights have also been used to interpret SVM models in the past. Posthoc interpretation of support vector machine models in order to identify features used by the model to make predictions is a relatively new area research with special significance in the biological sciences.

## V. SYSTEM SPECIFICATION

### A. IMAGE PROCESSING

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

Digital image processing allows the use of much more complex algorithms, and hence, can offer both more sophisticated performance at simple tasks, and the implementation of methods which would be impossible by analog means [15].

- Multi-scale signal analysis
- Pattern recognition
- Projection

Some techniques which are used in digital image processing include:

- Anisotropic diffusion
- Hidden Markov models
- Image editing
- Image restoration
- Independent component analysis

*https://dx.doi.org/10.22161/ijaers.5.4.7* *ISSN: 2349-6495(P) | 2456-1908(O)*

- Linear filtering
- Neural networks
- Partial differential equations
- Pixilation
- Principal components analysis
- Self-organizing maps
- Wavelets

### B. MATLAB SYSTEM

The MATLAB system consists of five main parts:

1. The MATLAB language.

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object- oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

2. The MATLAB working environment.

This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications.

3. Handle Graphics.

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete Graphical User Interfaces on your MATLAB applications.

4. The MATLAB mathematical function library.

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

5. The MATLAB Application Program Interface (API).

This is a library that allows you to write C and Fortran programs that interact with MATLAB. It include facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

## VI. CONCLUSION AND FUTURE WORK

In this paper, we have proposed a live video which is given as input for both training and testing phases. After that this video is converted into frames and the frame is resized individually. After that the skin is filtered by using gray illumination algorithm. Then Morphological feature extraction is performed for both train and test frames. The matching between train and test features are find to recognize the gesture. Support vector machine is used for gesture recognition. Finally, the character sound (gesture recognition output) is given as audio output.

In future, we would like to put our efforts in order to extend our work in creating more number of words and sentences of our Indian sign language. And hope to have a hardware system as a compact one make use of this project as a real time usage for the deaf and dumb people.

## REFERENCES

[1] Aditi Kalsh, N.S. Garewal," Sign Language Recognition System for Deaf and Dumb", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, Issue. 9, pp. 103-106.

[2] Shreyashi Narayan Sawant(May 2014), "Sign language recognition system to aid deaf-dumb people using PCA.", International Journal of Computer Science & Engineering Technology, vol. 5, No. 5, pp. 570-574

[3] Jyoeta Singha and Karen Das May 2013. "Recognition of Indian sign Language in live video. ", International Journal of Computer Applications, vol 70, No. 19, pp.17-22.

[4] P. V .V. Kishore and P. Rajesh Kumar (Oct 2012), "A video based Indian sign language recognition system (INSLR) using wavelet transform and fuzzy logic." International Journal of Engineering and Technology, vol.4, no. 5, , pp.537-542.

[5] Anup Nandy, Jay Shankar Prasad, Soumik Mondal, Pavan Chakraborty and G.C. Nandi (2010). "Recognition of isolated Indian sign language gesture in real time" Information Processing and Management. Springer Berlin Heidelberg. pp. 102-107.

[6] Kunal Wankhade , Prof. Gauri Zade.( May 2014), "Sign Language Recognition for Deaf And Dumb People Using ANFIS", International Journal of

*https://dx.doi.org/10.22161/ijaers.5.4.7* *ISSN: 2349-6495(P) | 2456-1908(O)*

Science , Engineering and Technology Research, Vol. 3, Issue.5, pp.1206-1210.

[7] Ashish Sethi ,Hemanth S, Kuldeep Kumar, Bhaskara Rao N, Krishnan R (May 2012), " Sign Pro-An Application Suite for Deaf and Dumb ", IJCSET, vol. 12, No. 5, pp. 1203-1206.

[8] Kumud Tripathi, and Neha Baranwal, G.C Nandi(2015). "Continuous Indian Sign Language Gesture Recognition and Sentence Formation." Procedia Computer Science 54: 523-531.

[9] Chandandeep Kaur, Nivit Gill(May 2015). "An Automated System for Indian Sign Language Recognition." International Journal Of Advanced Research in Computer Science and Software Engineering, Vol. 5, Issue.5, pp. 1037-1042.

[10] Sangeetha, K. and Barathi Krishna, L (March, 2014), "Gesture detection for deaf and dumb people", International Journal of Development Research, Vol. 4, Issue 3, pp. 749-752.

[11] Ahire, Prashant G.(2015) " Two Way Communicator between Deaf and Dumb People and Normal People" ,Computing Communication Control and Automation (ICCUBEA), 2015, International Conference on. IEEE.

[12] M. Sushmita, A. Tinku (May 2007), "Gesture Recognition: A Survey", IEEE transactions on systems, man, and cybernetics—part c: applications and reviews, vol. 37, issue 3, pp. 311-324.

[13] Suganya, R. and Meeradevi, T., 2015, February. "Design of a Communication aid for physically challenged", In Electronics and Communication Systems (ICECS), International Conference on pp.818-822, IEEE.

[14] WEBSITE: HTTP://WWW.PRI.ORG/STORIES/2017-01-04/DEAF Community-millions-hearing-India only just beginning-sign.

[15] Website: http://wfdeaf.org/human-rights/crpd/sign-language/#