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A Novel Approach to Low Cost Multi Language Speaker Sign Recognition System.

M Naresh Kumar[1], D Suresh[1], Ganesan P[2]*, BS Sathish[2]

[1]Dept. of Electronics and Communication Engineering, Sathyabama University, Chennai – 600 119, Tamil Nadu, India.
[2]Dept. of Electronics and Control Engineering, Sathyabama University, Chennai – 600 119, Tamil Nadu, India.

ABSTRACT

This work proposed a comprehensive approach for the recognition of speaker in multi Indian languages. The Objective of this work is to recognize the hand gesture using several combinations of techniques. Hand gestures are a potential symbolic representation for many applications including health care, virtual reality and human-robot interaction. Hand gestures play a vital role for transfering the information and emotions among each other. As the hand gestures are the outcome of the body movement, it is refered as dynamic hand gesture. So it is very important to track and identify the motion of hand to offer versatile use. Recognition of American Sign Language (ASL) from the video stream consists of three main parts as Image procurement, feature extraction and gesture allocation. Investigational outcomes demonstrate that the proposed approach can effectively identify the key hand gestures with greater accuracy rate and work very well in intricate situation.

Keywords: sign recognition, dynamic hand gesture, image procurement, feature extraction, gesture allocation

**Corresponding author*

INTRODUCTION

Gestures play an important role in human beings day by day activities for easier and flexible communication and understanding. Generally, gesture recognition is the process of recognizing or identifying the significant expressions of movement of face, armes, body, head and hands. Among all the gestures carried out, the hand gestures has a significant role which facilitate others to express or understand within a fraction of second. Nowadays, the interface of human-machine for various applications has increased a lot of research attentions utilizing hand gestures. Hand gestures based sign language recognition can be interpreted outstandingly by inspecting the patterns of four indispensable mechanism such as hand configuration (hand shape), orientation, movement and classification. Hand gestures has a great role for conveying the emotions and messages among each other, especially among deaf people. There are number of sign languages had developed based on the spoken languages and region such as American sign language (ASL), Arabic sign language (ASL) and newzealand sign language (NSL). So there is no unique method to follow worldwide. In this work, American sign language is utilized to recognize the expression of the speaker. In ASL, there are 26 lettres in which j and z are dynamic gestures and the remainig 24 letters are static gestures. The output of the proposed approach displayed in five languages as Tamil, English, Telugu, Malayalam and Hindi.

RELATED WORK AND LITERATURE SURVEY

Akmeliawati et al [2] projected the gesture and hand posture-tracking model for New Zealand sign language recognition. They tracked 13 gestures not including any marker. They used to recognize sign language by using static postures of a hand and fingers. They also used markers to accomplish precise results for posture identification. At the same time as they achieved high-resolution input images for identifying finger postures, the process accordingly produced in a high computational cost. Arthur and Vassilvitskii [3] extended the *k*-means method. They enhanced both accuracy and running time and proposed the *k*-means++ method for a cluster technique. They introduced a randomized seeding technique that allows initializing *k*-means by choosing arbitrary starting centers with very specific probabilities. The technique attempted to minimize the distance between points in the same cluster. This method is fast and accurate, as compared with the *k*-means. Chaudhary et al [5] elaborated about the detailed survey on hand gesture recognition. They used two different kinds of modeling approaches. They are an appearance-based approach and a model-based approach. They were concluded that by using this two modeling they can distinguish the different hand gestures. Chen and Georgans [6] proposed a technique of Haar features and Ada Boost for performing dynamic categorization of the hands. They purely identify static hand postures only. Their system was incapable of recognizing dynamic postures. They utilized stochastic, Context - free grammar to be acquainted with composite gestures. In adding together, they conducted parsing and recognition by means of a set of production rules.

Dardas et al [7] introduced a hand gesture finding and identification system through the Bag of Feature (BOF) and non linear Support vector machine (SVM) classifier. They built a grammar that generates Gesture guidelines to control applications. Their method is constrained to tracking and recognizing static postures. Their grammar was not capable to produce sentences from their static postures. Their system can accomplish an acceptable real-time performance, as well as high categorization accurateness under variable circumstances. On the other hand, full Degree of Freedom (DOF) hand pose information is restricted by appearance-based methods and may have an effect on the generalization of this system. El-Sawah et al [8] used a model-based method to calculate the probability for skin color observation using histogram technique. They used artificial neural networks/learning-based approaches to recognize the hand. They also used fuzzy logic, and genetic algorithm-based approaches to identify the hand. Hu used a genetic algorithm-based method and fuzzy logic to recognize the hand. Their focal point was on tracking fingers and hands to attain information regarding gestures. They also used fuzzy logic for revealing of hand gestures.

Joslin et al [9] proposed a new idea of dynamic hand gesture recognition method. Their center of attention was on tracking fingers and hands to produce output concerning gestures. They used inverse projection matrices and inverse kinematics to regulate a hand model. They applied the Hidden Markov Model (HMM) to recognize and distinguish among gestures. Conversely, this technique was low-speed and was lack of accuracy for the reason that high IP cost. Klaser proposed the 3-D histogram of oriented gradients (3-D HOG) that are used to represent features. There are a many number of space time feature detection and description models are available. Their model has higher resolution overlapping parts that can integrate temporal relations. Nolker and H. Ritter [10] used an appearance-based model to enable hand-gesture recognition using fingertips. The approach identifies continuous hand postures from gray level video images by using a neural network-based system. Their system was capable to distinguish a user's hand gesture thus analyzing the chain of identified hand postures.

Shi .F [11] proposed a new approach of a 3-D multi scale parts model, which preserved the orders of events. Their model has a coarse primitive level spatio-temporal (ST) feature, as well as word covering and event-content statistics. On the other hand, their model has higher resolution overlapping parts that can include temporal relations. By overlapping adjacent sub patches, they can successfully sustain an order of events. Their model produces state-of- the-art results for identifying dynamic hand gestures. They used this novel approach that is based on fingers as well as hand and arm movements. Regardless of its inadequacy of only being competent to take care of unordered features, Bag of Feature (BOF) became very popular for object classification. This development enables for a wider angle of choice to make significant dynamic gestures.

Varkonyi – Koczy [12] conducted various modeling of hand gestures and postures. Afterward, they developed an identification system of hand gestures to correspond with a smart environment. They used fuzzy neural networks for the detection of hand gestures. Their system was proficient to recognize a user's hand gesture thus analyzing the series of detected hand postures. They did not identify dynamic gestures. Consequently, they lacked the capability for humanoid communication in a smart environment. Wang et al. [13] proposed the dense sampling method in order to mine local 3-D multi scale, whole part features. . It extracts video blocks at normal positions and scales with respect to the both space and time. The 3-D histogram of oriented gradients (3-D HOG) descriptors is ultimate to extraction the image and represents the features. They used combination of dense sampling used to extract local 3-D detectors.

FRAMEWORK FOR HAND GESTURE RECOGNITION OF AMERICAN SIGN LANGUAGE

The hand gesture recognition of ASL consists of three stages as : image procurement , feature extraction and gesture allocation. The algorithm for the proposed ASL recognition is explained as follows

- Input image from camera or database is load into the proposed system
- SIFT output of unrecognized sign : The SIFT key points are helpful due to their uniqueness, which allows the exact match for a key point to be chosen from a huge database of other key points. The key points have been exposed to be invariant to image rotation, scale and robust across a considerable range of affine distortion, and variation in illumination.
- 3-D histogram of oriented gradients (3-D HOG) is employed to represent features. 3-D HOG descriptors can be calculated by using an integral video method, which is the method to work out spatial-temporal gradient histograms. 3-D HOG is generally utilized for the representation of vocabulary. In this work, HOG feature extract from the input of recognize sign after passed through SIFT process.
- Training and testing extract from the input of recognize sign after passed through HOG Feature.
- Training cassifier output extract from the input of recognize sign after passed through training and testing image.
- SVM Classifier outputs extract from the input of recognized / unrecognized sign after passed through training classifier.
- Output of recognized / unrecognized sign of the input image / sign after passed through all the above stages.

RESULTS AND DISCUSSION

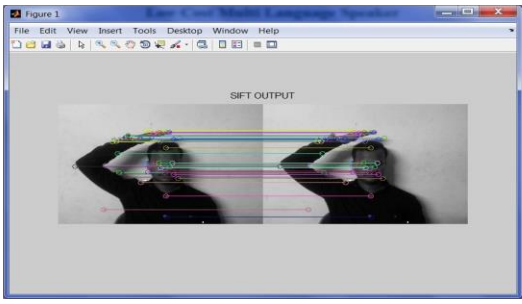
Figure 1: illustrates the database of sample images used in the proposed work. The database consiss of 12 images for its simplicity and faster execution.

Figure 1: database of sample images

The proposed approach for the recognition of speaker sign is illusterated in fig 2.

Figure 2: The proposed approach for the recognition of speaker sign

The fig 3 explores the SIFT output of recognize sign. The figure 4.4 shows the HOG Feature extract from the input of recognize sign after passed through SIFT process.



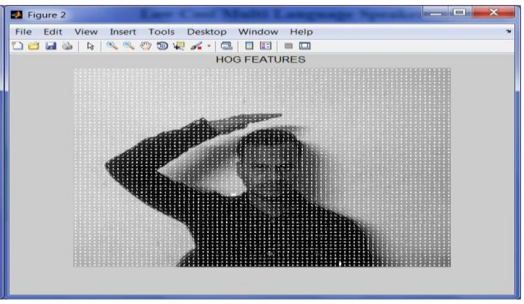
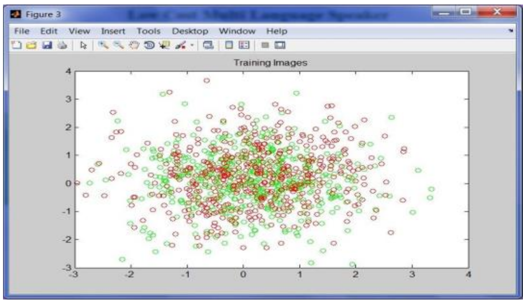


Figure 3: SIFT output of recognize sign **Figure 4: HOG Feature of recognize sign**

The fig 5 and 6 shows the training and testing extract from the input of recognize sign after passed through HOG Feature.



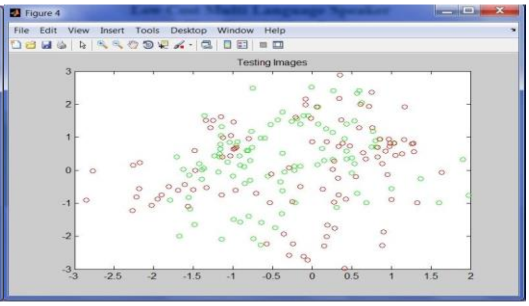


Figure 5: Training Image of recognize sign **Figure 6: Testing Image of recognize sign**

The fig 7 illustrates the SVM Classifier outputs extract from the input of recognize sign after passed through Training Classifier.

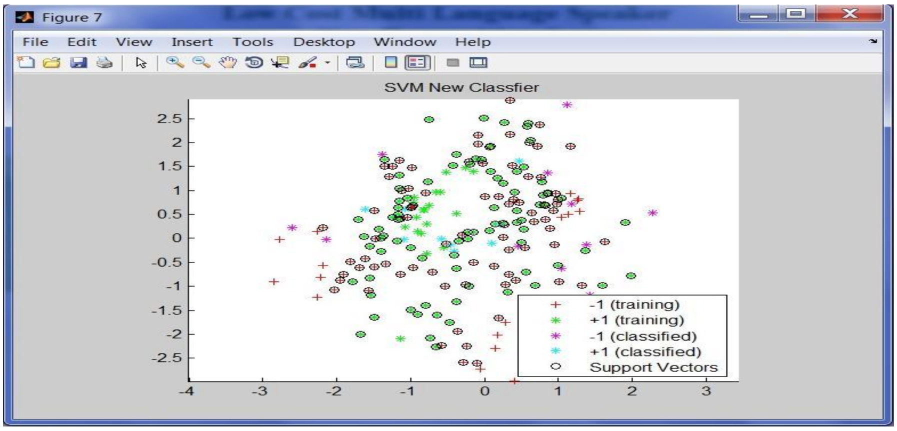


Figure 7: SVM Classifier of recognize sign

The fig 8 shows the output of recognized pattern of the input recognize sign after passed through all the above combination of techniques.

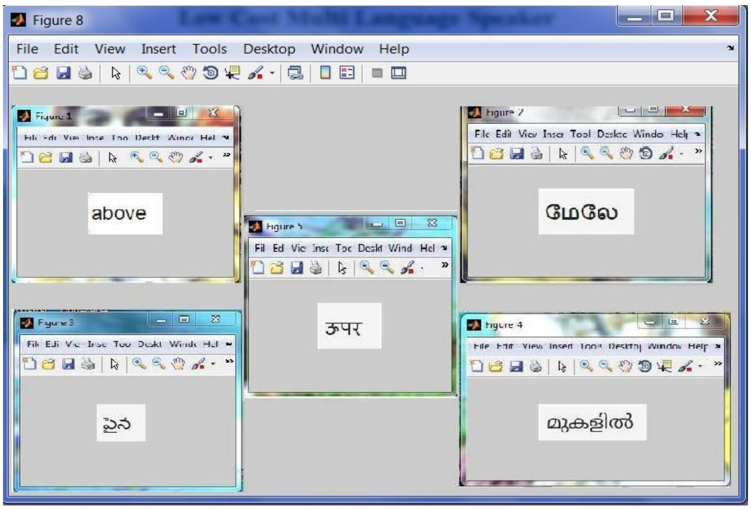


Figure 8: Output of recognize sign

The figure 9 and 10 depicts the output of unrecognized pattern of the input of the unrecognized sign after passed through all the above combination of techniques

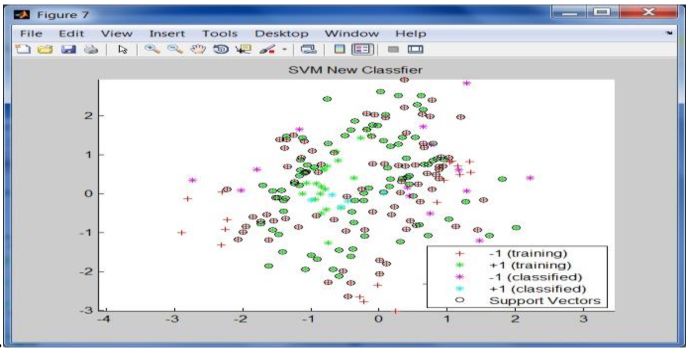


Figure 9: SVM New Classifier of unrecognized sign

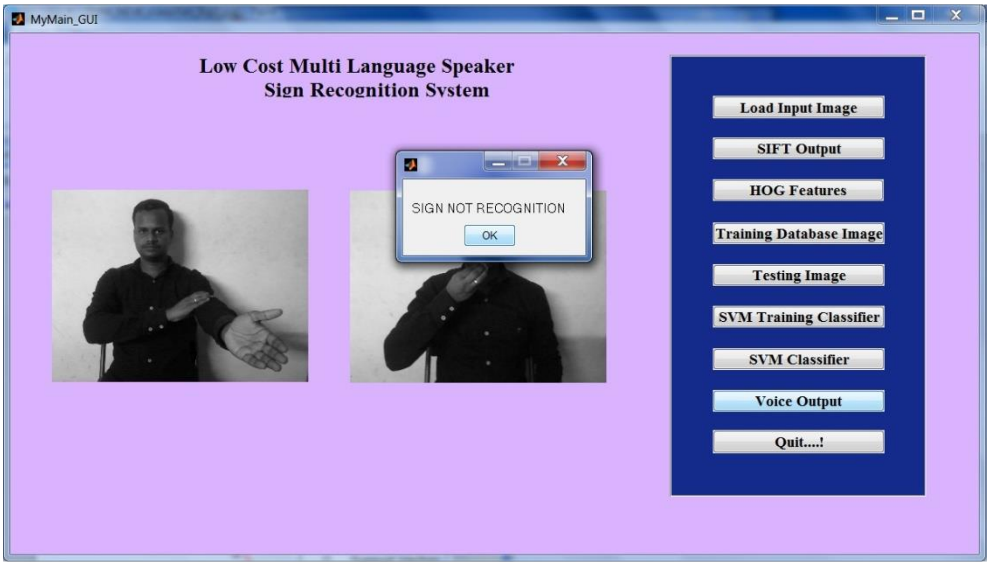


Figure 10: Output of unrecognized sign

CONCLUSION

This work presented a novel human and computer interaction system to identify or recognize the human hand gestures (speaker sign) in the form of voice for visually impaire people or display in multi languages for hearing impaired people. The proposed system has a greater accuracy of recognition of speaker sign as compared to traditional methods of recognition.The prospect scope of hand gesture identification of speaker is an innovative cooperative system for the controlling and communiacating with workstation. The potential development for hand gesture recognition can be employed on the smart mobile phone based android platform for smarter applications

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