Indian Sign Language Interpretation Using Camera

#1Samruddhi Naik, #2Kartik Poshattiwar, #3Minal Kapadnis

1samruddhi.naik17@gmail.com
2kp976431852@gmail.com
3minalkapadnis14@gmail.com

#1234Department of Information Technology, Savitribai Phule Pune University, Pune, India

ABSTRACT

Hand gestures are a strong medium of communication for hearing impaired society. It is helpful for establishing interaction between human and computer. Here, we have proposed a continuous Indian Sign Language (ISL) gesture recognition system where a single or both the hands are used for performing a particular gesture identified by the ISL. Recognizing a particular sign language gesture from continuous gestures is a very challenging issue.The primary intention is to solve this problem using gradient based key frame extraction method. These key frames are helpful for splitting continuous sign language gestures into sequence of signs as well as for removing uninformative frames. After the splitting of gestures, each sign is treated as an isolated gesture. Then the features of the pre-processed gestures are extracted using Orientation Histogram (OH) with Principal Component Analysis (PCA) which is applied for reducing dimension of features obtained after OH. Analysis of gestures is performed on our own continuous ISL dataset which is created using a camera by means of image processing and various algorithms like blob detection, template matching etc.The system finds applications in educational, industrial, medical and various related fields which have tremendous prospects in the future.

ARTICLE INFO

I. INTRODUCTION

Our Project presents the early findings of an exploration in to the suitability of a range sensing camera for recognising Indian Sign Language. A camera is an optical instrument for recording images, which may be stored locally, transmitted to another location, or both. The images may be individual still photographs or sequences of images constituting videos or movies. The functioning of the camera is very similar to the functioning of the human eye.The camera is a device which is easily available and has an adequate level of accuracy in producing a system which could be used to recognise Indian signs. This functionality could then be incorporated into a system to help young deaf and hard of hearing children to learn Indian signs. The system would be able to demonstrate specific signs using videos and images, and provide feedback to the child on its own about their Indian Sign accuracy through the application developed. This project is aimed specifically for Indian Sign Language and the principles will be relevant to any sign based communication system.Gesture recognition is concerned with identifying human gestures using technology. This is an established research area with a broad background and many gesture recognition systems have been developed. The Seek and Sign research project is specifically interested in gesture recognition technologies that may be suitable for recognising sign language. Research has been conducted in this area, with the most promising technology to date being glove technology, wrist sensors, 2D and 3D cameras, and the Kinect platform.
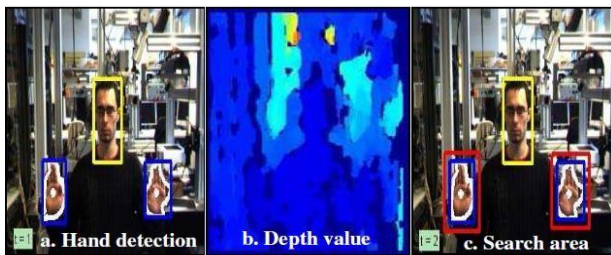
Fig.1 Hands and Face localization

Objectives of Work.

1) To suggest and build a new gesture based system by using a camera.
2) To develop a Sign language interpretation software using Image Processing and Artificial Intelligence.
3) To provide real-time translation of sign language through computer processing.
4) To suggest and build a simple application for interpreting input through camera that is more suited to Indian Sign language than the pre-existing methods.
5) To contemplate the use of an innovative input method for computers that is different from the conventional input devices such as keyboards, mice and touch screens.

II. LITERATURE SURVEY

Gesture recognition pertains to recognizing meaningful expressions of motion by a human, involving the hands, arms, face, head, and/or body. It is of utmost importance in designing an intelligent and efficient human–computer interface. The applications of gesture recognition are manifold, ranging from sign language through medical rehabilitation to virtual reality. In this paper, we provide a survey on gesture recognition with particular emphasis on hand gestures and facial expressions. Applications involving hidden Markov models, particle filtering and condensation, finite state machines, optical flow, skin colour, and connectionist models are discussed in detail. Existing challenges and future research possibilities are also highlighted.

A gesture recognition system must have dynamic features having orientation from spatiotemporal trajectories which could further be quantized to generate code words. The continuous gestures have a zero code word detection system with static velocity motion. The potential models which could be used to generate similar applications include hidden Markov model, neural network model and fuzzy system.

The major problems usually arise for segmentation which usually creates problems in understanding start and end of gestures. Ergodic models are also created which have a dynamic system with an invariant measure. Gaussian Mixture Model is used for skin colour detection. The orientation between 2 points is considered as the basic feature.

Sr. No.	Reference Name (IEEE/ACM/Springer /Any other journal, etc. Paper Title)	Work description	Problems found	Publication year
1	A Hidden Markov Model-based Continuous Gesture Recognition System for Hand Motion Trajectory	Interaction between humanoid robot and human being using Indian Sign Language	Left Right and Ergodic topologies of hidden Markov models are not preferable.	January, 2009
2	Continuous Indian Sign Language Gesture Recognition and Sentence Formation	The Proposed framework for continuous ISL gesture gives satisfactory performance	More improvements possible in accuracy and efficiency through HMM, SVM.	August, 2015
3	Recognizing & Interpreting Indian Sign Language Gesture for Human Robot Interaction	Approach for classification of ISL gesture for interaction between humanoid robot HOAP-2 and human being.		September, 2010

Table 1 Literature Survey

III. REQUIREMENTS

i.   **Analysis of a gesture based system**

To develop an Android Application for continuous Indian Sign Language (ISL) we would need a gesture recognition system in which both the hands are used for performing a gesture to create some meaningful sentence.

Sign Language
There are about 5000 gestures in vocabulary
Each gesture consists of a hand shape, a hand motion and a location in 3D space. It must be grammatically correct and syntactically precise.
Hardware Requirements (Minimum)
- 2 GB RAM
- Windows 7/8/8.1/10
- AMD Phenom II or intel i3/i5/i7
- USB/Pre-installed camera

Software Requirements (Minimum)
- Java
- Open CV

ii.   **Product Function Modules**

a. Blob analysis
In computer vision, blob detection methods are aimed at detecting regions in a digital image that differ in properties, such as brightness or colour, compared to surrounding regions. Informally, a blob is a region of an image in which some properties are constant or approximately constant; all the points in a blob can be considered in some sense to be similar to each other.

b. Template Matching
Template matching is a technique in digital image processing for finding small parts of an image which

match a template image. It can be used in manufacturing as a part of quality control, a way to navigate a mobile robot, or as a way to detect edges in images.
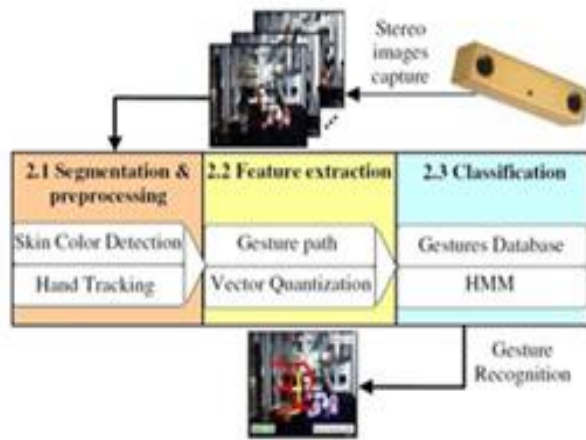

Fig. 2 Gesture Recognition System

iii. Tools for Gesture Recognition

1. Static gesture (pose) recognition
   - Template matching
   - Neural networks
   - Pattern recognition techniques
2. Dynamic gesture recognition
   - Time compressing templates
   - Dynamic time warping
   - Hidden Markov Models
   - Conditional random fields
   - Time-delay neural networks
   - Particle filtering and condensation
   - Finite state machine

Fig. 3 ISL video gestures with different light illumination condition

IV. SYSTEM ARCHITECHTURE

The system architecture is the conceptual model that defines the structure, behaviour, and more views of the system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviours of the system. It comprises of the system components, the externally visible properties of those components, the relationships (e.g. the behaviour) between them. It also provides a plan from which the products can be procured, and systems developed, which will work together to implement the overall system.
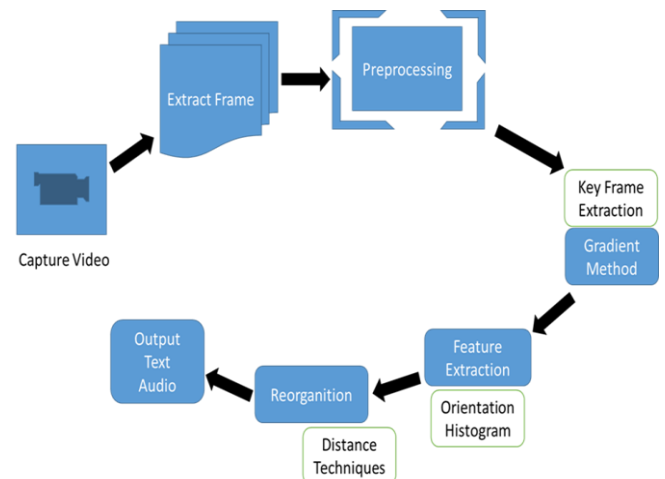

Fig. 4 System Architecture Diagram

V. CONCLUSION

The Sign Language application is an incredibly unique software with a ton of potential for mute people. The brighter side of creating such an application is that this application would promote the use of Indian Signs and help the deaf and mute kids in learning communication through sign languages. It gives an accurate level of detail, as provided by the camera. A modern day camera works as similar as a human eye. With maximum available accuracy, the camera would help in the working of the application.It also allows recognisable signs to be programmed or trained into the device for future recognition. This would help in modifying the gestures if needed and help in developing applications further in other Sign Languages.

VI. ACKNOWLEDGEMENT

REFERENCES

[1] M. Elmezain, A. Al-Hamadi, J. Appenrodt and B. Michaelis, "A Hidden Markov Model-based Continuous Gesture Recognition System for Hand Motion Trajectory", 19th International Conference on IEEE, Pattern Recognition, 2008, ICPR 2008, pp. 1–4, (2009).

[2] Kumud Tripathi, Neha Baranwal and G. C. Nandi, "Continuous Indian Sign Language Gesture Recognition and Sentence Formation", Eleventh International Multi-Conference on Information Processing-2015 (IMCIP-2015), Robotics and Artificial Intelligence Lab, Indian Institute of Information Technology, Allahabad, August (2015).

[3] A. Nandy, S. Mondal, J. S. Prasad and P. Chakraborty, "Recognizing & Interpreting Indian Sign Language Gesture for Human Robot Interaction", International Conference on Computer and Communication Technology (ICCCT), (2010), pp. 712–717, 17–19 September (2010).