SIGN LANGUAGE TRANSLATIONS FOR DEAF AND DUMB

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***Abstract*— The Sign language is very important for people who have hearing and speaking deficiencies generally called Deaf And Mute. It is the only mode of communication for such people to convey their messages and it becomes very important for people to understand their language. This paper proposes the method or algorithm for an application that would help in recognizing the different signs which are called Indian Sign Language. The images are of the palm side of the right and left hand and are loaded at runtime. The method has been developed with respect to a single user. The real-time images will be captured first and then stored in the directory and on the recently captured image and feature extraction will take place to identify which sign has been articulated by the user through SIFT (scale invariance Fourier transform) algorithm. The comparisons will be performed in arrears and then after comparison, the result will be produced in accordance through matched key points from the input image to the image stored for a specific letter already in the directory or the database the outputs for the following can be seen in below sections. There are 26 signs in Indian Sign Language corresponding to each alphabet out of which the proposed algorithm provided 95% accurate results for 9 alphabets with their images captured at every possible angle and distance i.e. for every alphabet even if have approximately 5 images at different angles and distances then the algorithm is working accurately for 45 types of inputs.**

Keywords—Indian Sign Language, Feature Extraction, Keypoint Matching, Sign/Gesture Recognition, convolutional Neural network (CNN), recurrent neural network (RNN)

I. INTRODUCTION

Creating a desktop application that uses a computer's webcam to capture a person signing gestures for American sign language (ASL), and translate them into corresponding text and speech in real-time. The translated sign language gesture will be acquired in a text which is further converted into audio. In this manner, we are implementing a finger-spelling sign language translator. To enable the detection of gestures, we are making use of a Convolutional neural network (CNN). A CNN is highly efficient in tackling computer vision problems and is capable of detecting the desired features with a high degree of accuracy upon sufficient training.

Sign languages are developed primarily to aid deaf and dumb people. They use a concurrent and specific combination of hand movements, hand shapes, and orientation in order to convey particular information. One such set of languages is the Indian Sign Language (ISL) system which is predominantly used in south Asian countries. A certain aspect that distinguishes ISL from other sign languages is that ISL devoid of any temporal inflections in its finger spelling chart and also the usage of both hands.

The advent of artificially intelligent algorithms coupled with the availability of big data and large computational resources has led to a huge growth in the field of healthcare, robotics, autonomous self-driving vehicles, Human-Computer Interaction (HCI), etc.

HCI finds its applications in augmented reality systems, facial recognition systems, and also hand-gesture recognition systems. This project falls under the domain of HCI and aims towards recognizing various alphabets (a-z) and digits (0-9) of the ISL family. Hand-gesture recognition is a challenging task, particularly the ISL recognition is complicated due to its usage of both hands. In the past, many works have been performed in this respect using sensors (like glove sensors) and other image processing techniques (like edge detection technique, Hough Transform, etc.) but were unable to achieve satisfactory results. However, with the new deep learning techniques like CNN, the performance in this field has grown significantly leading to many new future possibilities.

Many people in India are speech and/or hearing impaired, and they thus use hand gestures to communicate with other people. However, apart from a handful number of people, not everyone is aware of this sign language and they may require an interpreter which can be inconvenient and expensive. This project aims to narrow this communication gap by developing software that can predict the ISL alphanumeric hand gestures in real-time.

II. LITERATURE SURVEY

As mentioned in the Introduction that a number of researches have been carried out as it has become a very influential topic and has been gaining heights of increasing interest. Some methods are explained below: The paper Real-Time Hand Gesture Recognition Paper included the algorithm in which first the video was captured and then divided into various frames and the frame with the image was extracted and further from that frame various features like Difference of Gaussian. Scale-space Feature Detector and etc were extracted through SIFT which helped in gesture recognition[1]. A different method had been developed by Archana S Ghotkar, Rucha Khatal, Sanjana Khupase, Surbhi Asati, and Mithila Hadoop through Hand Gesture Recognition for Indian Sign Language consisting of the use of Camshaft and HSVmodel and then recognizing gestures through Genetic Algorithm, in the following applying camshaft and HSV model was difficult because making it compatible with different MATLAB versions was not easy and genetic algorithm takes a huge amount of time for its development.[2] A method had been developed by P Subha Rajan and Dr. G Balakrishnan for recognizing gestures for Indian Sign Language where they proposed that each gesture would be recognized through 7-bit orientation and generation process through RIGHT and LEFT scan. The following process required approximately six modules and was a tedious method of recognizing signs[3]. A method had been developed by T. Shanableh for recognizing isolated Arabic sign language gestures in a user-independent mode. In this method, the signers wore gloves to simplify the process of segmenting out the hands of the signer via color segmentation. The effectiveness of the proposed user-independent feature extraction scheme was assessed by two different classification techniques; namely, K-NN and polynomial networks. Many researchers utilized special devices to recognize Sign Language[4]. Byung - woo min et al, presented the visual recognition of static gesture or dynamic gesture, in which recognized hand gestures were obtained from the visual images on a 2D image plane, without any external devices. Gestures were spotted by a task-specific state transition based on natural human articulation[8]. Static gestures were recognized using image moments of hand posture, while dynamic gestures were recognized by analyzing their moving trajectories on the Hidden Markov Models

III. METHODS FOR SIGN IDENTIFICATION SYSTEM

A. Artificial Neural Network

An artificial neuron is a Computational model inspired by the natural neurons. The advantage of ANN is its accuracy and generality. It has the ability to learn relationships from modeled data and at the same time recognize the constraints [11]. In [12] Arabic sign language is converted into static hand gestures. To recognize that language two recurrent neural networks are used i.e. Partial recurrent network and a fully recurrent network. In this, the input image was captured through the digital camera. Colored gloves wear on hands. HIS model was used for the segmentation process. After that training and testing of images were done. The result of a fully recurrent network was better than a partially recurrent network. A real-time 2D tracking system [13] is used for the recognition of Myanmar's alphabetic language. Tin Hanin implemented this system to recognize the hand gesture for MAL. The input image is digitized photographs and applied to adobe Photoshop for recognizing the edges of images. The histogram is used for feature extraction. For further processing neural network is used. To recognize hand gestures for Japanese sign language, MLP neural network was used. Here, input was taken from the data glove interface and fed to MLP neural network. Then data were trained and tested. The major drawback of this system is that the data glove was unable to measure gesture direction. Shiga used this system for JSL [14]. Gonzalo et al. [15] implemented a continuous-time recurrent neural network real-time hand gesture recognition system. A Wireless mouse and triaxial accelerometer were used for capturing hand gestures. A genetic algorithm was used.

B. Hidden Markov Model

Liang et al. [16] implemented two HMM models for a continuous system for the Taiwanese sign language using a data glove. It consists of grammar and semantics for matching sentences. The main aim of this model is to provide estimates of the probability of a sequence of movements. Due to that, it increases the recognition rate. British sign language recognition by using Markov chain in combination with independent component analysis [17], data was captured through image technique. Feature extraction was used to extract the motion and shape of hands. Tani bata et al. [18] proposed HMM for an isolated JSL recognition system. Baum –Welch algorithm was used to model parallel left and right-hand data. The Viterbi algorithm was used for verification purposes. The multilayer architecture in sign language recognition for the signer independent CSL recognition, in which a combination of DTW and HMM are used. To solve the confusion set in vocabulary space DTW/ ISODATA algorithms are used [19]. The recognition accuracy was greater than the HMM-based recognition system. Volger [20] Proposed a system for recognition of American sign language using a parallel hidden Markov model. In this system, only phonemes were used for the continuous recognition system. Two channels are used from which one channel is for the left hand and the other for the right hand. Word is divided into fundamental phonemes as the same word used in speech recognition. The accuracy of that model was high.

IV. Conclusion

In this review paper, different techniques of sign language recognition are reviewed on the basis of sign acquiring methods and sign identification methods. For sign acquiring methods, vision based methods and for sign identification methods, artificial neuron network proves a strong candidature.

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References

[1] Pallavi Gurjal, Kiran Kunnur, “Real Time Hand Gesture Recognition using SIFT”, International Journal for Electronics and Engineering, 2012,pp 19-33.

[2] Ghotkar, Archana S., “Hand Gesture Recognition for Indian Sign Language”, International Conference on Computer Communication and Informatics(ICCCI), 2012, pp 1-4.

[3] Rajam, P. Subha and Dr G Balakrishnan , "Real Time Indian Sign Language Recognition System to aid Deaf and Dumb people", 13th International Conference on Communication Technology(ICCT), 2011,pp 737- 742

[4] Shanableh, Tamer ,T. Khaled, "Arabic sign language recognition in user independent mode”, IEEE International Conference on Intelligent and Advanced Systems, 2007, pp 597-600.

[5] Aleem Khalid Alvi, M. Yousuf Bin Azhar, Mehmood Usman, Suleman Mumtaz, Sameer Rafiq, Razi Ur Rehman, Israr Ahmed, "Pakistan Sign Language Recognition Using Statistical Template Matching", International Journal of Information Technology, 2004, pp 1-12.

[6] David G.Lowe, "Distinctive Image Features from Scale-Invariant Keypoints", International Journal of Computer Vision, 2004, pp 1-28.

[7] Yves Dufournaud,Cordelia Schmid, Radu Horaud, "Matching Images with Different Resolutions", International Conference on Computer Vision & Pattern Recognition (CVPR '00), 2000, pp 612-618.

[8] Byung-woo min, Ho-sub yoon, Jung soh, Takeshi ohashi and Toshiaki jima," Visual Recognition of Static/Dynamic Gesture: Gesture-Driven Editing System”, Journal of Visual Languages & Computing Volume10,Issue3, June 1999, pp 291-309..