

# Sign Quiz: Tool for Learning Finger spelled Signs in ISL

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**ABSTRACT**—Sign Language is one of the media of communication for deaf people. One should learn sign language to interact with them. Learning usually takes place in peer groups. There exist very few study materials for sign learning. Because of this, the process of learning sign language learning is a difficult task. Finger spelled sign learning is the initial stage of sign learning and moreover, are used when no corresponding sign exists or signer is not aware of it. Most of the existing tools for sign language learning use external sensors which are costly. Here discusses SignQuiz, which is a cost-effective web- based fingerspelled sign learning application for Indian sign language (ISL) utilizing automatic sign language recognition technique. SignQuiz helps to learn signs without any external help. This is the first attempt in ISL for learning finger spelled signs using a deep neural network. The results indicate that SignQuiz is better than the printed medium for finger spelled sign learning.

**Index Terms**—Sign language, SVM, P, reprocessing, Testing, Training

## I. INTRODUCTION

There are around 466 million people world wide with hearing loss and 34 million of these are children. ‘Deaf’ people have very little or no hearing ability. They use sign language for communication. People use different sign languages in different parts of the world. Compared to spoken languages they are very less in number. India has its own sign language by the name Indian Sign Language (ISL). In developing countries there are only very few schools for deaf students. Unemployment rate among adults with hearing loss are very high in developing countries. Data from Ethnologue states that among deaf population in India, which is about 1 percentage of total population, literacy rate and number of children attending school is very less. World Health Organization (WHO) “fact sheet” states that teaching sign language will benefit children with hearing loss. It goes on to state that official recognition of sign languages, increasing the availability of interpreters and providing

transcription in sign languages greatly improve accessibility.

Signs in sign languages are the equivalent of words in spo-ken languages. Signed languages appear to favor simultaneous sign internal modification, rather than the concatenation of morphemes. Although sign languages are rooted in manual gestures, they are not iconic in nature. But learners in the initial stages of SL learning use iconicity as a mnemonic aid to remember new signs. But the lack of iconicity makes it difficult to learn new signs for those who learn SL as a new language.

Finger spelling is the representation of the letters of a writing system and sometimes numeral systems. It acts as a bridge between sign language and oral language. Indian Sign Language (ISL) can represent English alphabets A-Z using finger spelling. It can be one handed or two handed and ISL follows two handed style. It is used to represent words that have no sign equivalent or used to emphasize a word or is used in teaching/learning of sign language. Though finger spelling usage is less in casual signing, they are an important component in sign language learning.

Sign Learning is very difficult for a beginner without the help of trained sign language practitioner. Learning through books is not effective as it is not easy to represent signs in a book using pictures. Though technology based tools exist for sign language learning, they do not provide any feedback on signs produced by the user. This makes it difficult to learn signs without any external help. Human resources in this field is very less. Figures from India states that there are only 250 interpreters ie, roughly one for every 20284 deaf people. Difficulty in understanding spoken language and its written forms, limited sign language proficiency of the teachers and the high expense [10] parents incur in educating their deaf child are factors that negatively affect sign language learning [11]. Apart from deaf people, parents, teachers, social workers and researchers need to learn signs. It is difficult for them to attend training programmes for learning

signs. For hearing and speaking parents of deaf children, lack of learning mechanism coupled with their speaking ability makes them favor lip reading instead of using sign language. This makes it difficult for the child to communicate properly. Like many spoken language varieties, sign language has many regional variations. This is a problem for communication within deaf community itself. Our sign learning application helps to tackle that problem by helping to learn same standardized sign irrespective of the location of the participant. Major highlight of our application is that, user can learn signs without any external help. SignQuiz is developed on the assumption that learning through practice will speed up learning. Unlike other existing mechanisms which need additional hardware which is costly, SignQuiz provides a low cost, machine learning based mechanism for learning signs. SignQuiz is available as a web based application. Sign language learner SignQuiz without any external help. Though there exists lots of research discussing machine learning based mechanisms for classifying signs, using sign classification as a tool for learning sign language is nonexistent.

## II. LITERATURE SURVEY

### A. State of the art

- 1) Hand Gesture Recognition and Voice Conversion for Deaf and Dumb : Communication is the main channel between people to communicate with each other. In the recent years, there has been rapid increase in the number of deaf and dumb victims due to birth defects, accidents and oral diseases. Since deaf and dumb people cannot communicate with normal person so they have to depend on some sort of visual communication. There are many languages spoken all around the world and interpreted. "Special people", that is people who have difficulty in speaking and hearing "The dumb" and "The deaf" people respectively find it difficult to understand what exactly the other person is trying to express and so with the deaf people. Sometimes people interpret these messages wrongly either through sign language or through lip reading or lip sync. This project is made in such a way to help these specially challenged people hold equal par in the society.
- 2) Automatic Indian Sign Language Recognition System : Sign Language is the most natural and expressive way for the hearing impaired. This paper presents a methodology which recognizes the Indian Sign Language (ISL) and

translates into a normal text. The methodology consists of three stages, namely a training phase, a testing phase and a recognition phase. Combinational parameters of Hu invariant moment and structural shape descriptors are created to form a new feature vector to recognize sign. A multi-class Support Vector Machine (MSVM) is used for training and recognizing signs of ISL. The effectiveness of the proposed method is validated on a dataset having 720 images. Experimental results demonstrate that the proposed system can successfully recognize hand gesture with 96 percentage recognition rate.

- 3) Sign Language Recognition : A novel system to aid in communicating with those having vocal and hearing dis-abilities. It discusses an improved method for sign language recognition and conversion of speech to signs. The algorithm devised is capable of extracting signs from video sequences under minimally cluttered and dynamic background using skin color segmentation. It distinguishes between static and dynamic gestures and extracts the appropriate feature vector. These are classified using Support Vector Machines. Speech recognition is built upon standard module - Sphinx. Experimental results show satisfactory segmentation of signs under diverse backgrounds and relatively high accuracy in gesture and speech recognition.
- 4) Real Time Sign Language Recognition using PCA : The Sign Language is a method of communication for deaf-dumb people. This paper presents the Sign Language Recognition system capable of recognizing 26 gestures from the Indian Sign Language by using MATLAB. The proposed system having four modules such as: pre-processing and hand segmentation, feature extraction, sign recognition and sign to text and voice conversion. Segmentation is done by using image processing. Different features are extracted such as Eigen values and Eigen vectors which are used in recognition. The Principle Component Analysis (PCA) algorithm was used for gesture recognition and recognized gesture is converted into text and voice format. The proposed system helps to minimize communication barrier between deaf-dumb people and normal people.

## III. PROPOSED METHOD

SignQuiz is designed as a web based application that helps to learn signs without any external help. It is designed to work from any web

browser so that users can access it without installing any new application. It works in two modes, learning and testing. In learning mode, signs are listed and one can learn the signs by clicking on the required ones. In testing mode, the user is tested for the learned signs. It is designed as a quiz application. User is asked to show a sign and system automatically detects the sign and gives feedback. Automatic Sign Language Recognition (ASLR) forms the core of SignQuiz. Transfer learning [43] is used to tune our model to detect ISL signs. Transfer learning helps to train on new classes even if new training set is limited. In the case of transfer learning based approach, one trained model thought of as analogues to prior knowledge a human obtains from previous experiences, helps in learning new tasks more efficiently. In this mechanism, rather than starting with random weights, weights of a trained model is used for initialization. This helps as a better starting point for training rather than random initialization. Using an existing model and adjusting its weights according to our task, transfer learning helps to easily do ASLR. In this study reveals that it has got performance on par with the state of art classification models.

#### A. System Architecture

SignQuiz is designed as a web based application. Sign classification model and sign identification logic resides in the server. From the SignQuiz home page, user can select either training or learning feature. In the training screen, alphabets from A-Z are listed. In the learning screen user can show signs corresponding to given alphabets for learning. Learning screen shows sign corresponding to English alphabets, current score and finished alphabet list. User can click on the capture button provided and can show the sign. A time delay is provided for sign capturing. After the sign is captured, it is send to the server from the browser. Image is captured within a two second delay to adjust for the lack of experience of the user in showing the sign. Server captures these images and finds out the alphabet corresponding to the sign. This is the output of the softmax classifier. Sign is accepted only if the accuracy is greater than 85percentage. Otherwise it is treated as an error.

Figure 1 shows architecture of SignQuiz.

For simplicity, both learning and training screens are de-signed as a single screen. Image capturing and score update are done dynamically. This is made possible through client side scripting language python. Recognition result, score and

other details are send back from server to browser in Json format.

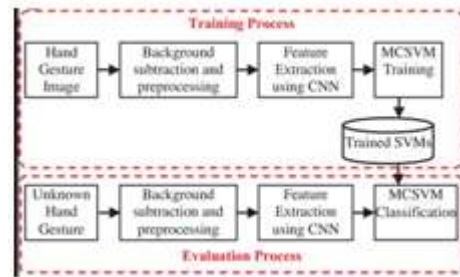


Fig. 1. Architecture

- 1) Training Phase : SignQuiz used pre-trained models for sign classification. By using CNN important features of sign are extracted. Using MCSVM a training model is generated and With the help of trained SVMs, classification can perform in the testing phase. The entire dataset is divided into two. That is 75 percentage for training and 25 percentage for testing.
- 2) Testing Phase: In the training phase, a learning algorithm uses the training data to generate a classification model (classifier). In testing phase, the learned classifier is evaluated using the testing dataset to get the correct classification accuracy. If the correct classification accuracy for the testing dataset is acceptable, the trained classifier can be used in real-world applications.

The proposed frame work is mainly need some module to import for the implementation of the sytem.

sklearn.model-selection : This module is used forsplit arrays or matrices into rndom train and test subsets.

NumPy : This pytho library used for working with arrays. It also has functions for working in domain of linear algebra. NumPy stands for numerical python. And the array object in NumPy is called ndarray. .

Random : It is used for generaating pseudo-random numbers. Which having set of methods.

Matplotlib.pyplot : Matplotlib having collection of com-mand style functions that make matplotlib work like MATLAB. Each pyplot functions make some changes to images.

#### B. Feature extraction

There are many methods to use variety of features for the features used for this type of classification are edges, template matching,

moment invariant based features etc. One of the widely used feature and the simplest feature are edge detection. Edge detection is identifying points in a digital image at which the image brightness changes sharply. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. There are several algorithms which help us in extracting the edge feature like canny, sobel, prewitt etc. Here CNN is used for extracting the features.

#### C. Classification Algorithm

MCSVM(( Multi-Class Super Vector Machine)is the algo-rithm used in the proposed method .It will provide highest accuracy more than other classifiers.

### IV. IMPLEMENTATION AND EVALUATION

Finger spelled d Indian Sign Language (ISL) signs were captured for training the model used for sign recognition. Capturing was done through mobile cameras, laptop camera and Digital SLR's. Signs corresponding to 20 fingerspelled alphabets were captured. This was collected with the help of 15 signers; 6 male and 9 female. The validity of the captured signs were confirmed by various sign language practitioners consisting of sign language interpreters, teachers and deaf people. Close to 1500 images were collected for each sign making the total number of images collected to about 201500. Among the captured signs, certain alphabets like "A"and"B"are double handed and certain others like Care single handed.



Fig. 2. Reading the dataset and preparing it for basic processing

### V. CONCLUSION

SignQuiz is a web based application for learning sign language making use of Deep Neural Networks (DNN). Sign-Quiz application can easily be used by both deaf and non-deaf people. Ease of use, availability, low cost of operation are the features that make SignQuiz auseful application for learning finger-spelled signs. By changing the model used, it can support any sign language. With proper training this application can easily include more signs. Usability can be improved if user can select alphabet range of his own choice for

learning. Getting each user a user account will help to stop and start as he wish. This will also help to understand easy or difficult signs based on the global data. Rather than setting sign classification accuracy threshold globally, it can be set for each sign for better working. More detailed study should be done to set this. To make SignQuiz capture the sign made by the user without any external help, application is designed so as to wait for few seconds after user clicks on the capture button. This will create confusion in a novice user. Rather than putting the delay, showing a timer or automatically understanding that user has shown the sign and capturing it will be helpful. From the results obtained from this study can help to design applications which are helpful in learning sign language.

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