Interpreting Sindhi Sign Language Using HAAR Algorithm

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Abstract— Gesture/sign commonly originate from hand signs. No any interpreter required for sign language which helps humans to communicate and interact naturally with each other. By helping of web-cam feature application allows users to show their hand signs which can be understand by deaf person and converted into Sindhi alphabets. This application was developed/designed for disabled person to learn Sindhi language by using hand signs, also this application provides the feature to convert hand sign into alphabets as well as from alphabets to hand sign, also this application makes them more comfort to learn sign language with user-friendly designed interface. This application is not restricted to disabled persons because it has integration with web-cam to capture the real-time gestures/sign of disabled and normal persons to manipulates and converts into alphabets. Microsoft .Net Framework provides vast libraries to integrate the feature of web-cam also third-party libraries such as EMGUCV and OPENCV are used in this application to complete all features. Application tracks the cascade gesture/sign of user and the match captured and converts into gray image and then matches signs by the algorithm. This is a complete tool for learning and using Sindhi Signs Language, also can be used in Disabled Person Schools and Organizations. Disabled persons can use this application to learn new signs and create it on real time by understanding Sindhi Sign Language itself.

Index Terms— Sign Language Recognition, Haar Algorithm, Hand Getsure Recognition, Sindhi Sign Language, Human Computer Interaction, Image Processing

1 Introduction

Sign Language is a language which is used by physically impaired persons to communicate with each other and normal persons as well. This language based on gestures, and facial expressions. It is also known as body language. The sign language is used in all over the world with respective sign languages such as American Sign Language, British Sign Language, Pakistani Sign Language, Spanish Sign Language and Arabic Sign Language etc. Unfortunately there is no any sign language which can be used as standard language because each language has its own symbols / gestures signs. Sindhi language is widely used in the province of Sindh where majority is of Sindhi people. There are native deaf and dumb community present in Sindh but no any sign language present nationally or provisionally. There is no any work done in Sindhi Sign Language, so I have chosen this topic for research to facilitate Sindhi native speakers who are deaf and dumb so that they can learn their native sign language.

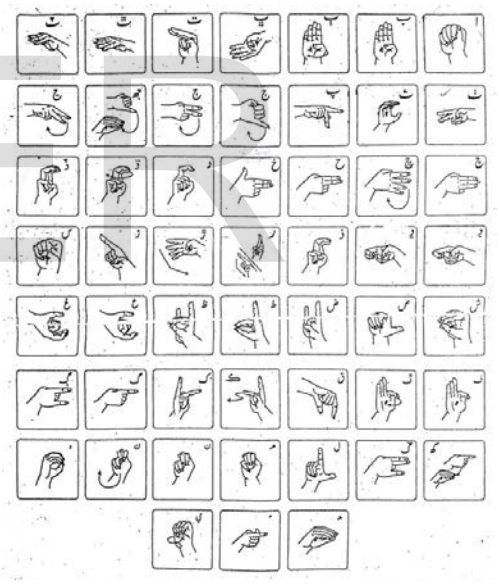

Fig. 1. Sindhi Sign Language

2 Literature Review

A lot of the work done in the field of sign language recognition of other languages in the countries but Pakistan is beyond in the work of sign language. Urdu Sign Language is present in the literature whereas Sindhi Sign Language is not in the light of research. So I have picked this topic for my project based research to facilitate the Sindhi deaf-mute individuals.

Boltay Haath is a project which aims that recognizing Pakistani Sign Language (PSL) gestures using Statistical Template Matching. In this project they used Data Gloves for hand gesture recognition [1]. Sumaira et al, in their paper they used "a fuzzy classifier to recognize alphabets of Pakistani sign lan-

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guage is proposed "[2]. The detection of Urdu Sign Language using Haar Algorithm is a way to identifying the character, and words of Urdu sign language [4]. Sign language interpretation is used to help deaf and dumb people. Sign language interpreter works on static hand gesture recognition system. Many algorithms are accurate under static background [5]. Sruthi, R., et al. "VISION BASED SIGN LANGUAGE BY USING MATLAB." They have used different algorithms and methods for sign language translation [10]. Saldaña González, Griselda, et al. "Recognition and Classification of Sign Language for Spanish." They had used a Data Glove in accelerometer that allows the training of Spanish Sign Language for deaf-mute people [14]. Bhavsar, Hemina, and Jeegar Trivedi proposed Image Based Sign Language Recognition using Neuro-Fuzzy Approach. They had developed the system which translate sign of deaf and dumb people into English Language for communication between normal people and deaf and dumb people using Neural Network and Fuzzy Logic [15].

3 METHODOLOGY

This application is divided into two major components, first one is converting 52 Sindhi alphabets into respective Sindhi Sign Language hand gestures and second one is converting captured hand gesture image of Sindhi Sign Language into respective Sindhi alphabet. The Sindhi alphabet to hand sign converter allows to those persons who are not familiar to Sindhi Signs so by writing Sindhi alphabet in textbox, application will retrieve respective hand sign in picture box. The second component is based on real-time image processing mechanism which captures the hand images through web-cam which made in front of it, it is also first time training component if no any alphabet saved in system then corresponded alphabet of captured sign will be saved into database that can be used to convert that sign into specified alphabet. Second time same component will be working as trained interpreter because respective alphabet already saved in database, it just requires recognition of hand sign to show respective alphabet on label. For recognition of hand signs, HAAR algorithm is being used in the application for detection of hand signs.

4 PROTOTYPE IMPLEMENTATION & DEVELOPMENT

The purpose of this research based project is to reduce communication gap between deaf-mute persons so that they can easily interact with normal persons. The application is being developed in C#.NET, EMGUCV, OPENCV and HAAR Algorithm for detection of hand signs, the reason behind using this technique is its calculation speed. It can be calculated in constant time of approximately 60 microprocessor instructions. HAAR Algorithm or HAAR Like Feature works on a rectangular regions at a specific location in detection window, basically this method is mostly used for face recognition but now a days is it also being used in eye detection as well as for hand detection. One can create his own HAAR Cascade Classifier by training images of particular object which has to be detected and some background images. The images containing object are called positive images and images containing background are called negative images. By training of both positive and negative images we can get HAAR cascade classifier in the form of an .xml file which is being used in the program as a detection medium.

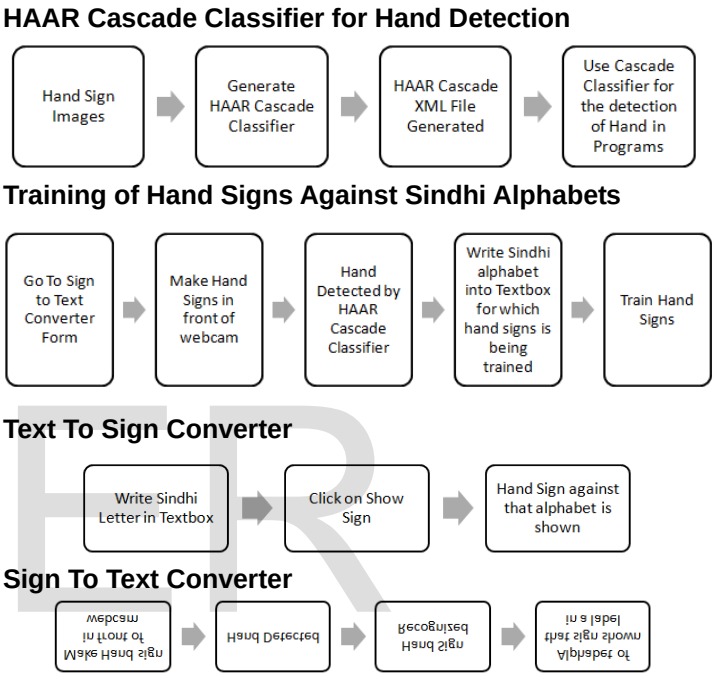

Fig. 2. Process diagrams of proposed system

The first step of the application is to train hand signs against corresponding letter which will be trained by making hand sign in front of web cam, application will detect hand through HAAR cascade classifier then one have to write Sindhi alphabet against that sign and click on train button the sign will be trained against that alphabet and those sign against alphabets will be stored into a folder database. If one want to see hand sign against any letter then he has to go to Text-To-Sign Converter and write Sindhi alphabet and trigger event the sign will be shown into a picture box that is the second step of the application. The third and last step is to recognize those hand sign which have been trained for that one have to go to the Train and Recognize Sign form and start the recognition process. One have to make hand signs in front of web cam and if a similar sign is trained into system before system will recognize that sign and corresponding letter will be shown into a label.

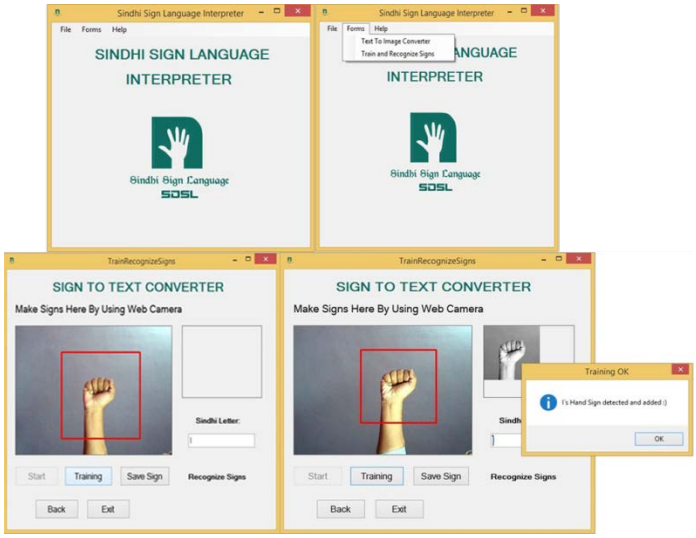

Fig. 3. SdSL User Interface and Training Form

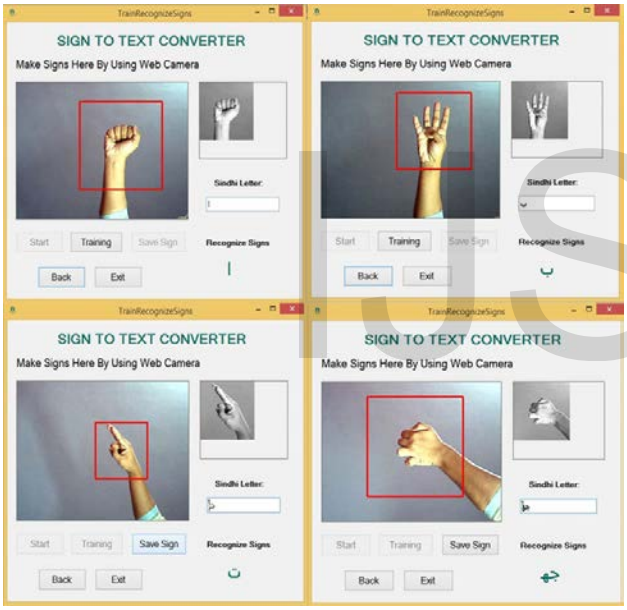

Fig. 4. SdSL Recognition of Sindhi Letter signs

5 Experiment & Results

There are 52 alphabets in Sindhi Language so we trained 52 hand signs. While training of two hand signs against one alphabet the result is not so satisfying and for those hand signs which are similar to each other application got confused and showing all the alphabets of signs which are similar to that so that it can't recognize properly. While training of four signs against one alphabet the result is little bit fine but not that much accurate, in this case similar signs are little bit recognized but not so satisfying. So finally 10 hand signs against 1 alphabet leads to 70-80% accuracy. For achieving more accuracy training samples should be increased, maximum number of signs are being trained against one alphabet. This projects works best in the environment and lightning conditions where the application is trained and gives accurate results while training is done in another environment and recognition is being performed in another so the application efficiency is reduced.

6 Conclusion & Future Work

This research based project concludes the Sindhi Sign Language (SdSL) for deaf and dumb persons. This project is divided into two components, first one is Sindhi Text to Sign Conversion and second one is Sign to Sindhi Text Conversion. SdSL was developed using C#.Net, Visual Studio also it includes some third party libraries such as EMGUCV and OPENCV for image processing and very effective and fast HAAR Algorithm is also used for detecting and recognizing the hand signs. Second one component which convert Sign to Text also works as first time training of hand signs, user make a sign front of web-cam and write corresponding alphabet it will be considered as one time training because next time sign to text converter will recognize that sign. In Text to Sign Converter one will write Sindhi letter in textbox and sign of that letter will be displayed. Unfortunately no any work is done for Sindhi Sign Language so this project will help in future and practically this research project require some special environment where it will work properly such good lighting condition in the room. By following this rule project will give better result.

This SdSL require some implementation which was not done due to lack of time, such as complete sentence conversion from sign and sentence to sign, moreover it require more effecting algorithm for better performance because currently it takes too much time to convert sign to text. Future work also require deep analysis of algorithm with different and simple methods.

I also have some interesting ideas which should be implemented in future such as Mobile App which should help deaf dumb person to communicate with normal person without having any person who understands sign language. It should be developed as web-based application for special schools or organizations. It should support other languages such as Urdu Sign Language, Arabic Sign Language etc.

Acknowledgment

I am very thankful and appreciating to all those who supported me to complete this project and report. Specially I am very thankful to my Supervisor, who has helped me out of the way, without his help project would not have been possible for me to complete it.

Nobody has been more important to me in the pursuit of this project than the members of my family. I would like to thank my parents, whose love and guidance are with me in whatever I pursue. They are the ultimate role models.

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