Sign Language Translator Using Machine Learning

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***Abstract*- Sign language is a medium of communication to the people who are suffering from hearing loss and also to the people who are unaware of the language spoken by the speaker. Around 360 million people are globally suffering from disability of hearing loss out of 328 million are adults and 32 million children. To develop a communication approach for people to understanding sign language used by hearing impaired people with ease, in this paper it is proposed that a method of converting the cue symbols and hand movements to speech (or) into text format. Reducing limitation with the existing mode where the accuracy rate is increased. For example resistance value is varied with the small change in the movement of the flex sensor. For each and every value we can define the function (or) moment name.**

Index Terms- sign language, flex sensors, accuracy rate

I. INTRODUCTION

(i).SIGN LANGUAGE;

Sign language is the language a type of language that uses hand movements, facial expressions and body language to communicate. It is used predominantly by the deaf and dumb people, There are different types of sign language. mostly used are American Sign Language (ASL) and British Sign Language (BSL),

(ii).MACHINE LEARNING

Machine Learning (ML) is the scientific study of algorithms and statistical models that computer systems use to effectively perform a specific task without giving explicit instructions, relying on patterns and inference instead. It is seen as a subset of Artificial Intelligence. Machine Learning algorithms build a mathematical model of sample data known as "training data", in order to make predictions or decisions without being explicitly programmed to perform a task.

Sign language converter is a technique used for converting the hand gestures into their respective voice or text message. In this paper we are using machine learning. Instead of using softwares like Matlab, Lab view, c-programming, etc. The samples are given as the input. If the user matches the samples of already defined then the output is obtained in the form of text or speech. We can also interface with a smartphone to built in real-time applications becomes much easier.

Sign language conversion is one of the efficient ways to ensure communication between normal and impaired people and this approach is at foremost importance as according to WHO (World Health Organisation) around 360 million people around the globe are deaf. The sign language can also be used when the listener is not having the knowledge of the language being spoken by the speaker.

(iii)SVM

Support vector machines (SVMs), also known as support vector networks, are a set of related supervised learning methods used for classification and regression. Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that predicts whether a new example falls into one category or the other. An SVM training algorithm is a non-probabilistic, binary, linear classifier, although methods such as Platt scaling exist to use SVM in a probabilistic classification setting. In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces.

II. LITERATURE SURVEY

Some of the Literature articles mentioned here describe various other algorithms used for achieving sign language to speech conversion or similar processes.[1] Mohammed Elmahguibi developed a Data Acquisition and control system(DAC) translates sign language into text that any one can read.[2] Jian Wu,Lu san Roozbeh jafari uses IMU and Surface EMG Sensors attached to a glove along with statistical template matching technique that allows gesture recognition and accordingly the corresponding output voice is generated. [3] A.B Grieve Smith developed a Sign Language application using Web3d and perl for coversion of sign language into text.[4] Suharjito,Ricky Anderson uses a method that produces Sign animation based on the given input, so as to facilitate and reduce the communication gap between a healthy and an impaired person. [5] Muttaki Hassan,Tanvir Hossian Sajib and Mrinmoy Dey used Machine learning approach for Detection and Recognition of sign language using HOG (HISTOGRAM OF ORIENTED GRADIENTS) for deaf/dumb people.

III. PROPOSED METHOD

The goal of this paper is to search for the best feature and algorithm to distinguish each selected sign. The translation consists of five processes.1)input 2)constraint 3)feature selection 4)attribute selection 5)data set for training and testing.

(i).INPUT:
Since the prediction model must be able to distinguish between '3' selected gestures the input data for these gestures are collected using Accelerometer, Gyrometer, Flex sensors values. The selected three signs are Hi,come here,numbers .

Each gesture is collected 15 times from the 20 volunteers. Despite the similarities in some hand signs, they are distinguished by different hand position and the movement. It captures three axis from the accelerometer and orientation of the axis from the gyroscope. The set of attributes collected on each sign are

1. Accelerometer in X, Y, Z axis (Laccel-X,laccel-Y,Laccel-Z).
2. Gyrometer (orientation in X, Y, Z directions).
3. Flex sensor values in terms of resistance.

There are certain requirements for collecting the data each gesture. The arduino will collect the data from Accelerometer, Gyrometer and flex sensors reading and by using Bluetooth module the values are transferred to the system:

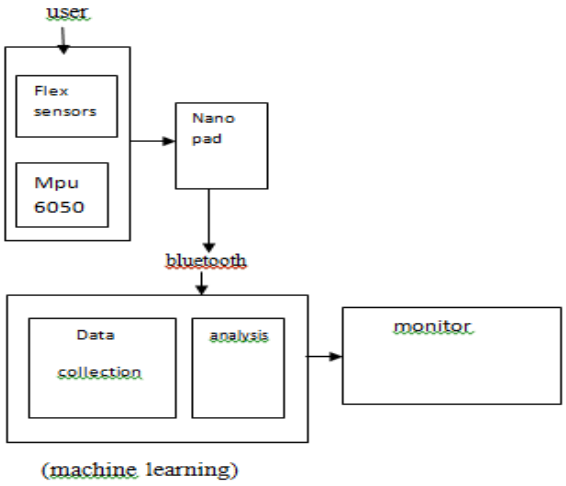
(ii).CONSTRAINT:
There is same constraint for collecting the selected sign to make easier in analyzing the data. The time limit for collecting the data is said to 4 seconds rounded from the longest gesture length of the chosen gesture. The changes in the starting portion of radio carpal joint (wrist joint) could leads to an entirely different set of data.

(ii).FEATURE SELECTION:
The feature selection is the process to select a certain features to map data in order to put them in right category for the right translation. Based on our paper and data, the features selected have been mean, and standard deviation. After data is collected for all attributes we have to then manually compute for mean and standard deviation. The calculated mean and standard deviation for selected gesture are combined into one file. Finally the feature resulting the best accuracy is used to train the predicted model. The list of feature sets that has been used to test for the best features to represent the gestures are summarized in the table. The attributes which are not necessary in each feature set will later be eliminated in highest in predicting gestures:

Feature set

- Calculated mean values of attributes from the hand
- Calculated standard deviation value of attributes from the hand
- Calculated mean and standard deviation values from the hand

Block diagram:



IV.ATTRIBUTES SELECTION

The set of attributes used in training in prediction model can alter the accuracy of the model. Since some irrelevant and redundant attributes might lead to misclassification, it is better to keep just the attribute that will help in identifying selected sign. Furthermore, the fewer the attributes used it will take less time in training a prediction model. It is supported that many techniques in selecting the relevant attributes for solving the specific problem. The process attribute selection is divided into attribute evaluator and specific method. Attribute evaluator is the method that used to evaluate each attribute in trained data set according to the context of the classes. The function of the search model is to rank the attribute according to the correlation with the classes are navigate different grouping of the attributes to result in a shortlist of the chosen features. Some attribute evaluators are required to be used with specific search methods such as correlation attribute evaluation technique that must be used with ranker search method.

V. DATA SET FOR TRAINING AND TESTING

The machine learning algorithm implemented in the prediction model falls in the supervised learning algorithms category. We are going to use three machine learning algorithms which are multi layer perception, decision tree and support vector machine. All of these three algorithms are the models that map the input data to an output value. The reason of the use of three different machine learning algorithms is that three algorithms are minimum required to standard testing.

VI. EXPERIMENTAL RESULTS

According to the result shown in the table implementation of SLT with both mean and standard deviation as the extracted feature gives the best performance. The attributes used are shown. According to the table the elimination of attributes used as the input of the machine algorithm shows the better accuracy rate. The selected row that uses only some of the attributes has better results than the row all that used every attributes to create the prediction model. Since some irrelevant and redundant attributes might lead to misclassification. It is better to keep just the attribute that helps in identifying the selected sign. Therefore the elimination of some attributes results in increased accuracy.

Feature selection

	Feature set1	Feature set2	Feature set3	Feature Set4	Feature Set5
accelerometer	5360 3200 16684	10132 5820 16324	6728 1608 16152	-6488 1400 16232	-6240 1688 15004
Gyro meter	1921 5201 -1680	913 -1888 -1382	-1041 2084 -1702	-392 -302 -985	-886 -800 -273
Flex sensor	21219 23032 21411	21411 22926 21411	21030 22926 22000	21411 22820 21900	21504 23032 22567

VII.EXPLANATION

The Accelerometer takes the readings of the speed of the movement of the sensors in the X,Y,Z axis The Gyrometer takes the readings of the rotation of the sensors in the X,Y,Z directions. The flex sensors takes the readings based on the ohms law depending on the bending of flex sensors. All the readings are stored in the form of sets as Feature set 1, Feature set 2, Feature set 3.

VIII. CONCLUSION

To summarise, this paper aims to translate the central Indian sign language using M.L to receive the input data that used to create the prediction model with optimized selected feature which will ensure the correct mapping of the gesture performed and the translation. The developed models are able to make it up to an accuracy of 100% with forty attributes used out of an 80 attributes. The prediction model is able to translate all three signs correctly.
However the accuracy rate altered by the collected data. The data collected from the expert gives a better distinguish between signs than non expert.

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