A Survey Paper on Sign LanguageRecognition Using Machine Learning Approach

Prathamesh Dhavale	Nikita Gurjar	Divya Dave	Avinash Rajput	Deepika Patil Assistant
Student: Computer Science & Engineering Department Sanjay Ghodawat Group of Institutions	Student: Computer Science & Engineering Department Sanjay Ghodawat Group of Institutions	Student: Computer Science & Engineering Department Sanjay Ghodawat Group of Institutions	Student: Computer Science & Engineering Department Sanjay Ghodawat Group of Institutions	Professor: Computer Science & Engineering Department Sanjay Ghodawat Group of Institutions

Abstract: In the world of sign language, and hand gestures, a lot of research work has been done over the past three decades. Woefully, every research has its own limitations and are still unable to be used commercially. The main problem of this way of communication is normal people who cannot understand sign language can't communicate with these people or vice versa. Many researches have known to be successful for recognizing sign language, but require an expensive cost to be commercialized. Researchers do their researches in various ways. It starts from the data acquisition methods. The data acquisition method changes because of the cost needed for a good device, but cheap method is needed for the Sign Language Recognition System to be commercialized. The method used in developing Sign Language Recognition also varies between researchers. Each method has its own strength compare to other methods and many researchers are still using different methods in developing their own Sign Language Recognition.

I.   Introduction

Language that is used by deaf and dumb people is called Sign Language. Sign Language is considered to be the only way of communication between deaf and hearing impaired peoples. Sign Language is generally composed of two types of signs, i.e., Manual signs and Non-manual signs. Manual signs are composed of sign gestures which are performed using hand and nger movements, whereas non-manual signs are represented by various facial expressions, head tilting, lip pattern, mouthing, and other similar signals. These are then added with the hand or manual signs to create a useful meaning. Thus, the meaning of a hand sign is incomplete without facial expressions. Non-manual signs play an important role in Sign Language Recognition (SLR) systems because they carry grammatical and prosodic information. At each time we cannot get Translator/Interpreter easily, because availability of translator is limited and expensive also. So the solution of this problem is that we have to use some automatic system that can automatically translate signs into spoken language. Sign Language Recognition system is the automatic computerized system that automatically recognize signs and translate into normal language. The idea is to make computers to understand sign language and develop a user friendly environment. Making a computer to understand facial expressions and human gestures are some steps towards it. Gestures are the non-verbally exchanged information. The project determines human gestures by creating an HCI. In our project we are focusing on Image Processing and for better output generation

II.   Literature Survey

Many researchers have been done on this issue and some of them are still operational, but nobody was able to provide a full edged solution to the problem. Ming Jin Cheok Zaid Omar and Mohamed Hisham Jaward developed hand gesture recognition system, in which recognition involves complex processes such as motion modeling, motion analysis[3].

V. V. Kishore, E. Kiran Kumar, D. Anil Kumar , presented methods for Indian Sign Language Recognition. Wavelet based fusion of two weak edge detection models. One is morphological subtraction model and another one is gradient based canny edge operator[4].

Vinay Kumar K, R.H.Goudar and V T Desai developed Sign Language Uni cation , in which they have used Sign language (SL) recognition under Support Vector Machines(SVM) are used to quickly and reliably determine between poses such as sitting, standing and reaching or facing left rather than right[5].

Keerti Keshav Kanchi developed a face recognition system which is one of the biometric information processing systems. The developed algorithm for the facial expression recognition system, which uses the two-dimensional discrete cosine transform(2DDCT) for image compression and the self organizing map(SOM) neural network for recognition purpose, simulated in MATLAB[6]. By using 2D-DCT we extract image vectors and these vectors become the input to neural network classifier, which uses self organizing map algorithm to recognize familiar faces (trained) and faces with variations in expression. In this paper they have developed and illustrated a recognition system for human faces using a novel self

organizing map based retrieval system. SOM has feature extracting property due to its topological ordering. The facial analytics result for the 25 images of AT &T database reflects that the face recognition rate using one the neural network algorithm SOM is 95.05% for 5 persons. Octavio Arriaga developed a general convolutional neural network (CNN) building framework for designing real-time CNNs.They validate their models by creating a real-time vision system which accomplishes the tasks of face detection, gender classification and emotion classification simultaneously in one blended step using there proposed CNN(convolutional neural network) architecture. Along with this they also introduced the very recent real-time enabled guided back propagation visualization technique. Guided back propagation which uncovers the dynamics of the weight changes and evaluates the learned features. They argue that the careful implementation of modern CNN architectures, the use of the current regu-larization methods and the visualization of previously hidden features are necessary in order to reduce the gap between slow performances and the real-time architectures[6].

Mrs.Archana S. Vaidya developed an identication of the number of ngers opened in a gesture representing an alphabet of the Binary Sign Language. The system doesn't requires the hand to be perfectly aligned to the camera. The project uses image processing system to identify, especially English alphabetic sign language used by the deaf people to communicate[2].The basic objective of this project is to develop a computer based intelligent system that will enable dumb people significantly to communicate with all other people using their natural hand gestures. The idea consisted of designing and building up an intelligent system using image processing, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures and generate easily recognizable form of outputs[2].Hence the objective of this project is to develop an intelligent system which can act as a interpreter between the sign language and the spoken language dynamically and can make the communication between people with hearing impairment and normal people both effective and efficient. Pradeep Kumar, Partha Pratim Roya, Debi Prosad Dogra developed recognizing hand and nger gestures. A SLR(Sign Language Recognition) system is incomplete without the signer's facial expressions corresponding to the sign gesture. In this paper, we present a novel multimodal framework for SLR system by incorporating facial expression with sign gesture using two dierent sensors, namely Leap motion and Kinect. We have collected a dataset of various dynamic sign word gestures. The recognition is performed by using Hidden Markov Model (HMM). Next, they applied Independent Bayesian Classification Combination (IBCC) approach to combine the decision of different modalities for improving recognition performance[2].

III. Machine Learning Approaches

Machine learning is field of computer science that uses statistical techniques to give computer system the ability to "learn" with data, without being explicitly programmed.

3.1   Decision Tree Learning: Decision tree comprises a set of rules that provide the means to associate specific molecular features and/or descriptor values with the region of interest. The Decision Tree approach has been applied to problems such as designing combinational libraries. Decision Tree Learning is one of the predictive modelling approach used in statistics, data mining and machine learning.

3.2   Association Rule Learning: Association rule learning is a method for discovering interesting relations between variables in large database. Most of the programmers use this machine learning approach to build association rules where machine learning is type of artificial intelligence (AI) that seeks to build programs to become more efficient without being explicitly programmed.

3.3   Artificial Neural Network: Artificial Neural Network (ANN) also called as neural networks inspired by biological neural networks. Computations of ANN are structured in terms of interconnected group of neurons, processing information using a connectionist approach to computation.

3.4 Support Vector Machines: Support Vector Machines (SVMs) are set of related supervising methods used for classification and regression. Given a set of training examples, 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 model is a representation of the examples as points in space, mapped so that it can be classified easily
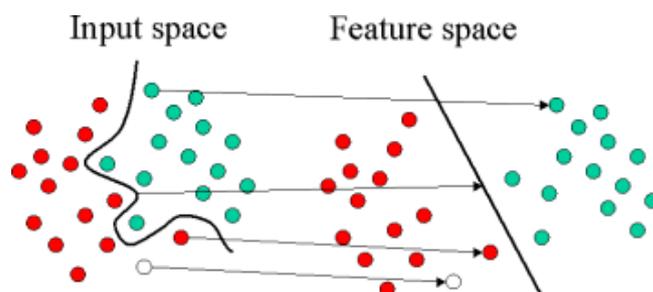

Fig: SVM algorithm

3.5 Clustering: Cluster analysis is the set of observations applied into subsets (called clusters) so that

observations within the same cluster are similar according to some predesignated criterion or criteria, while observations drawn from different clusters are different. There are 5 different clustering algorithms K-Means clustering, Mean-Shift.

Machine Learning technique	Advantages	Disadvantages
Decision Tree Learning	• Ability of selecting the most discriminatory features • Handling both continuous and discrete data	• They are unstable • Calculations can get very complex as time goes on
Association Rule Learning	• Finds similar patterns from data and produces rules. • Generates association relationship from data.	• Helps to find sequential patterns • Uses acquisition, integration and integrity checks methods..
Support Vector Machine	• Supervised Learning Technique • Helps for classification and prediction purpose	• Produces very accurate classifiers • Less over fitting and handles noise
Clustering	• The objectives of the technique are as follows: ✓ To discover natural groupings ✓ To produce hypothesis from data ✓ To find reliable organization of data.	• Provides end user high level view of what is going in database. • Very efficient technique
k-Nearest Neighbor	• Robust to noisy training data • Effective if training data is large	• Need to determine value of parameter of k • Computation cost is high
Genetic Algorithm	• It can find fit solutions in less time • Coding genetic algorithm is easy.	• Hard for people to come up with good heuristic • Might not find optimal solution to defined problem in all cases

As per the comparison in Table: Comparison between machine learning techniques there are different machine learning approaches which can be used to identify the plant disease but SVM algorithm should be preferred because it gives better classification and prediction results which is helpful to identify the plant diseases.

Future Work

Motivations to carry out further research in order to develop enhanced version of the proposed system. System would be able to communicate in both directions i.e. It will have the capability to translate normal languages to hand gestures successfully. The image processing part of the system will also be modified to work with every possible environment.. A challenge will be to recognize signs that involve motion. Application can also be created for more convenience.

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