

Sign Language Recognition For Deaf And Dumb People Using ANFIS

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Abstract

In the world of sign language, and gestures, a lot of research work has been done over the past three decades. This has brought about a gradual transition from isolated to continuous, and static to dynamic gesture recognition for operations on a limited vocabulary. In present scenario, human machine interactive systems facilitate communication between the deaf, and hearing people in real world situations. In order to improve the accuracy of recognition, many researchers have deployed methods such as HMM, Artificial Neural Networks, and Kinect platform. Effective algorithms for segmentation, classification, pattern matching and recognition have evolved. The main purpose of this paper is to analyze these methods and to effectively compare them, which will enable the reader to reach an optimal solution. This creates both, challenges and opportunities for sign language recognition related research

Keywords: Sign Language Recognition, Hidden Markov Model, Artificial Neural Network, ANFIS.

1. Introduction

Sign languages are the most raw and natural form of languages could be dated back to as early as the advent of the human civilization, when the first theories of sign languages appeared in history. It has started even before the emergence of spoken languages and this has wide range of application.

The research is motivated because it has a wide range of application first is that a sign language system would be potentially beneficial in aiding communication between members of the Deaf community and the hearing community with the common people. The second is that the process of developing distance learning teaching assistance also it is beneficial in medical field also it is very help full in monitoring of patients

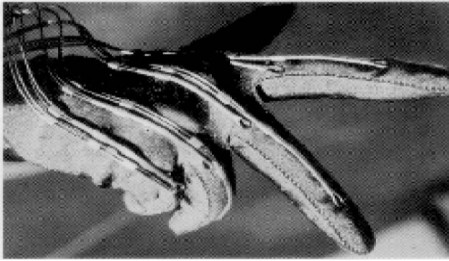
In the present research is a prototype system for the automatic recognition of sign language, based on a series of artificial neural networks, , HMM,ANFIS. This language used for developed a system which is beneficial for a common man and deaf and dumb people. A simple sign language with one hand has the same meaning all over the world and means either 'hi' or 'goodbye'. Many people travel to foreign countries without knowing the official language of the visited country and still manage to perform communication using sign language. These examples show that sign language can be considered international and used almost all over the world and convey proper information to all. So in this method we used ANFIS based classifier for the recognition of sign language.

2. Related Work

In the past, several method of gesture recognition also Human computer interface (HCI) suggested such as Neural Network, HMMs and Fuzzy Systems but these differ from one to another in their models. Some of them are Neural Network, HMMs [1] and Fuzzy Systems [2].

The past decades have witnessed two specific patterns for categories of sign language recognition The first system is categories into the electromechanically device such as a glove based system when this system developed research has been limited to small scale systems able of recognizing a minimum subset of a sign language. Christopher Lee and Yangsheng Xu [3] developed a glove-based gesture recognition system that was able to recognize 14 of the letters from the hand alphabet, learn new gestures and able to update the model of each gesture in the system in online mode, with a rate of 10Hz. Over the years advanced glove devices have been designed such

as the Sayre Glove, Dexterous Hand Master and Power Glove [4]. The most successful commercially available glove is by far the VPL Data Glove as shown in figure

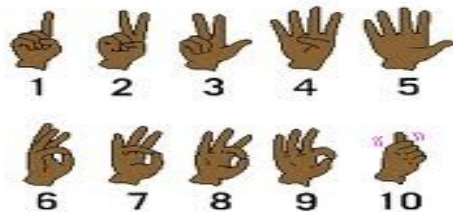


Fels and Hinton 1995a, Fels and Hinton 1995b)

Although sharing the same name, authors and much of the same technology as the Glove-Talk system, Glove-TalkII takes a fundamentally different approach to the mapping of hand gestures to speech. The original Glove-Talk maps each gesture to a single word. Glove-TalkII is based on a much finer grained approach in which features of the hand are mapped onto the articulatory features which control the production of speech.

American Sign Language is the language of choice for most deaf people in the United States. It is part of the “deaf culture” and includes its own system of puns, inside jokes, etc. However, ASL is one of the many sign languages of the world.

As an English speaker would have trouble understanding someone speaking Japanese, a speaker of ASL would have trouble understanding the Sign Language of Sweden. ASL also has its own grammar that is different from English. ASL consists of approximately 6000 gestures of common words with finger spelling used to communicate obscure words or proper nouns. Finger spelling uses one hand and 26 gestures to communicate the 26 letters of the alphabets. [5] Examples of signs shown in Figure.



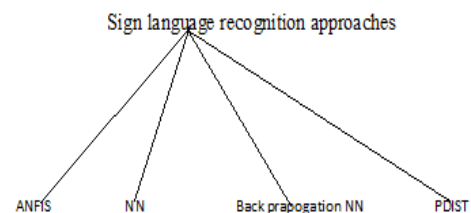
There are few technologies already using vision based analysis system. Example, Hand gesture recognition which using ‘Vision-Based’ approaches use only the vision sensor (camera) for understand musical conduction action. This system works by when the conductor uses

only one-side hand and must in the view range of camera..When the camera capture the image of hand gesture, the system extract the human hand region which is the region of interest (ROI) using the intensity color information.

The system is obtained the motion velocity and the direction by tracking the center of gravity (COG) of the hand region, which provides the speed of any conducting time pattern. [6] For this Hand Gesture Recognition project, is based on Human-Computer Interaction (HCI) technology. The computer can perform hand gesture recognition on American Sign Language (ASL). [7]The system use MATLAB Toolboxes, Neural Network to perform the gesture recognition. It work by feed numerous types of hand gestures images then into ‘neural network’ and the system will train the network itself. Once the ‘neural network’ is trained, this ‘neural network’ can perform multiples of hand gesture recognition of ASL. [8]

MacLean James[9] proposed the use of a back propagation neural network for recognition of gestures from a set of segmented hand images. This system showed promise in the field of language invariant teleconferencing. Loeding and Sarkar[10] developed a system which made use of Signemes i.e. parts of signs that are present in most occurrences, taken from videos. Extaction of Signemes is done using Iterated Conditional Modes (ICM). The feature extraction aspect of image analysis seeks to identify inherent characteristics, or features of objects found within an image. These characteristics are used to describe the object, or attribute of the object, prior to the subsequent task of classification. Shreenivasan and Geethapriya[11] formulated a real-time system, which has applications in video games. Extraction and clustering of key points is done using rotation and scale invariant matching (RASIM) and k-harmonic means techniques. Ghosh and Ari [12] developed a system for human alternative and augmentative communication (HAAC).

4. Exiting Method



Above method used for recognition but according to Sir jang paper after training 50 sample the error index in ANFIS is very low that's why we are trying to implement a system of sign language recognition by using ANFIS.

4.1 Neural Networks:-

Neural network is also known as **Artificial Neural Network (ANN)**, is an artificial intelligent system which is based on biological neural network. Neural networks able to be trained to perform a particular function by adjusting the values of the connections (weight) between these elements. [13]

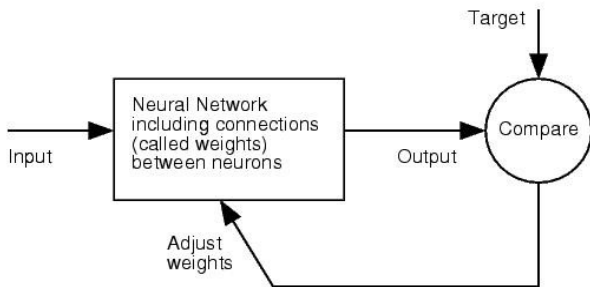


Figure 4.1 : Neural Network Block Diagram

Neural network is adjusted and trained in order the particular input leads to a specific target output. Example at Figure, the network is adjusted, based on a comparison of the output and the target until the network output is matched the target. Nowadays, neural network can be trained to solve many difficult problems faced by human being and computer

4.2 Hidden Markov Model: (HMM)

In case of dynamic process modeling, the approach to be chosen is stochastic. In nature, e.g. Hidden Markov Models (HMMs) [14] or Dynamic Bayesian Networks [15]. A time-domain process illustrates Markov property if the conditional probability density of an event, given all present and past events, depends only on the *j*th most recent event. If the current event depends solely on the most recent past event, then the process is termed a first order Markov process. It is considered as a useful assumption, while considering the orientations of hands of a signaller for time axis. The HMM, known for its rich mathematical structure, is considered to be a widely used tool for efficiently modeling spatio-temporal information in the most natural way possible. The algorithms that can be employed in the pass include the Baum-Welch and Viterbi [9], for evaluation, learning, and decoding before the interpretation can actually be started upon The Hmm generalized topology is known as the „Ergodic model“ ,

as per Acharya's term conditions, wherein any state can be reached from any other state

5. Proposed method using ANFIS classifier :-

In our work we have presented a system based on hand feature extraction in combination with a multi-layer fuzzy neural-network based classifier The hand gesture area is separated from the background by using skin detection and segmentation method of skin color, then a contour of hand image can be used as a feature that describe the hand shape. As such, the general process of the proposed method is composed of three main parts:-

1) A preprocessing step :-

This step is creating a skin-segmented binary image by using a threshold value of probability, if the probability of a pixel in skin likelihood image is more or equal to estimated threshold value, it supposed that this pixel represents skin color, if not it supposed that this pixel does not represent skin color. The skin color pixels are white and the other ones are black in the skin – segmented image.

2) A feature extraction step :-

The hand contour will act as the feature of the gesture. The feature extraction aspect of image analysis seeks to identify inherent characteristics, or features of objects found within an image. These characteristics are used to describe the object, or attribute of the object, prior to the subsequent task of classification. For posture recognition, (static hand gestures) features such as fingertips, finger directions and hand's contours can be extracted. But such features are not always available due to self-occlusion and lighting conditions. Feature extraction is a complex problem, and often the whole image or transformed image is taken as input. Contour detection process consists of two steps: first find the edge response at all points in an image using gradient computation and in the second step modulate the edge response at a point by the response in its surround.

3) A classification step.

The unknown gesture's feature will be produced and entered to the fuzzy neural network .The gesture recognition process diagram is illustrated in Figure 3.1,the hand region obtained after the pre-processing stage

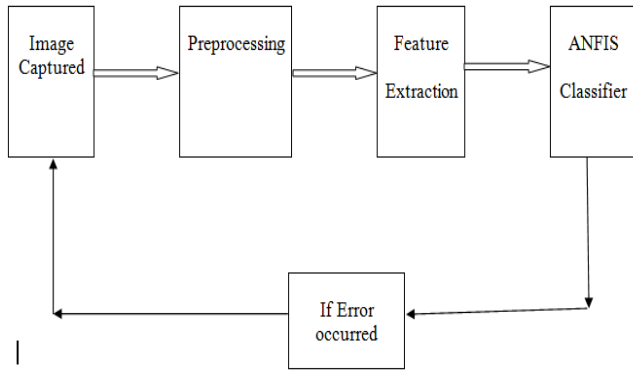


Fig. 5.1 The system process

It will be used as the primary input data for the feature extraction step of the gesture recognition algorithm. Our classification process based on the use of single , with hybrid training algorithm. In the feature extraction stage the hand contour is resized in order to make it appropriate for neural network input, then it entered to the classification stage. The recognition process consist of two phases , training and classification, as shown in the Figure 3.1

6. Result:-

In this present system we recognize sign language by using three methods like Neural Network, PDIST and ANFIS. But the accuracy and time required for classification is less in ANFIS.

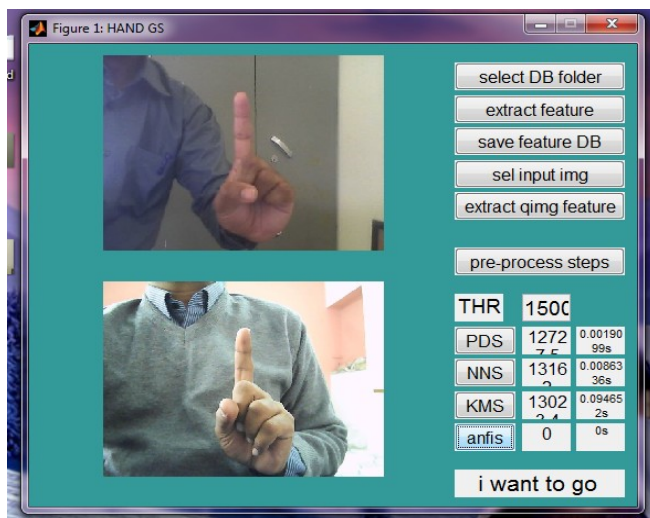


Table 6.1 Comparative Analysis

<i>Classifier Algorithm</i>	<i>No. of Sample</i>	<i>Accuracy</i>	<i>Time required for Classification</i>
<i>PDIST</i>	<i>35</i>	<i>LOW</i>	<i>0.0019099 S</i>
<i>NN</i>	<i>35</i>	<i>HIGH</i>	<i>0.0086336 S</i>
<i>ANFIS</i>	<i>35</i>	<i>HIGH</i>	<i>0.000014 S == 0 S</i>

6. Conclusions

After the survey on the approaches used in various vocabulary-based sign language recognition systems, we can give an opinion about the methodologies and algorithms involved. Most of the times, a combination of different methods and algorithms has to be used to achieve a moderate to acceptable rate of recognition. For example some methods are suitable only against dark backgrounds. A system which gives maximum efficiency, has low cost, and is an optimal mixture of methods, giving results against complex backgrounds as well, should be preferred. From a technical point of view, there is a vast scope in future for research and implementation in this very field. The upcoming years could witness a combinatorial explosion of different methodologies, such as using several HMMs in parallel, independent or coupled usage of ANN and HMMs etc. The ultimate gain of the proposed study is enormous and accuracy and time required for classification in ANFIS is less than other so it is beneficial to use ANFIS in gesture recognition .

References

[1] Czapnik Karol, Kasprzak WALodzimierz, Wilkowski Arthur, “Hand Gesture Recognition in Image equences Using Active Contours and HMMs.”
 [2] D. M. Gavrila, “The visual analysis of human movement: A survey.”
 [3] Liu Yucheng and Liu Yubin, “Incremental Learning Method of Least Squares Support Vector Machine”, International Conference on Intelligent Computation Technology and Automation” VCL-94-104, 2010
 [4] K. T. Fang, Y.Wang, and P. M. Bentler, “Some applications of numbertheoretic methods in statistics,” Stat. Sci., vol. 9, pp. 416–428, 1994.

- [5] Gallaudet University Press (2004). 1,000 Signs of life: basic ASL for everyday conversation. Gallaudet University Press. <http://venturebeat.com>
- [6] [Bauer & Hienz, 2000] Relevant feature for video-based continuous sign language recognition. Department of Technical Computer Science, Aachen University of Technology, Aachen, Germany, 2000. pages 440 – 445.
- [7] Starner, Weaver & Pentland, 1998] Real-time American Sign Language recognition using a desk- and wearable computer-based video. In proceedings IEEE transactions on Pattern Analysis and Machine Intelligence, 1998, pages 1371-1375.
- [8] L. Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms, and Applications", Prentice-Hall, Inc. 1994, pp-304-315.
- [9] James MacLean, "Fast Hand Gesture Recognition for Real-Time Teleconferencing Applications
- [10]. Loeding Barbara, Sarkar Sudeep, "Automated Extraction Of Signs From Continuous Sign Language Sentences Using Iterated Condition Modes."
- [11] Geethapriya J and Srinivasan A, "A New Framework for Real-time Hand *Gesture Detection and Recognition*// in *International Conference on Information and Network Technology (ICINT 2012)*, *IPCSIT vol. 37 (2012)* © (2012) *IACSIT Press, Singapore 2012*.
- [12] Ghosh, D.K. , Ari, S. —*A Static Hand Gesture Recognition Algorithm Using K-Mean Based Radial Basis Function Neural Network*// in *Information, Communications and Signal Processing (ICICS) 2011 8th International Conference on* 13-16 Dec. 2011.
- [13] G. Joshi, J. Sivaswamy, "A simple scheme for contour detection", 2004 pages 236-242
- [14] K. R. Linstrom and A.J. Boye. "A neural network prediction model for a psychiatric application" in *International Conference on Computational Intelligence and Multimedia Applications*, pp. 36-40, 2005.
- [15] J. Yamato, J. Ohya, and K. Ishii, "Recognizing human action in timesequential images using hidden Markov model," in *Proc. IEEE Int. Conf. Comput. Vis. Pattern Recogn.*, Champaign, IL, 1992, pp. 379–385.
- [16] Rung-Huei Liang Ming Ouhyoung, "A Real-time Continuous Alphabetic Sign Language to Speech Conversion VR System" in *Communications & Multimedia Lab., Computer Science and Information Engineering Dept, National Taiwan University, Taipei, Taiwan*.
- [17] Rung-Huei Liang Ming Ouhyoung, "A Real-time Continuous Gesture Recognition System for Sign Language" in *National Taiwan University, Taipei, Taiwan*.
- [18] D. M. Gavrilu, "The visual analysis of human movement: A survey."