International Journal of Engineering Research and General Science Volume 2, Issue 3, April-May 2014
ISSN 2091-2730

Design & Implementation of ANFIS System for Hand Gesture to Devanagari Conversion

Pranali K Misal [1], ProfM.M. Pathan[2]

[1]Scholar, Department of Electronics Engineering, G.H.Raisoni College of Engineering, Digdoh hill, Nagpur, India

[2]Faculty, Department of Electronics Engineering, G.H.Raisoni College of Engineering, Digdoh hill, Nagpur, India

E-mail- missal.pranali20@gmail.com

ABSTRACT- Sign language mainly uses hand gesture for communicate between vocal and hearing impaired people and normal people. It is also used to share message. This research work presents a simple sign language recognition system that develops using ANFIS & neural network. Devanagari language is one of the most used for writing. The system works uses functions like skin color detection, convex hull, contour detection and identification of extrema points on the hand. This is technology which is convert image from video acquisition into Devanagari Spoken language. The database of all alphabets is created first then after feature extraction of all images. The features calculated first then from centroids values trained Neural network. The Algorithms for training neural network is linear vector Quantization. The feature extraction point trained in neural network after that from a new recognizes hand gesture and translate sign language into Devanagari alphabets. The system architecture contains video acquisition, image processing, feature extraction & neural network classifier. This system is used to recognize more alphabets which can sign with one and two hands movement. This system useful to identify the gesture after that sign translating Devanagari language. This project aims to develop and test a new method for recognition of Devanagari sign language. To do so preprocessing, contour & convex based feature extraction is done. The method is evaluated on database and proves to be superior than rule based methods. To identify Devanagari alphabets of sign language, in an image morphological operation and skin color detection is performed. A MATLAB implementation of the complete algorithm is developed and conversion of sign language into Devanagari spoken language with the better accuracy.

Keywords—Hand gesture, Sign language recognition, Image processing, ANFIS, Feature Extraction, contour points, convex hull Devanagari Alphabets & numerals.

INTRODUCTION

Hand gesture technique is a way of communication between vocal and hearing impaired people. A person who has knowledge of sign language can talk and hear properly. Untrained people cannot communicate with mute person, because the person can communicate with Impaired People by training sign language. Hands Gesture to Devanagari voice system will be more useful for the vocal & hearing impaired for communicate with normal people more fluently. The proposed system will be use for sign language into spoken language. The aim of this research work includes conversion of hand gesture to Devanagari speech. The vocal and hearing impaired community has developed their own culture and communicates with ordinary person by using sign language.

Hands gestures are basically physical action by using hands & Eyes, we can communicate with the deaf & dumb people. Gesture represents ideas and actions of deaf & dumb people. They can express their feelings with the different hand shapes, fingers patterns & movements of hands. The gestures vary greatly culture among People, hand Gesture are basically used in communication between the peoples those who are unable to speak with another. It is shown that people who are hearing impaired people , when they talk on telephone, and unable to see each other as well as face to face communication. These problems overcome by hand gesture recognition system which recognizes Devanagari alphabets & numerals. It is the demand of available advanced technology to recognize, classify and various different hand gestures and use them in a wide range of application. Linear vector Quantization algorithm is used for training the neural network. Devanagari alphabets are includes in two palm or both hand movement numerals in only one hand movements. The background for image is in white background, because color gloves are very expensive. In this proposed work, only use white background for better feature extraction.

II. RELATED WORK ON HAND GESTURE RECOGNITION

Gesture Recognition is becomes important factor for sign language. There has been gesture recognition technique developed for voice recognition by using hand gesture. Ullah [7] designed a system that of 26 images representing each alphabet, which is used for training purpose. The American Sign Language from static images using CGP has recognition accuracy of 90%. Miller & Thomson first gave the idea of CGP. CGP genes are represented by nodes each of which some characteristics, which represents the actual system of CGP chromosomes or genotype. The accuracy of this system is reported on sized images of 47*27 pixel resolution, by taking too small a data set for testing and manual preprocess of training images. CGP based system are faster with respect to conversion GP algorithms., but recently developed Neuro- Evolutionary approaches, CGP is slow. For the fast ability learning approaches like Cartesian genetic programming evolved Artificial Neural network (CGPANN).Dr. Raed Abu Zaiter & Maraqa [3] developed a system for recognition of Arabic sign language using recurrent neural network. This paper used color coded glove to extract perfect feature with recognition accuracy rate of 95% is reported. In this paper, the images have been captured by a color camera & image digitized into 256*256 pixel image, and then it is converted into HIS system, then after color segmentation is done with matlab6. The result show an improvement in generalisability of system when using fully recurrent neural network rather than using Elman network.

Paulraj [4], developed systems which convert sign language into voice signals i.e. Malaysian language. In this paper, feature extraction method done by Discrete Cosine Transform (DCT). This system use a camera for lighting sensitivity & background condition, skin color segmentation applied for each of gesture frame images and segmented. The feature extraction stage the moment is calculated from the blob method, in the calculated from blob alone in a set of image frame. They surveyed the use of Skin Color Segmentation system. They found that accuracy rate 95% in Recognition of 92.85% in A Phoneme Based Sign Language Recognition System Using Skin Color Segmentation. Akmeliawati [6], developed an automatic sign language translator provides a real time English translation of Malaysia SL. This sign language translator can recognize both finger, spelling and sign gestures that involve static and motion sign. In this neural network is used to translate sign language to English. In earlier days, English & Malay languages learnt only as second languages. The data gloves are less comfortable to signer. But these gloves are very costly. In this automatic sign language translator recognize all 49 signs in BIM vocabulary. This system achieved recognition rate of over 90%.

Fang et al [1] make use of three additional trackers in their hybrid system with self organizing feature maps & HMM to accuracy which is between 90-96%. But using SOFM/HMM system increases recognition accuracy by 5% than HMM. The recognition rate of this system is 91%. Which is recognizing sentences of 40 signs, this system imposing a strict grammar, in real time performance accuracy rate was 97%. A self adjusting recognition algorithm is proposed for improving for SOFM/HMM discrimination. The aim of sign language recognition is to provide an efficient and accurate mechanism to transcribe sign language into text or speech so that communication between deaf and hearing impaired people is very easy. Their system correctly recognizes 27 out of 31 ASL symbols. The recognition rate for their system was 91% which recognizing sentences of 40 signs. Memona Tariq, Ayesha Iqbal, Aysha Zahid, and Zainab Iqbal [2], presented a machine translation of sign language into text. The approaches rely on intrusive hardware webcam and in the form of wired or colored gloves. The specific language dialect dependent on accurate gesture for their better understanding. The functions use for feature extraction like skin color based thresholding, contour detection & convexity detect, for detection of hands and identification of important points on the hand. In testing, it can be used for translation of trained sign language symbols. The system recognized one hand including 9 numerals & 24 alphabets of English language. The maximum recognition average accuracy is of 77% on numerals and alphabets.

III. SYSTEM DESIGN ARCHITECTURE

The flowchart of this system is shown in fig 1 and its main steps are discussed in the following section. The first step is to collect database of all Devanagari alphabets. The database having a large amount of Devanagari alphabets images, The features are calculated by convex hull, extrema points and counter point's methods. After calculating feature of centroids values, then these values are stored in neural network for training. Fuzzy system use for rule based system. In neural network for training purpose algorithm uses linear vector quantization in this system, then after classification is done by this algorithm. Then from video acquisition new

image is captured & compared with the database. The image processing is process, and then correctly converts sign language into Devanagari Voice for alphabets.

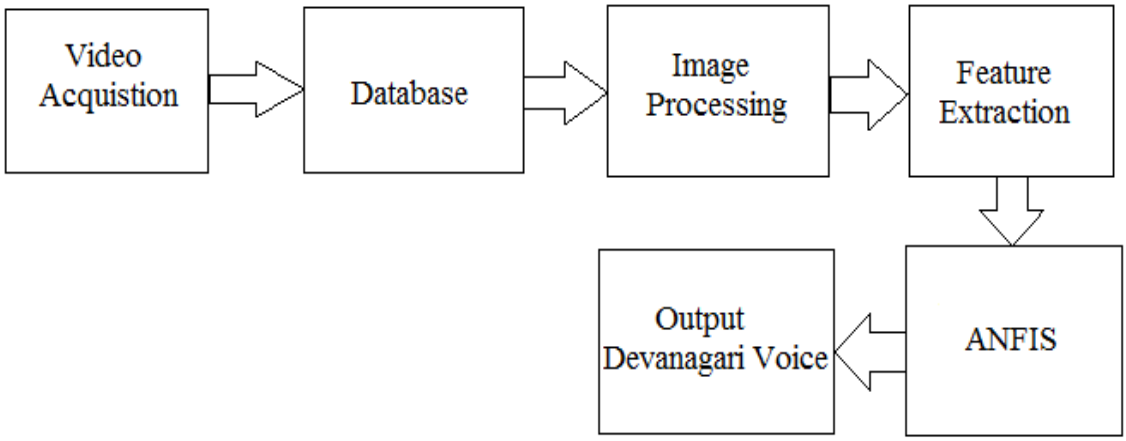

Fig 1 -.System Architecture

Feature extracted from image based on the distance between centroid, fingers & palms. These feature vectors are used for neural network system.

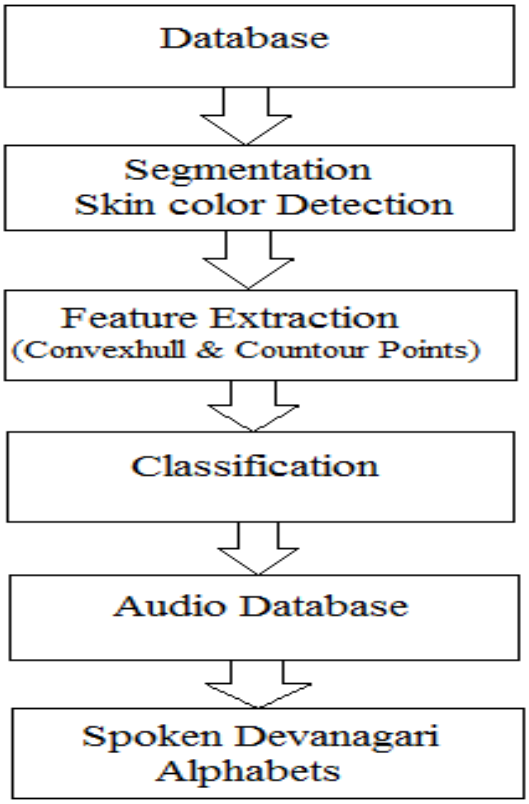

Fig 2 - flow chart of this system

A. SKIN COLOR DETECTION-

Image is captured from video to identify hand, determine gesture. For identification of hand gesture RGB, gray scale color model are require. The skin color detection i.e. detects only skin color by using morphological operation. The skin color is detected & then boundary of the hand is located by points. The convex hull is useful for collecting features from image. The boundary covered around the hand by using skin color detection technique.

B. FEATURE EXTRACTION-

The image is captured in white background for better Results. It is processed by function of skin color from skin color detection and then determines contour and convex hand of the shape. To determine the spatial moment or position of hand are required for contouring. Contour is boundary or outline of curved shape it draws outline around the hand. The hand having different orientation in convex hull & contour points feature extraction. The key information contains in fingers and palm. For hand gesture identification method, convex hull designed for counter points. Finding detect of convexity contour points are necessary for joining points. The start points of detects are marked, used for computing feature vector. Defects points are unevenly distribution vary in number from one frame to other. The defected points are filtered by identifying all contour points. The distances of contour points are determined from centroid. The distances are feature extracted from every hand gesture.

Fig 3- Original Image

Fig 4- Convex hull

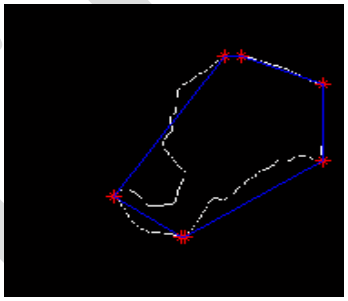

Fig 5- Contour points

C. ANFIS-

The adaptive neuro-fuzzy inference system (ANFIS) proposed by Jang in 1993, implements a Sugeno fuzzy inference method. The ANFIS architecture contains a six layer feed-forward neural network as shown in Figure 3. Layer 1 is the input layer that passes external crisp signals to Layer 2, known as the fuzzification layer; to determine the membership grades for each input implemented by the given fuzzy membership function. Layer 3 of ANFIS is the rule layer, which calculates the firing strength of the rule as the product of the membership grades.

Layer 4 is called the 'normalized firing strengths', in which each neuron in the layer receives inputs from all neurons in Layer 3, and calculates the ratio of the firing strength of a given rule to the sum of firing strengths of all rules. Layer 5 is the defuzzification layer

that yields the parameters of the consequent part of the rule. A single node in Layer 6 calculates the overall output as the summation of all incoming signals. ANFIS training can use alternative algorithms to reduce the error of the training. The LVQ network use as a classifier for sign recognition, where each neuron corresponds to a different category.

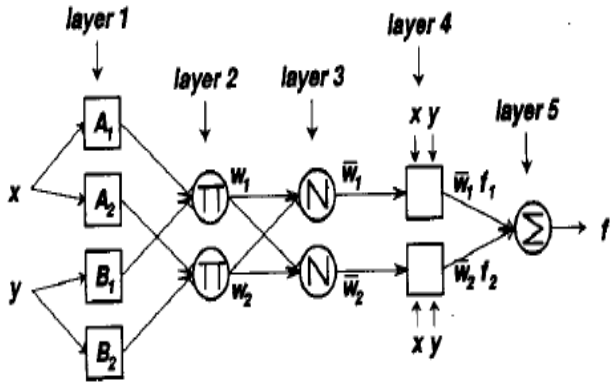

Fig. 6 Adaptive Neuro-Fuzzy Inference System (ANFIS)[9]

IV.CONCLUSION

In this paper, we proposed, design and tested method for Devanagari Sign Language Recognition using the neural network, ANFIS classifier and features extracted from contour points & convex hull. From the experiments, we concluded that, obtained slightly better results 90%. Sign language recognition system is created by using skin color detection and neural network using LVQ algorithm. The sign language to voice system helps vocal and hearing impaired people to communicate with normal people more fluently by using this system. Our approaches described in the paper recognition accuracy greater than 90%. Sign language is the most important language for vocal and hearing impaired people. The aim of this research work to convert sign language into Devanagari spoken language. Though a lot of work has been done in this area previously, but direction is to extend this system to recognize Devanagari alphabets which can be signed with one hand movements.

REFERENCES

[1] G. Fang, W. Gao, J. Ma, " Signer-independent sign language recognition based on SOFM/HMM", Recognition, Analysis, and Tracking of Faces and Gestures in Real-Time Systems, Proceedings, IEEE ICCV Workshop, pp. 90-95, 2001.

[2] Memona Tariq, Ayesha Iqbal, Aysha Zahid, and Zainab Iqbal", Sign Language Localization: Learning Eliminate Language Dialects, Journal to International of Human Computer Interaction, 2012.

[3] Meenakshi Panwar "Hand Gesture based Interface for Aiding Visually Impaired" International Conference on Recent Advances in Computing and Software Systems, 2012.

[4] M. Maraqa, R. Abu-Zaiter, "Recognition of Arabic Sign Language (ArSL) using recurrent neural networks", Applications of Digital Information and Web Technologies, ICADIWT, First International Conference, pp. 478-481, 2008.

[5] M. P. Paulraj, S. Yaacob, M. S. bin Zanar Azalan , R. Palaniappan, "A phoneme based sign language recognition system using skin color segmentation", Signal Processing and its Applications (CSPA), 6th International Colloquium, pp. 1-5, 2010.

[6] R. Akmeliawati, M. P-L. Ooi, Y. C. Kuang, "Real-Time Malaysian Sign Language Translation using Color Segmentation and Neural Network", IEEE Instrumentation and Measurement Technology Conference Proceedings, IMTC, pp. 1-6, 2007.

[7] F. Ullah, "American Sign Language recognition system for hearing impaired people using Cartesian Genetic Programming" Automation, Robotics and Applications (ICARA), 5th International Conference, pp. 96-99, 2011.

[8] Chunli Wang, Wen GAO, Shiguang Shan "An Approach Based on Phonemes to Large Vocabulary Chinese Sign Language Recognition", Fifth IEEE International Conference on Automatic Face and Gesture Recognition (FGR.02), 2002.

[9] Jyhshing Roger Jang, "ANFIS: Adaptive- Network-Based Fuzzy Interface System," in proceeding of IEEE Transaction on System, Man and Cybernetics Vol.23,NO.3,MAY/JUNE, 1993.

[8] H. Birk, T. B. Moeslund, and C. B. Madsen, "Real-time recognition of hand alphabet gestures using principal component analysis," in Scandinavian Conference on Image Analysis (SCIA), 1997, pp. 261– 268

[9]T. Starner and A. Pentland, "Visual recognition of American sign language using hidden markov models," In Intl. Conf. On Automatic Face and Gesture Recognition, pp. 189–194, 1995.

[10]C. Vogler and D. Metaxas "Asl recognition based on a coupling between hmms and 3d motion analysis" In Proc.Intl. Conf. on Computer Vision, pp. 363–369, 1998.

[11]Y. Nam and K. Wohn "Recognition of Space-Time Hand-Gestures Using Hidden Markov Model" In Proceedings of the ACM Symposium on Virtual Reality Software and Technology, pp. 51{58, Hong Kong, July 1996.

[12] B. Bauer, H. Hienz, and K.F. Kraiss "Video-Based Continuous Sign Language Recognition Using Statistical Methods" In Proceedings of the International Conference on Pattern Recognition, pp. 463{466, Barcelona, Spain, September 2000.