

Sign Language Recognition Using Thinning Algorithm

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Abstract- we have proposed a method for real time Hand Gesture Recognition and feature extraction using a web camera. In this approach, the image is captured through webcam attached to the system. First the input image is preprocessed and threshold is used to remove noise from image and smoothen the image. After this apply region filling to fill holes in the gesture or the object of interest. This helps in improving the classification and recognition step. Then select the biggest blob (biggest binary linked object) in the image and remove all small object, this is done to remove extra unwanted objects or noise from image. When the preprocessing is complete the image is passed on to feature extraction phase. For feature extraction “HU moments” are used because of their distinct properties like rotation, scale and translation invariance. The extracted features are normalized and matched with the training dataset features using KNN (K-nearest neighbor) algorithm. Euclidean distance in KNN is used to calculate the distance and then for finding the nearest neighbor. The test image is classified in nearest neighbor’s class in training set. The classification results are displayed to user and through the windows text to speech API gesture is translated into speech as well. The training data set of images that is used has 5 gestures, each with 50 variations of a single gesture with different lighting conditions. The purpose of this is to improve the accuracy of classification.

Keywords- Hand gestures, gesture recognition, contours, HU moments invariant, Sign language recognition, Matlab, K-mean classifier, Human Computer interface, Text to speech conversion and Machine learning.

I. INTRODUCTION

Hands are human organs which are used to manipulate physical objects. For this very reason hands are used most frequently by human beings to communicate and interact with machines. Mouse and Keyboard are the basic input/output to computers and the use of both of these devices require the use of hands. Most important and immediate information exchange between man and machine is through visual and aural aid, but this communication is one sided. Computers of this age provide humans with 1024 * 768 pixels at a rate of 15 frames per second and compared to it a good

typist can write 60 words per minute with each word on average containing 6 letters. To help somewhat mouse remedies this problem, but there are limitations in this as well. Although hands are most commonly used for day to day physical manipulation related tasks, but in some cases they are also used for communication. Hand gestures support us in our daily communications to convey our messages clearly. Hands are most important for mute and deaf people, who depends their hands and gestures to communicate, so hand gestures are vital for communication in sign language. If computer had the ability to translate and understand hand gestures, it would be a leap forward in the field of human computer interaction. The dilemma, faced with this is that the images these days are information rich and in-order to achieve this task extensive processing is required. Every gesture has some distinct features, which differentiates it from other gestures, HU invariant moments are used to extract these features of gestures and then classify them using KNN algorithm. Real life applications of gesture based human computer interaction are; interacting with virtual objects, in controlling robots, translation of body and sign language and controlling machines using gestures.

II. PROBLEM STATEMENT

We study and develop system by using thinning algorithm to make the cut image of the human hand for simple recognition of the painted gesture. All the signs wont to represent alphabets and numbers are recognized using the planned technique.

III. LITERATURE REVIEW

A. An Evaluation of Parallel Thinning Algorithms for Character - Recognition

Authors: Lam, L and Suen C.Y

Description:

Skeletonization algorithms have played an important role in the preprocessing phase of OCR systems. In this paper we report on the performance of 10 parallel thinning algorithms from this perspective by gathering statistics from their performance on large sets of data and examining the effects of the different thinning algorithms on an OCR system.

B. Vision based Hand Gesture Recognition.**Authors:** P. Garg, N. Agrawal, S. Sofat,**Description:**

This project presents an approach to develop a real-time hand gesture recognition enabling human-computer interaction. It is "Vision Based" that uses only a webcam and Computer Vision (CV) technology, such as image processing that can recognize several hand gestures. The applications of real time hand gesture recognition are numerous, due to the fact that it can be used almost anywhere where we interact with computers ranging from basic usage which involves small applications to domain-specific specialized applications. Currently, at this level our project is useful for the society but it can further be expanded to be readily used at the industrial level as well. Gesture recognition is an area of active current research in computer vision. Existing systems use hand detection primarily with some type of marker. Our system, however, uses a real-time hand image recognition system. Our system, however, uses a real-time hand image recognition without any marker, simply using bare hands.

C. A Framework for Hand Gesture Recognition with Application to sign language.**Authors:** M. K. Bhuyan, D. Ghosh, P. Bora**Description:**

Sign language is the most natural and expressive way for the hearing impaired. Because of this, automatic sign language recognition has long attracted vision researchers. It offers enhancement of communication capabilities for the speech and hearing impaired, promising improved social opportunities and integration. This paper describes a gesture recognition system which can recognize wide classes of hand gesture in a vision based setup. Experimental results demonstrate that our proposed recognition system can be used reliably in recognizing some signs of native Indian sign language.

D. Computer Vision-based Bangladeshi Sign Language Recognition System.**Authors:** S. Begum, Md. Hasanuzzaman**Description:**

Sign language is a specific area of human gesture communication and a full-edged complex language that is used by various deaf communities. In Bangladesh, there are many deaf and dumb people. It becomes very difficult to communicate with them for the people who are unable to understand the Sign Language. In this case, an interpreter can help a lot. So it is desirable to make computer to understand the Bangladeshi sign language that can serve as an interpreter. In this paper, a Computer Vision-based Bangladeshi Sign

Language Recognition System (BdSL) has been proposed. In this system, separate PCA (Principal Component Analysis) is used for Bengali Vowels and Bengali Numbers recognition. The system is tested for 6 Bengali Vowels and 10 Bengali Numbers.

E. Smart Gloves for Hand Gesture Recognition Sign Language to Speech Conversion System**Authors:** Abhijith Bhaskaran K, Anoop G Nair, Deepak Ram K, Krishnan Ananthanarayanan, H R Nandi Vardhan**Description:**

People with speech impairment find it difficult to communicate in a society where most of the people do not understand sign language. The idea proposed in this paper is a smart glove which can convert sign language to speech output. The glove is embedded with flex sensors and an Inertial Measurement Unit (IMU) to recognize the gesture. A novel method of State Estimation has been developed to track the motion of hand in three dimensional spaces. The prototype was tested for its feasibility in converting Indian Sign Language to voice output. Though the glove is intended for sign language to speech conversion, it is a multipurpose glove and finds its applications in gaming, robotics and medical field.

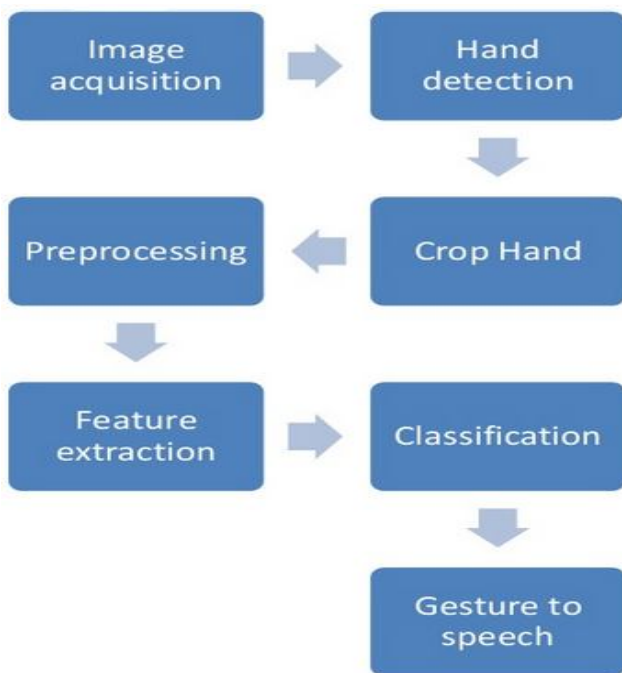
IV. PROPOSED SYSTEM

In this project, background history of project, their need their future scope is given in this project so that we get to know how system will prove beneficial to peoples to use. Hand gesture technique is used in this project. Vision based hand gesture recognition system are mentioned as hand plays vital communication mode. Considering earlier reported work, varied techniques offered for hand chase, segmentation, feature extraction and classification are listed. Vision based system have challenges over ancient hardware based approach; by economical use of computer vision and pattern recognition, it's potential to work on such system which may be natural and accepted, in general.

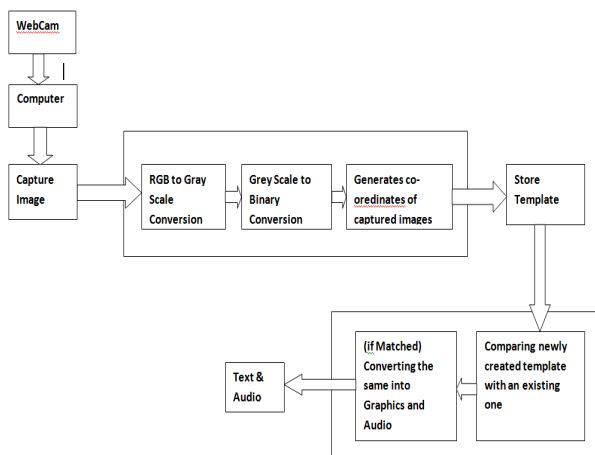
Proposed Method:- In order to extract features and recognize a gesture following method is proposed:

1. A GUI which allows the user to capture the scene. This phase is called image acquisition.
2. After capturing the image, next step is to detect the hand and separate the hand from the scene, because only hand gesture is needed for accurate classification. If hand is not separated from the scene it will affect the accuracy of the system while extracting and matching the features.
3. Crop hand out of scene.

4. Preprocessing steps, which are:
 - 4.1. Convert RGB to Gray scale.
 - 4.2. Gray filtering using Value.
 - 4.3. Noise removal and smoothing.
 - 4.4. Remove small objects other than hand.
5. Feature extraction using HU moments invariant.
6. Classification using KNN algorithm. Using Euclidean distance formula for calculating distance and having threshold to have better results.
7. Translation (conversion) in Speech. The proposed method is given in the figure 3.1.



A. BLOCK DIAGRAM OF SYSTEM



System Description:

User can offer image to the system then system can perform image preprocessing steps then perform feature extraction and match with info pictures and find result.

V. CONCLUSION AND FUTURE SCOPE

In this paper, we have developed a novel sign language learning system based on 2D image sampling and concatenating to solve the problems of conventional sign recognition. In this system, the data sampled from the sign language demonstration video was learned by a customized convolutional neural network. The final test accuracy was 86%. As a result, we obtained high accuracy using only 2D images obtained from a low-cost camera with much less data size than previous studies. Since the learning data used in this paper was only 20 cases, if we can obtain and use data in more various situations, we can learn more various actions with higher success rate.

Future work

There are some aspects of projects which can be improved in future.

- Instead of webcam a better and more accurate acquisition device can be used which even used Infrared for accuracy e.g. Kinect.
- Mechanism for hand detection is not accurate.
- HU set of invariant moments are very basic descriptors as features of image which will not have good accuracy. A better descriptor can give good results but classification mechanism may change.

Potential applications

Image recognition concept has vital applications in various fields like:

- Robotics.
- Artificial Intelligence.
- Controlling the Computer through hand gestures.

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REFERENCES

- [1] Jamie Lynn Boenheim, “Human Activity Recognition Using Limb Component Extraction”, March 2008.
- [2] Tin Hninn and Hninn Maung, “Real-Time Hand Tracking and Gesture Recognition System Using Neural Networks”, *World Academy of Science, Engineering and Technology*, Vol. 50, pp. 466-470, 2009.
- [3] Justus Piater, Thomas Hoyoux, Wei Du, “Video Analysis for Continuous Sign Language Recognition”, *In 4th Workshop on the Representation and Processing of Sign Languages: Corpora and Sign Language Technologies*, 2010.
- [4] Elena Sánchez-Nielsen, La Laguna, Luis Antón-Canalís and Mario Hernández-Tejera, “Hand Gesture Recognition for Human-Machine Interaction”, *Journal of WSCG*, Vol. 12, No. 1-3, 2003.
- [5] Ravikiran J, Kavi Mahesh, Suhas Mahishi, Dheeraj R, Sudheender S and Nitin V Pujari, “Finger Detection for Sign Language Recognition”, *Proceedings of the International MultiConference of Engineers and Computer Scientists*, Vol. 1, pp. 0-4, 2009.
- [6] Lam, L and Suen C.Y, “An Evaluation of Parallel Thinning Algorithms for Character - Recognition”, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 17, No. 9, pp. 914-919, 1995.
- [7] K. Srinivasan, K. Porkumaran and G. Sainarayanan, “Development of 2D Human Body Modelling using Thinning Algorithm”, *ICTACT Journal on Image and Video Processing*, Vol. 1, No. 2, pp. 80-86, 2010.
- [8] V. Vijaya Kumar, A. Srikrishna, Sadiq Ali Shaik and S. Trinath, “A New Skeletonization Method Based on Connected Component Approach”, *International Journal of Computer Science and Network Security*, Vol. 8, No. 2, pp. 133-137, 2008.
- [9] Lei Huang, Genxun Wan and Changping Liu, “An Improved Parallel Thinning Algorithm”, *Proceedings of the Seventh International Conference on Document Analysis and Recognition*, pp. 780-783, 2003.
- [10] U. Zeshan, “ ‘A’ level Introductory course in INDIAN SIGN LANGUAGE”, Ali Yavar Jung National Institute for Hearing Handicapped, Mumbai, 2001, pp. 1-38.
- [11] P. Garg, N. Agrawal, S. Sofat, “Vision based Hand Gesture Recognition”, *Proceedings of world Academy of Science, Engineering and Technology*, Vol.37, 2009, pp. 1024-1029.
- [12] U. Zeshan, M. Vasishta, M. Sethna, “Implementation of Indian Sign Language in Educational Setting”, *Asia Pacific Disability Rehabilitation Journal*, Vol.16, No.1, 2005, pp. 16-39.
- [13] Dasgupta, Shulka, S. Kumar, D. Basu, “A Multilingual Multimedia Indian Sign Language Dictionary Tool”, *The 6th Workshop on Asian Language Resources*, 2008, pp. 57-64.
- [14] M. K. Bhuyan, D. Ghosh, P. Bora, “A Framework for Hand Gesture Recognition with Application to sign language”, *India Conference, IEEE*, Sept. 2006, pp. 1-6.
- [15] P. Subha Rajan, G. Balakrishnan, “Recognition of Tamil Sign Language Alphabet using Image Processing to aid Deaf-Dumb People”, *International Conference on Communication Technology and System Design*, 2011, pp. 861-868.
- [16] S. Begum, Md. Hasanuzzaman, “Computer Vision-based Bangladeshi Sign Language Recognition System”, *IEEE, International conference on Computer and Information Technology*, 2009, pp. 414-419.