International Journal of
Emerging Research in Management &Technology
ISSN: 2278-9359 (Volume-2, Issue-3)

Research Article | **March 2013**

Neural Network based Hand Gesture Recognition

Sujeet D.Gawande
M.E. Scholar.
Department of Computer Science and Engineering,
G.H.Raisoni College of Engineering and Management,
Amravati, India

Prof. Nitin .R. Chopde
M.E Computer Engineering
Department of Computer Science and Engineering,
G.H.Raisoni College of Engineering and Management,
Amravati, India

Abstract-

Considerable effort has been put towards developing intelligent and natural interfaces between users and computer systems. This is done by means of a variety of modes of information (visual, audio, pen, etc.). The use of gestures as means to convey information is an important part of human communication. The automatic recognition of gestures enriches Human–Computer Interaction by offering a natural and intuitive method of data input. This paper presents a new technique for hand gesture recognition, for the Human-Computer Interaction (HCI) based on shape analysis. The objective of this effort was to explore the utility of a neural network-based approach to the recognition of the hand gestures. A neural network is build for the classification by using back-propagation learning algorithm. The overall model is designed to be a simple gestural interface prototype for various PC applications.

***Keywords*- Human Communication Interaction (HCI), Mouse replacement, American Sign Language, Artificial Neural Network, Gesture modeling.**

I. INTRODUCTION

Human-Computer Interaction (HCI) has become an increasingly important part of our daily lives. It is widely believed that as the computing, communication, and display technologies progress even further, the existing HCI techniques may become a bottleneck in the effective utilization of the available information flow. For example, the most popular mode of HCI is based on simple mechanical devices—keyboards and mice. These devices have grown to be familiar but inherently limit the speed and naturalness with which human can interact with the computer. This limitation has become even more apparent with the emergence of novel display technology such as virtual reality. Thus in recent years the field of computer vision has devoted considerable research effort to the detection and recognition of faces and hand gestures [1]. Being able to recognize faces and hand gestures has tremendous potential in applications such as teleconferencing, telemedicine, and advanced interfaces for HCI. Hand gestures are an appealing way to interact with such systems as they are already a natural part of how we communicate, and they don't require the user to hold or physically manipulate special hardware. [2] Recognizing gestures is a complex task which involves many aspects such as motion modeling, motion analysis, pattern recognition and machine learning, even psycholinguistic studies generally; gestures can be classified into static gestures and dynamic gestures. Static gestures are usually described in terms of hand shapes, and dynamic gestures are generally described according to hand movements. [3] Gesture recognition system we have proposed is a step toward developing a more sophisticated recognition system to enable such varied uses as menu-driven interaction, augmented reality, or even recognition of Sign Language. Freeman and Roth introduced a method to recognize hand gestures, based on pattern recognition technique developed by McConnell employing histograms of local orientation. Naidoo and Glaser [4] developed a system that is recognized static hand gesture against complex backgrounds based on South African Sign Triesch and Malsburg [5] loyed the Elastic-Graph Matching technique to classify hand postures against complex backgrounds, hand postures were represented by labelled graphs with an underlying two dimensional topology, attached to the nodes were jets. A jet is simply a local image description based on Gabor filters. This approach can achieve scale-invariant and user-independent recognition, and it does not need hand segmentation. Since using one graph for one hand posture is insufficient, this approach is not view-independent. The recognition rate achieved against complex backgrounds was 86%. Just proposed to apply to the hand posture classification and recognition tasks an approach that has been successfully used for face recognition, the feature based on the local non-paramedic pixel operator: Modified Census Transform (MCT) and are illumination invariant.

A. MOUSE REPLACEMENT

Another interesting characteristic that will be ignored by this project is the ability that ASL offers to describe a person, place or thing and then point to a place in space to temporarily store for later reference. ASL uses facial expressions to distinguish between statements, questions and directives. The eyebrows are raised for a question, held normal for a statement, and furrowed for a directive. There has been considerable work and research in this paper brings out an innovative idea called as mouse for handless human (MHH) to use the camera as an alternative to the mouse. The mouse operations are

controlled by the hand gesture captured by the camera Gesture Recognition Technology for Games Poised for Breakthrough on the website of Venture Bet (http://venturebeat.com).[6] In the near future, for example, users will likely be able to control objects on the screen with empty hands, as shown in Figure 1.

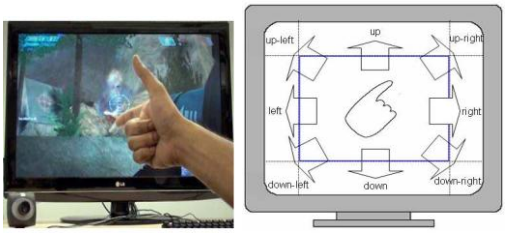

Fig. 1 Controlling Games with Gesture

Most applications, such as recognizing particular static hand signal, require a richer description of the shape of the input object than image moments provide. If the hand signals fell in a predetermined set, and the camera views a close-up of the hand [7], we may use an example-based approach, combined with a simple method top analyze hand signals called orientation histograms. The user shows the system one or more examples of a specific hand shape. The computer forms and stores the corresponding orientation histograms. In the run phase, the computer compares the orientation histogram of the current image with each of the stored templates and selects the category of the closest match, or interpolates between templates, as appropriate. This method should be robust against small differences in the size of the hand but probably would be sensitive to changes in hand orientation.

B. AMERICAN SIGN LANGUAGE

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 [8]. 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 alphabet. Another interesting characteristic that will be ignored by this project is the ability that ASL offers to describe a person, place or thing and then point to a place in space to temporarily store for later reference. ASL uses facial expressions to distinguish between statements, questions and directives. The eyebrows are raised for a question, held normal for a statement, and furrowed for a directive. There has been considerable work and research in facial feature recognition, they will not be used to aid recognition in the task addressed. This would be feasible in a full real-time ASL dictionary. Some of the signs can be seen in fig 2 below.

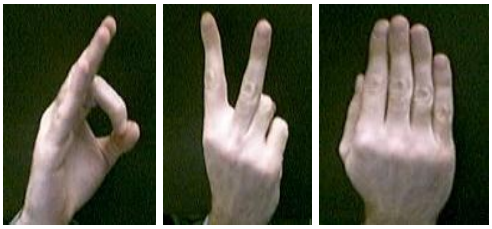

Fig. 2 **ASL** examples

Full ASL recognition systems (words, phrases) incorporate data gloves. Takashi and Kishino discuss a data glove-based system that could recognize 34 of the 46 Japanese gestures (user dependent) using a joint angle and hand orientation coding technique. A separate test was created from five iterations of the alphabet by the user, with each gesture well separated in time. While these systems are technically interesting, they suffer from a lack of training.

C. ARTIFICIAL NEURAL NETWORK

An Artificial neural network is an information processing system that has certain performance characteristics in common with biological neural networks. Artificial neural networks have been developed as generalizations of mathematical models of human cognition or neural biology, based on the assumptions that [9]:

1. Information processing occurs at many simple elements called neurons.
2. Signals are passed between neurons over connection links.
3. Each connection link has associated weight, which in a typical neural net, multiplies the signal transmitted.

Each neuron applies an activation function (usually nonlinear) to its net input (sum of weighted input signal) [10]. Figure 3 shows a simple artificial neuron.

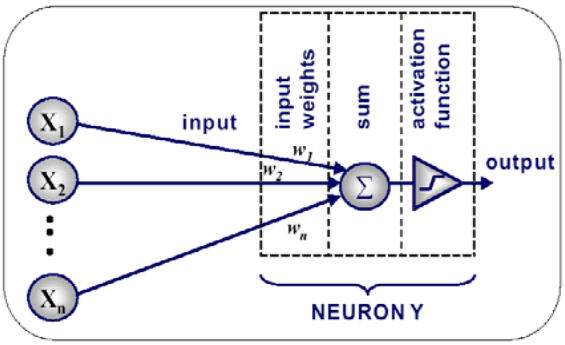

Fig. 3 A Simple Artificial Neuron

Today neural networks can be trained to solve problems that are difficult for conventional computers or human beings. The supervised training methods are commonly used, but other networks can be obtained from unsupervised training techniques or from direct design methods.

II. METHOD

In this paper, a new approach for the static hand gesture recognition is proposed. The presented system is based on one powerful hand feature in combination with a multi-layer neural-network based classifier. The hand gesture area is separated from the background by using the well-known segmentation method of skin color that used in face recognition , then a contour of hand image is used as a feature that describe the hand shape. The image size is adjusted so that the width and height reaches a default value.

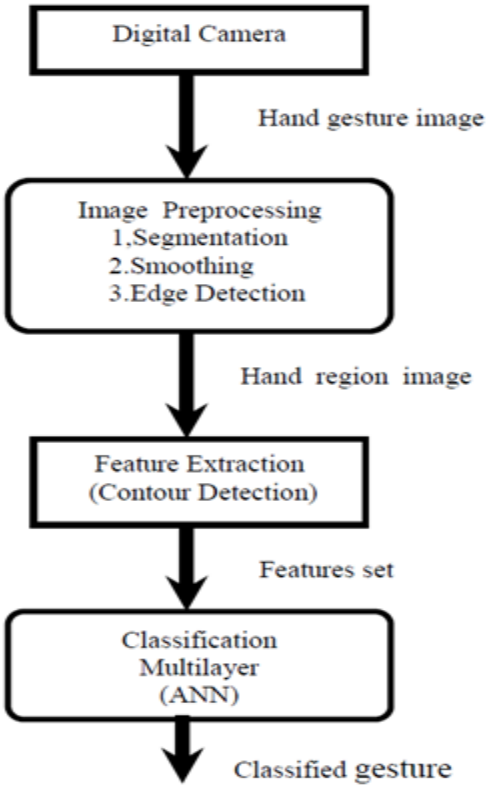

Fig. 4 Block diagram of the recognition system

As such, the general process of the proposed method is composed of three main parts:-

1. A preprocessing step to focus on the gesture.

2. A feature extraction step that use the hand contour of the gesture image, it is based on an algorithm proposed by Joshi, and Sivaswamy [11]. The hand contour will act as the feature of the gesture.

3. A classification step the unknown gesture's feature will be produced and entered to the neural network.

The gesture recognition process diagram is illustrated in figure 4, the hand region obtained after the preprocessing stage and it will be used as the primary input data for the feature extraction step of the gesture recognition algorithm.

A. GESTURE MODELING

In Human-Computer Interaction (HCI), the selection of hand gestures is an essential aspect to best design appropriate gesture vocabulary for Human-Computer Interaction [12].The differentiation and anatomical possibilities of hand gestures must be considered. One purpose of Human-Computer Interaction is to make a computer tasks controlled by a set of commands in the form of hand gestures. In our hand recognition system, six commands of static hand gestures are designed. Figure 5 show the static control commands hand gestures for Human-Computer Interaction.

Fig. 5 Hand gestures for Human-Computer Interaction (HCI)

B. FEATURE EXTRACTION

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. Feature extraction operates on two-dimensional image arrays but produces a list of descriptions or a 'feature vector' [13]. 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. Features are thus selected implicitly and automatically by the recognizer [14]. Following fig. 6 shows feature extraction of image analysis. In this paper we select the hand contour as a good feature to describe the hand gesture shape [15]

Fig. 6 The feature extraction aspect of image analysis.

III. EXPECTED RESULT

Many attempts to recognize static hand gestures shapes from images [16] achieved fairly good results, but this is mainly due to either very high computation or the use of specialized devices. One such attempt is that of Driesch and Malsburg how have achieved good recognition rate (86.2%) using the Elastic-Graph matching technique to classify hand postures against complex backgrounds [17]. The aim of this system is to achieve relatively good results but at the same time a trade off must be considered between time and accuracy. However we will aim to achieve very good accuracies.

IV. CONCLUSION

This paper propose a method of classifying static hand gestures using hand image contour where the only features are that of low-level computation. Using Skin color segmentation provide good results for isolate foreground from background This method robust against similar static gestures in different light conditions. The major goal of this research is to develop a system that will aid in the interaction between human and computer through the use of hand gestures as a control commands.

REFERENCES

[1] Bowden & Sarhadi," Building temporal models for gesture recognition" in Proc. British Machine Vision Conference, 2000, p. 32-41.
[2] J.Maclean, R.Herpers, C.Pantofaru, L.Wood, K.Derpanis, D.Topalovic,J.Tsotsos, "Fast hand gesture recognition for real-time teleconferencing applications," *Proc. Of the IEEE* ICCV Worksop on Recognition, Analysis and Tracking of Faces and Gesture in Real-Time Systems, RATFE-RTS 2001, pp. 133-144, 2001
[3] Chang, J. Chen, W. Tai, and C. Han, "New Approach for Static Gesture Recognition", Journal of *Information Science and Engineering22, pp. 1047-1057, 2006.*
[4] S. Naidoo, C. Omlin and M. Glaser, "Vision-Based Static Hand Gesture Recognition Using Support Vector Machines", 1998,p. 88 – 94.
[5] J. Driesch, and C. von der Malsburg, "Robust classification of hand postures against complex backgrounds", in Proc. Second International Conference on Automatic Face and Gesture Recognition, p. 170 – 175
[6] (2004)Gallaudet University Press, 1,000 Signs of life: basic ASL for everyday conversation, Gallaudet University Press [online] Available,. httpm
[7] Bauer & Hienz," Relevant feature for video-based continuous sign language recognition", Department of Technical Computer Science, Aachen University of Technology, Aachen, Germany, 2000.p. 440 – 445.
[8] Starner, Weaver & Pentland, ,"Real-time American Sign Language recognition using a desk- and wearable computer-based video", in proc. IEEE transactions on Pattern Analysis and Machine Intelligence, 1998, p. 1371-1375.
[9] L. Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms, and Applications", Prentice-Hall, Inc. 1994, p.304-315.
[10] K.Murakami, H.Taguchi, " Gesture Recognition using Recurrent Neural Networks, in CHI '91 Conference Proceedings ACM. 1991, p. 237-242.
[11] G. Joshi, and J. Sivaswamy, "A simple scheme for contour detection", 2004, p. 236-242.
[12] (1998),Hans-Jeorg Bullinger Human-Computer Interaction [online], available, http://www.engadget.com.
[13] G. Awcock, and R. Thomas, "Applied Image Processing. ", Acmillan press LTD, London1995, p.1281 - 1284
[14] Vladimir I. Pavlovic, Rajeev Sharma, Thomas S Huang, "Visual Interpretation of Hand Gestures for Human-Computer Interaction: A review" *IEEE Transactions of pattern analysis and machine intelligence, Vole 19, NO 7, July 1997, pp.*677 - 695
[15] Davis & Shah" Visual gesture recognition", in proc. IEEE Visual Image Signal Process, 1994, vol.141,Issue:2,p. 101 – 106.
[16] "Hand gesture Recognition of Radial Basis Functions (RBF) Networks and Decision Trees *"International Journal of Pattern Recognition and Artificial Intelligence.* Volume: 11, Issue: 6 1997 pp. 845-850.
[17] Face detection in complicated backgrounds and different illumination conditions by using YCbCr color space and neural *network Pattern Recognition Letters, Volume28, and Issue 16, 1 December 2007, Pages 2190-2200.*