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Hand Gesture Recognition on Indian SignLanguage using Neural Network

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Abstract

In order to recognize hand motions during human-computer interaction, a unique approach is presented in this study. Frequently The hand gesture recognition system is made such that it just needs a camera as unique hardware. The study of user and computer interaction is known as human-computer interaction, or HCI. Our major goal is to investigate the neural network-based method for hand gesture detection. We have employed an orientation histogram technique that can identify a subset of Indian sign language (ISL) hand movements. An picture is transformed using a pattern recognition algorithm into a feature vector, which is then compared to the feature vector of the training set of motions. A perceptron network is finally used to create the final system.

Keywords: HCI, ISL, ANN, Pattern Recognition.

I. INTRODUCTION

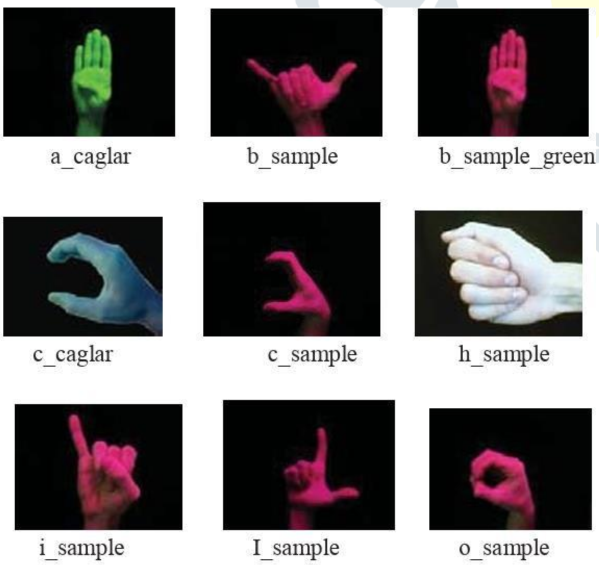
The goal is to create a user-friendly human-computer interface (HCI) and teach computers to understand human language. A step in that direction is teaching a computer to recognize speech, facial emotions, and human movements [1]. The study of user-computer interfaces is known as human-computer interaction (HCI) [2]. Gestures serve as a nonverbal means of communicating information that cannot be expressed orally. As we all know, one individual is capable of making many motions at once. A gesture is a physical movement that conveys a thought or attitude [3]. A set of hand and arm motions known as hand gestures range from the

static condition of pointing to the dynamic state [4]. Currently, hand gesture detection is a hot issue in several fields, including computer society. A hand gesture recognition system has been used for a variety of applications in sign language, virtual worlds, intelligent surveillance, robot control, and other fields [5]. Each motion in sign language has a specific meaning.

II. SURVEY

We have taken into account a number of earlier efforts in this subject. These various works were created by various researchers. Different researchers used a variety of strategies, including vision-based, data-glove-based, artificial neural network, fuzzy logic, genetic algorithm, hidden markov model, support vector machine, etc. The works that have come before are listed below. Numerous studies have been conducted on various facets of this strategy. Based on McConnell's histograms of local orientation-based pattern recognition approach, Freeman and Roth [13] jointly established a method to identify hand motions in 1995. Their approach classifies gestures by using the orientation histogram as a feature vector. The lighting changes in the image are provided by this approach, which is quick and easy to compute. Naidoo et al. [14] are a part of a different group of academics that proposed a similar approach in 1998 for identifying static hand photographs against intricate backgrounds.

Hand motions are categorized using a method. A linear machine with some excellent characteristics is the support vector machine (SVM). Licsar and Sziranyi [15] (2002) created a different hand gesture detection system based on the form analysis of static movements for HCI. MFD (Modi Descriptors) are used in this appearance-based identification method to categorize different hand forms. Chang et al. (2006) [16] introduced a novel method for recognizing static gestures based on Zernike Moments (ZMs) and Pseudo-Zernike Moments (PZMs). Using the modified color segmentation method, a static input gesture is first segmented into a binary hand outline. The binary hand outline and Minimum Bounding Circle (MBC) are optional in the second stage. By examining the unprocessed streams produced by the sensors attached to human hands, Parvini and Shahabi (2007) [17] have likewise suggested a method for identifying static and dynamic hand motions. The process of identifying a sign involves observing all variations of hand gestures and finger-joint movements from a beginning position to an ending position. A framework for a human-computer interface that can recognize gestures from the Indian sign language is presented in D. Deora and N. Bajaj's 2012 paper, "Indian sign language recognition" [18]. . For words and phrases, this approach may be expanded. PCA is utilized for recognition in this case. This research also suggests using neural networks for recognition. P. R. Vinod, V. Adithya, and U. Gopalakrishnan Indian sign language recognition using an artificial neural network-based technique [19] in 2013. They created a system that can decode sign language automatically. The installation of such a system gives hearing-impaired persons a platform for communication with the rest of the world



without the use of an interpreter. In this article, we provide a technique for the automated decoding of Indian sign language fingerspelling. The suggested solution recognizes various indicators using artificial neural networks and digital image processing methods. M. S. Kumbhar and S. N. Sawant. Real-time PCA for Sign Language Recognition [20]. This study describes a MATLAB-based sign language recognition system that can identify various Indian Sign Language motions. Four modules make up the proposed system: feature extraction, sign recognition, sign-to-text conversion, and sign-to-voice conversion. Pre-processing and hand segmentation are also included. Different characteristics are retrieved for recognition, including Eigen values and Eigen vectors. The motion was detected using the Principle Component Analysis (PCA) technique, and the recognized gesture was then transformed to text and speech format. The suggested approach reduces communication gaps between the deaf-dumb and the general population.

III. APPLICATIONS

Given that vision-based recognition is currently more practical, the study of vision-based hand gesture recognition has recently been quite active. Applications like sign language recognition, socially assistive robotics, pointing-based direction indication, facial gesture control, human-computer interaction (HCI), immersive gaming technology, virtual controllers, affective computing and remote control, smart surveillance, robot control, and medical systems, among others [5] were inspired by it. Below is a summary of several application areas for hand gestures. Sign Language Understanding Robotic command Control of the Graphic Editor VEs, or virtual environments Recognition of Numbers Television Control a 3D model.

IV. INDIAN SIGN LANGUAGE

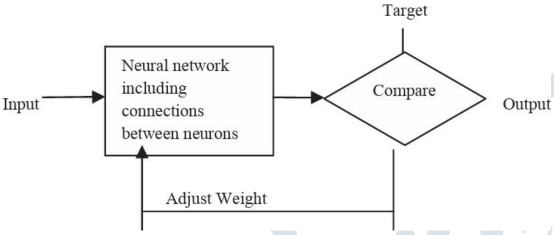
Known for its use in a variety of motions, Indian Sign Language (ISL) is a sign language. ISL is now often used by the deaf and the illiterate to identify actions [6]. ISL was once used by hearing-impaired Indians to communicate with hearing persons using computers. ISL is sometimes called the Deaf and Dumb language. Apparently, ISL is a gestural language [6]. A speech channel is not required for ISL communication. Glove-based analysis, vision-based analysis, and sketching gestures analysis are the three basic methods used in hand gesture analysis. It is often divided into two states. 2) Non-manual (facial expression, eye gaze, and head/body stance). Instruction manual (hand outline, location, direction, and motions). One-handed and two-handed signs in ISL can have a static or dynamic state. It is appropriate to consult the chart of the relevant sign language hierarchy before designing any sign language learning system. ISL's letter set is displayed in Figure 1.

Fig-1 (ISL Alphabet Set)

V. NEURAL NETWORK

A neural network is a mostly parallel distributed processor with basic processing units that has a natural propensity for accumulating and storing investigative knowledge. By altering the values of the connections (weights) between components, we may direct a neural network to carry out a certain function. Neural networks are often controlled, or trained, so that every input results in a certain intended output. Fig. 2 depicts such a situation. So, until the network output meets the target, the network is controlled, which is based on a comparison of the output and the target [11].

Fig-2 Neural Network



In a variety of application areas, including pattern recognition, identification, classification, speech, vision, and control systems, neural networks have been trained to carry out composite operations.

THE PERCEPTRON CONVERGENCE ALGORITHM

For the improvement of the error-correction learning algorithm for a single-layer perceptron, we will work with the signal-flow graph shown in Fig 3.

FIG-3

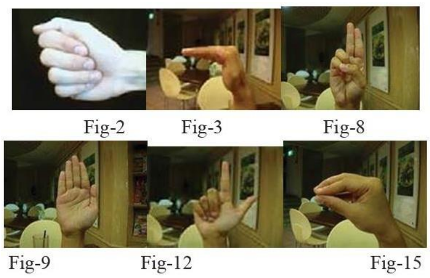


Fig-25

We may categorize the (p+1) by-1 input vector as follows using the perceptron single flow graph:

x(n) = [-1, x1(n), x2(n),... xp(n)]T

In accordance with this, we define the (p+1)-by-1 weight vector as [(n),w1(n),w2(n), wp(n)]T

The convergence algorithm's variables and parameters are listed below.

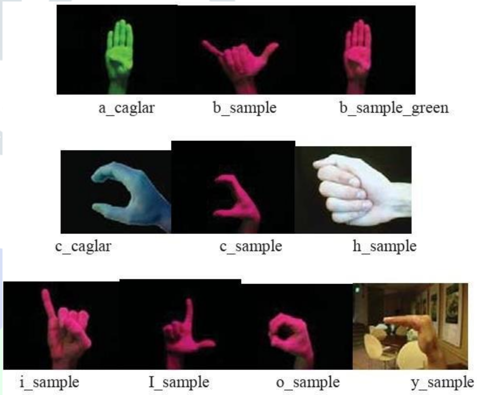
input = x(n) Weight is w(n).
(n) = the threshold Actual response: y(n) Desired response: d(n)

In order to fully assent to the 4-step algorithm:

Initialization, first.
Step 1:Put w(0)=0. then carry out the calculations shown below for time n=1, 2....

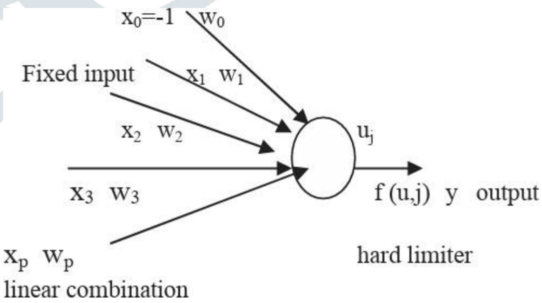
Step 2: Activation Apply the desired response d(n) and the continuous-valued input vector x(n) to start the perceptron at time n.

Step 3: Determine the Actual Response. Calculate the perceptron's real response: y(n) equals wT(n)x(n)
The linear output is written as u(n)= wT(n)x(n), where sgn(u) = +1 if u>0 and sgn(u) = -1 if u0



Step 4: variation of Weight Vector w(n-y(n)]x(n) where d(n) =+1 if x(n) belongs to class C1 d(n) = -1 if x(n) belongs to class C2 Step 5: Increment time n by 1 unit and go back to step 2.

VI. EXPERIMENTS AND RESULT



The experiments below are carried out with MATLAB R2012a and ADOBE Photoshop 7.0. putting the findings of the reference on display. Different Sign pictures are taken into account, and they produce various outcomes. First, a pre-processing procedure was used on several photos, taking into account the blurring and noise parameters as stated in table 1. The pre-processing processes, such as blurring and noise, are described in Table 1. Adobe Photoshop is used to carry out this process. If the image contains noise, we attempt to extract it before

Table 1: Experiment Result

Gesture	Number of gesture	Successful recognition	Recognition rate %
Open	2	2	100
Close	1	1	100
Refresh	1	1	100
Cut	3	3	100
Copy	3	2	66.6
Total	10	8	93.32

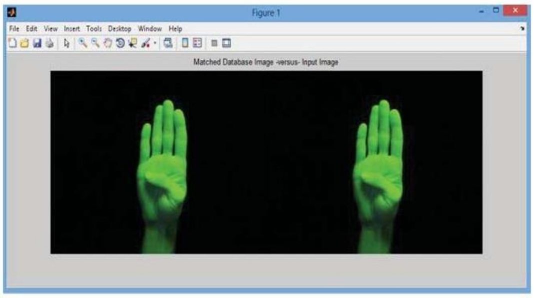
searching the database for the corresponding input image. Every time the method is used, the outcome varies as well. There is barely any change. In Adobe Photoshop 7.0, all filtering procedures were carried out. Calculated in pixel radius is blur. Similar to capturing a picture of a moving automobile, motion blur. Either uniform or gaussian noise. Now we will run the algorithm in MATLAB to distinguish the input image from the database image. Below are some photos that were pulled from the database.

We will now attempt to match the input photographs with the database images by supplying them. The outcome is defined to be a match database image versus the input image since we will obtain the matching image from the database image.

Fig-5 Test Image

We will now use a series of photographs as a refresh. cut gesture= b_sample, i_sample, I_sample copy gesture= c_caglar, c_sample, o_sample gesture= y_sample open gesture= a_caglar, b_sample_green close gesture= Refreshing motion

OPEN GESTUTRE



CLOSE GESTURE

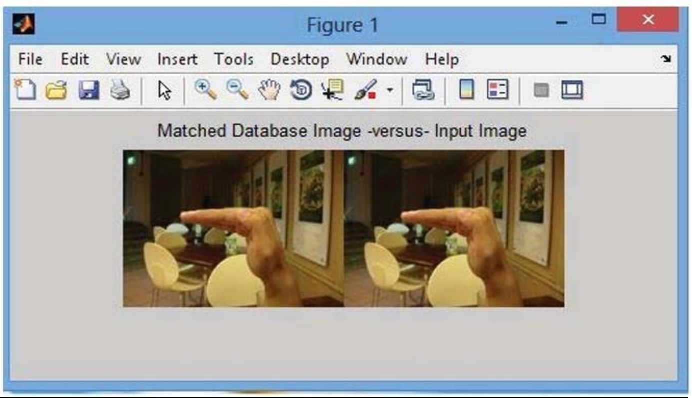
Fig-8 Output Image Close gesture

The performance of the proposed system is assessed based on its capacity to correctly recognize gestures to their corresponding input gestures; the metric used to do this is known as the recognition rate. Each gesture has a table of recognition results, and with neural network outputs for one gesture image. The definition of the recognition rate is

Recognition rate = No of successful recognition gestures X 100 / Total number of gestures

VII. CONCLUSION

Neural networks were combined to begin this research. We will utilize orientation histograms because we discussed how they function and how important they are for categorization. Histograms of orientation have been employed in other approaches to pattern recognition that also make use of unique comparing and classifying techniques. It's a powerful algorithm. We may demonstrate inferences from the network output, which is another benefit of employing neural networks. At long last, it is announced that the project has a solid conclusion. Only the initial phase of the project makes this possible. The output vector will remain constant no matter how many times you execute the program. With the perceptron, this is not the situation. In addition to not being completely stable, it is difficult to determine the



ideal settings since there are so many variables that can be involved (such as the number of layers and nodes). It all boils down to the application, as was already indicated.

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