

Hand Signs Recognition System Based On Genetic Algorithm

Adnan Ahmed

Department of Computer Science, Bahria University Karachi, 75260, Pakistan
Adnan.bukc@bahria.edu.pk

Hassan Farooq

Department of Computer Science, Bahria University Karachi, 75260, Pakistan

Kanwal Jahan

Department of psychology, Sir Syed Govt. College Nazimabad Karachi, Pakistan

Received: 6th September, 2022; Accepted: 13th September, 2022; Published: 21st September, 2022

Abstract: Gestures-based correspondence is a common language used by persons who use a hearing aid for correspondence purposes. Regardless of how well they communicate with one another using a gesture-based approach, they struggle with a lack of clarity when they try to communicate with individuals who can see sound, particularly those who can't understand gesture-based communication. Hand gestures are one of the nonverbal communication strategies used in gesture based communication. It is most commonly used by hard of hearing and imbecilic people who have hearing or speech problems to communicate among themselves or with other people. Numerous producers throughout the world have developed various gesture-based communication frameworks, however they are neither adaptable nor practical for end users. Currently, a number of experts in academia and industry are interested in this topic. It enables a person to work successfully and efficiently with a machine without the need for any additional equipment. In this study, we discuss work in the field of hand signal recognition, with a focus on sensitive processing-based strategies such as hereditary computation.

Index Terms: Computer vision, Hand Sign Recognition, Sign Gesture Recognition, Hand Sign Classification

1. INTRODUCTION

Gestures are the implied expressions of human which he communicates as activities. It permits people to impart sentiments and considerations with various feelings with words or without words [1]. Gestures Recognition has become a functioning examination territory in the field of Computer vision, Image Processing and Artificial Intelligence. Human hand can have development toward any path and can curve to any edge in every accessible facilitate [2]. Correspondence by means of gestures as such a sign is a champion among the most trademark techniques for trading data for hardest of hearing people [4]. The target of Gestures based correspondence, communication through signing acknowledgment (SLR) is to give a gainful and definite instrument to make an interpretation of Gestures based correspondence into the substance or talk with the goal that correspondence among in need of a hearing aid and tuning in to society can be more useful [5].

In this entire world, there is a tremendous advancement of processing procedures and because of universal strategies for figuring, current client association with the pointing and situating gadgets, for example mouse, console and pen are not unreasonably adequate. These gadgets are just restricted so the orders set is additionally constrained. Utilizing

Hand Signs Recognition System Based on Genetic Algorithm

body parts like hand gestures for communication shown below in figure [1], for example, utilization of hands, is a superior alternative. Hands can be utilized as an info gadget for giving characteristic communication.

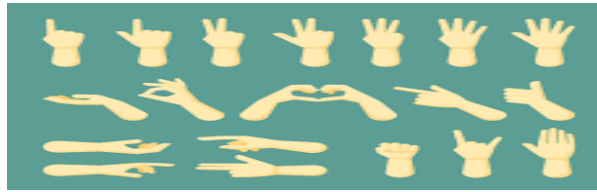


Fig. 1. Hand signs patterns

There are essentially two techniques to differentiate hand signal acknowledgement. The first is instrumental recognition, while the second is recognition based on vision. A few sensors are placed on an instrumental glove, and someone must wear the glove in order to receive contributions, and then the contribution for hand motion is made as indicated by hand or finger development [6, 7]. The photocell is dealt with by this instrumented glove. When light strikes a photocell, it causes the growth of hands and fingers, and the information obtained differs. Instrumented gloves are less commonly used due to their expensive cost and the fact that they are more difficult to use because contributing to this approach increases the risk of making a mistake, such as holding hand in realized on a field-programmable door display and utilizing same for a long period A vision-based technique appeared to beat this methodology.

2. LITERATURE REVIEW

There is some evidence that people who cannot hear and understand spoken instructions. In [1] N. Intwala., *et al.* (2019) developed an active system for sign language gesture acquisition and recognition using an accelerometer glove, as well as the usage of marking signals to certify communication. The most important information regarding developing sensors is provided, as well as the structure of the sign collecting system and expand recommendation. The game plan assessment presents the outcomes of a movement confirmation attempt using a specified set of motion-based correspondence movements and an illustrated approach using hidden Markov model (HMM) and equal HMM techniques.

According to [3] Zhou, D., *et al.* (2016) they employs the most effective computation for hand motion recognition, which yields optimal results and is low in complexity. However, if the skin shading is the same as the foundation or the circumstance where the hand is present, his framework will not identify the skin shade and foundation, which is a substantial concern because it may modify our complete result and lead to fraudulent yield. To help distinguish between skin and foundation shading, we're utilizing the YUV shading space using camshaft calculations in my project.

In [4] Tang, K. S., *et al.* (1996) presented a half-and-half system for an equipment framework for posture recognition. Self-masterminding map (SOM) and Hebbian framework are two cross-variation frameworks. Feature vectors are extracted from data location images and routed to a lower-dimensional neuronal guide in the SOM. The Hebbian framework is a single-layer feed forward neural framework that recognizes characterizations using a Hebbian learning figure. The SOM-Hebb classifier's ability to transform and scale was improved by adding disturbance to the arrangement data. The whole framework is a revolutionary video preparation strategy. The system was designed to see 24 American motion-based correspondence hand signals, and its veracity was tested using two amusements reproductions and testing.

In [6] Kelly, D., *et al.* (2010) have suggested a new different case learning thickness framework count that generally expels bound indications from full sentences utilizing the fragile and turbulent management of substance understandings. Our spatiotemporal sign and hand position classifiers are then set up using the isolated separated

Hand Signs Recognition System Based on Genetic Algorithm

samples. The tests were carried out to see how well the updated sign extraction, hand position representation, and spatiotemporal sign spotting structures were executed.

According to [7] Gałka, J., *et al.* (2016) the direction histogram is used to categorize distinct gestures and interjections. The histogram is incredibly simple and useful since it ensures that motion recognition is accurate in a variety of lighting and colors. Because the growth of the hand in a unique motion changes over time, the primary preferred place of the histogram is in powerful signals, as demonstrated by this article. As a result, the histogram aids in the discovery of dynamic motions without difficulty. In any event, the fact that analogous motions can have different sorts of histogram directions and that comparable histogram directions might speak to completely different movements is a bit perplexing in motions using direction histogram.

As signal acknowledgment is valuable for these days so a few analysts likewise shaping Gesture acknowledgment utilizing repetitive neural systems. As indicated by Murakami *et al.* Intermittent neural system additionally has its own preferred position in motion acknowledgment as in gesture based communication to separate between words like prepared undeveloped, mother, father, present.

In [11] Chaudhary, A., *et al.* (2011) developed a unique approach in which the primary model set is changed to a specific endorser with his or her little fraction of planning data. Initially, inclination multiplication is utilized to separate the models of endorser let loose secured Markov models; after that, the flexible planning vocabulary may be fashioned in this way. To give guarantee balanced models, a combination of most outrageous a posteriori and iterative vector field smoothing is used to consider the collected sign signals of the fresh language. The preliminary results, which are based on six guarantors, show that the suggested technique can reduce the amount of altered data while still achieving a high recognition rate.

It's difficult to develop an invention that allows humans to go missing. So this neural system is quite useful because it allows our framework to capture prior history and separate the words that are used two by two, which is very confusing. However, intermittent neural systems in signal recognition have their own drawbacks; for example, learning simply 10 to 20 words while Because developing the framework might take four to five days, that is a substantial amount of time, we don't employ neural networks for motion detection in my framework.

There are many different methods for recognizing gestures, including statistical modelling techniques like Hidden Markov Models (HMM) and Principal component analysis (PCA), which are used to extract characteristics from photographs of hand gestures. It models a variety of data and is a twofold stochastic process driven by a Markov chain, to methods based on soft computing tools like Artificial Neural Networks (ANN) [13] Genetic Algorithms (GA)[15] are effective for difficult pattern identification and classification applications. For the feature selection issue, utilize [16]. For classification, methods like Support Vector Machines (SVM)[18], particle filtering and condensation algorithm, and finite state machines (FSM) [19] a method for gesture recognition has been utilized.

There is a class of parallel adaptive Genetic algorithms. Methods for searching based on the principles of natural natural genetics and selection. In the previous twenty over the years, it has been utilized to address a variety of search, machine learning and optimization. GA has excellent advantages over alternative methods, such as its simplicity recognize, it is multi-objective optimization-compatible, and it excellent in "noisy" situations. GA has innate parallelism and is widely available.

3. HAND GESTURES BASICS

Here we can concentrate on human to machine connection (HMI), in which machine would have the option to perceive the signal made by human. There are approaches of two sorts.

- a. Appearance based methodologies where hand picture is reproduced
- b. Model based methodologies where various models are utilized to display picture

Human Computer Interface (HCI): is the process of collaborating or conversing with a machine. Humans can use a variety of methods to communicate with computers, including hand movements, eye recognition, and other devices such as instrumented gloves.

3.1. GESTURES

We may define gesture as a form of body language that involves the movement and motion of body parts to communicate with others. If both parties understand the meaning of the gesture, it is a very rapid way to communicate. This allows us to express our feelings with just a few gestures. There are two sorts of movement gestures:

- a. Dynamic Gesture - Variation over time. Waving a hand, for example, signifies "goodbye."
- b. Static Gesture - seen during a short period of time. It is a form of static gesture that signifies "halt."

4. PROPOSED WORK

Geometry Design in 3 ds Auto CAD (computer-aided design) deploying sophisticated software on a computer to model physical infrastructure and material qualities that is used to create and sketch two and three-dimensional pictures. Creating a 3Ds image needs altogether its six Degrees of Freedom (DOF), and the process of distributing points in space with a mouse is extremely chaotic and difficult making it impossible for a programmer or user to build 3D design using mouse and keyboard. CAD now has the ability to rotate or translate picture points in any direction. We can also see the image from whichever orientation we choose to analyze it using this.

4.1. Virtual reality is a computer-generated three-dimensional environment that users may utilize with the assistance of software to run their programs and test their systems as if they were in a real setting. The virtual environment that is now in use may be presented on displays and allows the operator to access. It runs all of the system's programs. It may be broken down into the following categories:

- a. Creating an imitation or simulation of a real-world environment for software, projects, or systems testing and training. This might potentially be used for educational purposes.
- b. We can create an atmosphere that seems like real-life locations but does not occur. For example, we encounter various maps or locations that seem exactly like real-life locations in games but are do not exist in real life like Pubg and GTA Vice City.

4.2. Sign Language is distinct from the verbal or spoken language we use on a daily basis. This sign language encompasses all nonverbal forms of communication (5), such as body movement in response to any remark, hand gestures to communicate concepts to others, and facial expressions. Individuals who are deaf or mute typically utilize

Hand Signs Recognition System Based on Genetic Algorithm

this language. It was extremely difficult to communicate with certain physically challenged people before this language was discovered. They can understand you but not express themselves at times, and they can express themselves but not understand you at other times. A deaf person may be able to comprehend what you're trying to say after seeing this language, and a mute person may even be able to communicate after seeing it.

We may observe one side reporter talk on specific news channels, and according to that reporter's report, a person uses sign language to communicate that information to deaf people, and by doing so, a normal person can learn how to use sign language effectively.

5. PHASES OF GESTURE RECOGNITION

Phase 1: The first image is captured from the stream using an OpenCV enabled camera .

Phase 2: In the second the picture is handled that's the kind of data it's holding.

Phase 3: In the 3rd phase to find the optimal signal, information computations are used.

Phase 4: Obtained signal is currently contrasted and motion dataset.

Phase 5: When on the off chance that any dataset motion is coordinated with input motion, at that point the outcome will have shown on screen or motion is perceived.

The next step after tracking the hands is to separate the hands from the backdrop. Several general-purpose characteristics are retrieved during feature extraction, and a suitable classifier infers the link between the features and classes. The following features have been chosen from the shape representation suggested in [12].

With the extraction of the input character's features, we look up those features in the database and take the features that are most comparable as the outcome.

Shown in figure [2] initially, the hand sign will be acquired.



Fig.2. Hand Gesture Recognition

Then, the recognized hand gesture will be then subjected to Convex hull + Extreme point. After that finding the center of palm and construct a circle with center of palm and around the fingers. Here, bitwise will be carried out between hand region and circle. Later, fingers will be count. shown in figure [3].

Hand Signs Recognition System Based on Genetic Algorithm

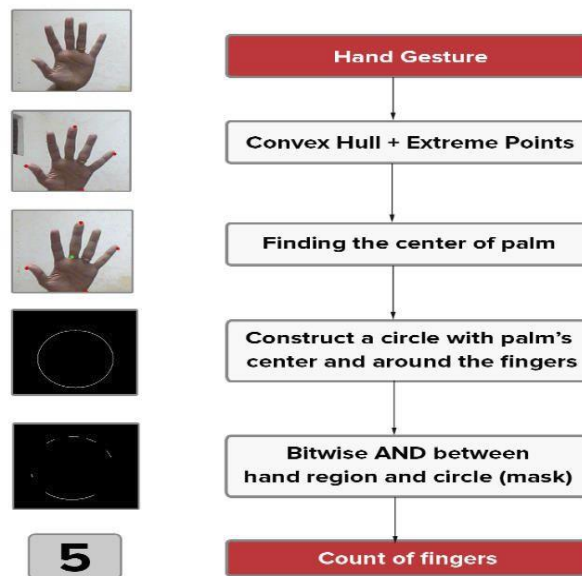


Fig.3. Framework for hand sign recognition

6. CONCLUSION

Interaction between living things, such as humans and machines, via a computer interface. The recognition system for hand gesture this is how it works: initially, the user provides input to the system by performing hand motions, then the system shots the movements with a camera or sensor and transforms it to a signal, which is then provided to the software. Now it's up to the software to take the signal, study the input provided by gestures, and see whether any related data is recorded in the dataset, after which we'll have our result.

References

- [1] N. Intwala, A. Banerjee, Meenakshi and N. Gala, "Indian sign language converter using convolutional neural networks", *5th International Conference for Convergence in Technology (I2CT)*, pp. 1-5, 2019.
- [2] Chaudhary, A., Raheja, J. L., Das, K., & Raheja, S. (2013). Intelligent approaches to interact with machines using hand gesture recognition in natural way: a survey. *arXiv preprint arXiv:1303.2292*.
- [3] Zhou, D., Fang, Y., Botzheim, J., Kubota, N., & Liu, H. (2016, December). Bacterial memetic algorithm based feature selection for surface EMG based hand motion recognition in long-term use. In *2016 IEEE Symposium Series on Computational Intelligence (SSCI)* (pp. 1-7). IEEE.
- [4] Tang, K. S., Man, K. F., Kwong, S., & He, Q. (1996). Genetic algorithms and their applications. *IEEE signal processing magazine*, 13(6), 22-37.
- [5] Murakami, K., & Taguchi, H. (1991, March). Gesture recognition using recurrent neural networks. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 237-242).
- [6] Kelly, D., Mc Donald, J., & Markham, C. (2010). Weakly supervised training of a sign language recognition system using multiple instance learning density matrices. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, 41(2), 526-541.
- [7] Hikawa, H., & Kaida, K. (2014). Novel FPGA implementation of hand sign recognition system with SOM–Hebb classifier. *IEEE Transactions on Circuits and Systems for Video Technology*, 25(1), 153-166.

Hand Signs Recognition System Based on Genetic Algorithm

- [8] Gałka, J., Maşior, M., Zaborski, M., & Barczewska, K. (2016). Inertial motion sensing glove for sign language gesture acquisition and recognition. *IEEE Sensors Journal*, 16(16), 6310-6316.
- [9] Felipe A. Monteiro, Thyago Estrabis, Raymundo Cordero, Juliana Montemor, João O. P. Pinto, "Tuning of a Type-III Software-Based Resolver-to-Digital Converter through Genetic Algorithm", *2020 IEEE International Conference on Industrial Technology (ICIT)*, pp.576-581, 2020.
- [10] Miller, G. F., Todd, P. M., & Hegde, S. U. (1989, June). *Designing Neural Networks Using Genetic Algorithms*. In *ICGA* (Vol. 89, pp. 379-384).
- [11] Chaudhary, A., Raheja, J.L., Das, K., Raheja, S. (2011). *A Survey on Hand Gesture Recognition in Context of Soft Computing*. In: *Meghanathan, N., Kaushik, B.K., Nagamalai, D. (eds) Advanced Computing. CCSIT 2011*. Communications in Computer and Information Science, vol 133. Springer, Berlin, Heidelberg.
- [12] Sushmita Mitra and Tinku Acharya, "Gesture Recognition: A Survey", *IEEE Transactions on Systems, MAN, and Cybernetics—Part C: Applications and Reviews*, Vol. 37, No. 3, May 2007.
- [13]. Assoc Prof Abd Manan Ahmad, Dr Abdullah Bade, et al. "Using Principal Component Analysis And Hidden Markov Model For Hand Recognition Systems", 2009 International Conference on Information and Multimedia Technology.
- [14]. Stefan Oniga, Alin Tisan, Daniel Mic, Attila Buchman and Andrei Vida-Ratiu, "Hand Postures Recognition System Using Artificial Neural Networks Implemented in FPGA", 30th ISSE 2007.
- [15]. Md. Rezwanul Ahsan, Muhammad Ibn Ibrahimy, Othman O. Khalifa, "Electromyography (EMG) Signal based Hand Gesture Recognition using Artificial Neural Network (ANN)", 2011 4th International Conference on Mechatronics (ICOM), 17-19 May 2011.
- [16] Ho-Duck Kim, Chang-Hyun Park, Hyun-Chang Yang, and Kwee-Bo Sim, "Genetic Algorithm Based Feature Selection Method Development for Pattern Recognition", *SICE-ICASE International Joint Conference 2006* Oct. 18-21, 2006.
- [17]. Angel Dacal-Nieto^{1,2}, Esteban Vázquez-Fernández^{1,3}, Arno Formella², Fernando Martín³, Soledad Torres-Guijarro¹, Higinio González-Jorge¹, "A genetic algorithm approach for feature selection in potatoes classification by computer vision", 2009 IEEE.
- [18]. Majida Ali Abed , Ahmad Nasser Ismail and Zubadi Matiz Hazi, "Pattern recognition Using Genetic Algorithm", *International Journal of Computer and Electrical Engineering*, Vol. 2, No. 3, June, 2010
- [19]. Yu Yuan and Kenneth Barner, "Hybrid Feature Selection for Gesture Recognition using Support Vector Machines", *ICASSP* 2008.

Authors' Profiles



Mr. Adnan Ahmed completed his Masters in Computer Science from University of Karachi and MS Computer Science from SMI University Karachi and pursuing his Ph.D in Machine Learning under NED University Karachi. Presently he is working as Senior Lecturer in Computer Science Department of Bahria University Karachi. His research Interest includes Machine Learning, Deep Learning, Artificial Intelligence, Brain signals & Quantitative EEG.



Mr. Hassan Farooq is a researcher who completed his Master of Science (MS) in Computer Science from one of the leading institute, named Bahria University, Karachi, Pakistan. He obtained a Bachelor of Engineering (BE) from IQRA University, Main campus Karachi Pakistan. He was also a member of the BUKC CS Department. His research Interest includes Machine Learning, Deep Learning, Artificial Intelligence, Heterogeneous Networks & Satellite Object Recognition.