

A Systematic Review on Hand Gesture Recognition

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Abstract: Hand gestures can act as an input to the computer for interactions with the humans. For example, playing or pausing media player using hand gestures or recognizing numbers from hand gestures. This paper describes the methods used for interaction between the human and the computer and the techniques which can be used to improve it. The potential applications of the developed system recognising static hand gestures are: recognition of sign language, controlling media players in laptops, controlling TV. While developing the system it is encountered that some problems which can be used for further researchers as an improvements to the system which are Dynamic gesture Recognition, Using both hands in virtual Reality, Usage of flow menus to practically use the hand gestures in HCI.

Keywords: Feature Extraction, HCI (Human Computer Interaction), Gesture Recognition

1. INTRODUCTION

Computers have become an essential part in everyone's life. Whether computers are being used for professional or non-professional tasks, the way humans interact with computers has evolved over time towards easing the interaction between humans and the computer. The most common input devices are the mouse and the keyboard. Any device that came in market is always a step ahead from the previous one in terms of performance, solving complex problems etc. Since the complexity of human needs has taken many folds and continues to grow, it is very important for computer programmers to keep the interaction of humans and computers as simple as possible. However earlier, the prime focus of computer programmers was more towards speed and the modifiable features. But the need for human interaction with computers as simple as possible has drawn their attention. There have been many attempts to create new ways through which a human can interact with computer and give commands to perform a task. There have been many attempts to create new ways through which a human can interact with computer and give commands to perform a task.

The main aim is to make machine understand humans in every way possible and keep it simple as well that is user friendly. Recognising facial expressions, understanding natural language, recognising hand gestures are a step closer towards it. Gestures are non-verbal form of communication. Humans use these gestures to convey several information. Since these gestures are vision-based, it is the field of researchers studying vision. The project aims at designing an interface for recognising hand gestures by computers. Developing this kind of system requires a complex algorithm.

Hand gesture detection is playing a key role in our Society and is having its deep roots in Human Day-to-Day conversation. As of today, Humans are more desired to talk to a computer through gestures or face detection rather than using mice and keyboard for interaction, as in games, Automation and everywhere we are seeing the importance of hand

gesture-based detection initiated with the invention of Sayre Glove in 1977. Gestures play an important role when we talk about individuals having some disabilities who are deaf and dumb. They are unable to communicate at hospitals, Banks and other important areas where communication plays an important role.

Gestures also play an important role while two persons of different regions try to communicate so Hand gesture also plays an important role there also. Keeping all these factors in mind there are many algorithms which are recurrently being used. In this paper we will try to understand which are giving more accuracy and where is the need of improvement.

Hand Gesture Basic Images:

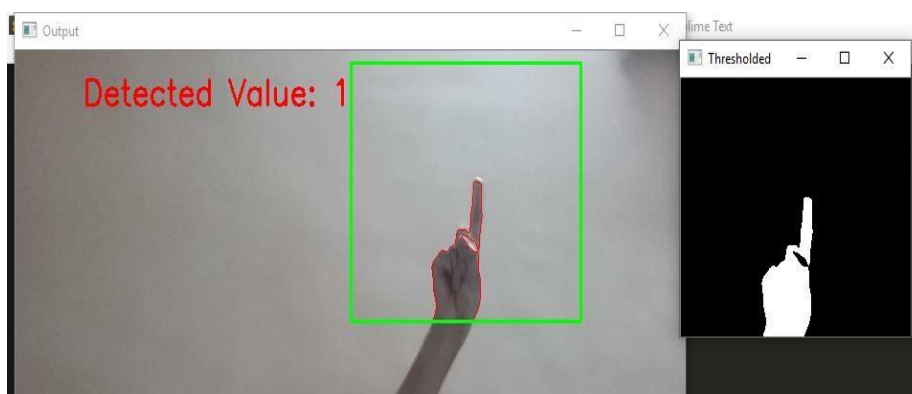


Fig 1: Hand gesture detected value 1

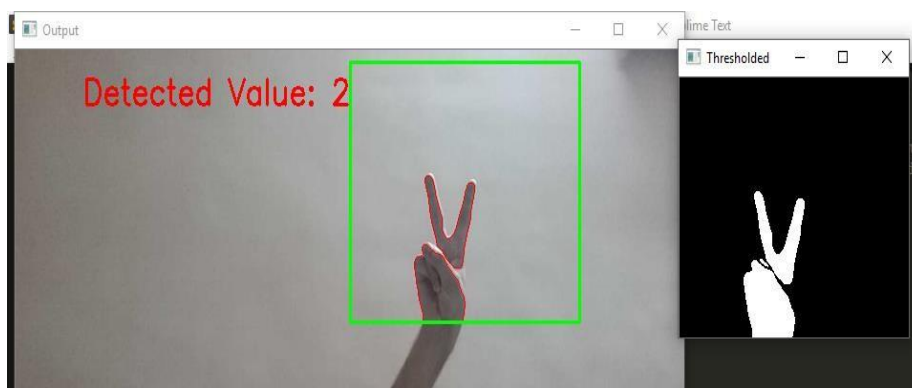


Fig 2: Hand gesture detected value 2

2. PREVIOUS WORK

Recognising Static Hand gestures using Deep Neural Networks: This algorithm allows computers to recognise six static hand gestures for six specific tasks which are as follows:-

- Open
- Close

- Cut
- Paste
- Maximize
- Minimise

The Summarized points which are discussed in this paper are:

- Database
- HandContour
- FeatureExtraction
- Using ActivationFunctions
- Back Propagation LearningAlgorithms
- Classification

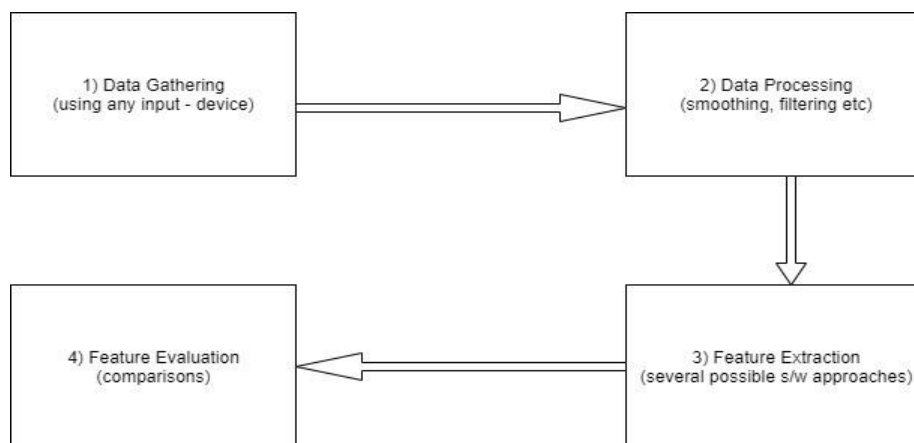


Fig 3: Basics of gesture recognition

Image is processed through 3 phases:

Preprocessing	Feature Extraction	Classification
Background is removed and the accuracy is 70.8%	For Scaling and transition Hand Contour will acts as feature input. Accuracy was 86.3%	It is done on the basis of output result which we want

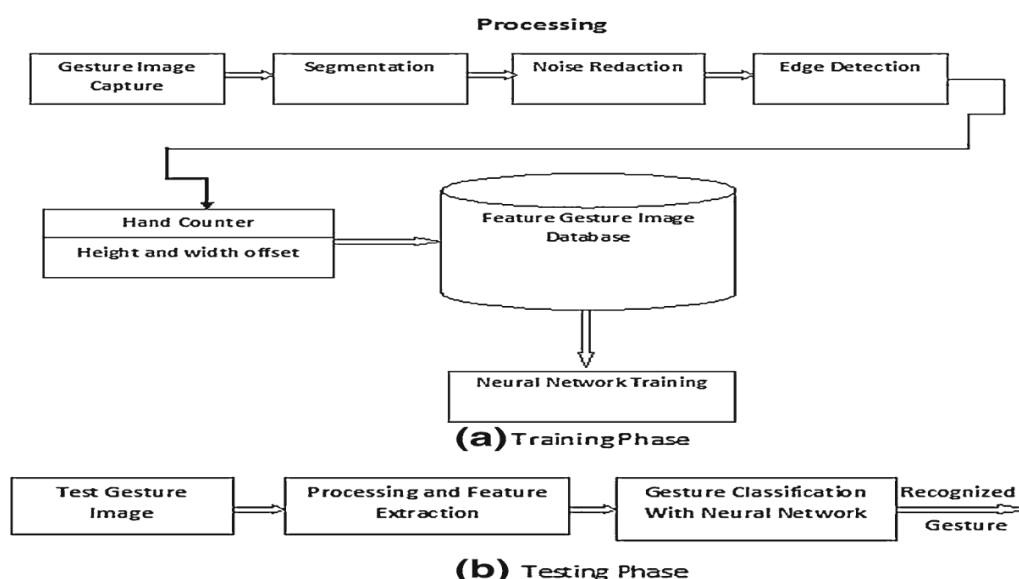


Fig 4: Training Phase Proposed method

Hairong Jiang et al. (2014) [6] developed a vision-based machine for individuals with upper extremity physical impairments so that laboratory tasks which require physical manipulation can also be done by these individuals like normal individuals do. For gestures various dynamic algorithms and models were created. Assistive technology is a new way in support of supportive technologies which is required for people with physical impairments. Discrete, Continuous and Hybrid modes were used for checking the task completion time. These gestures were captured and then mapping is performed with the commands such as turn right, turn left, go forward, go backward, stop, robotic arm action, enable robotic arm and change mode.

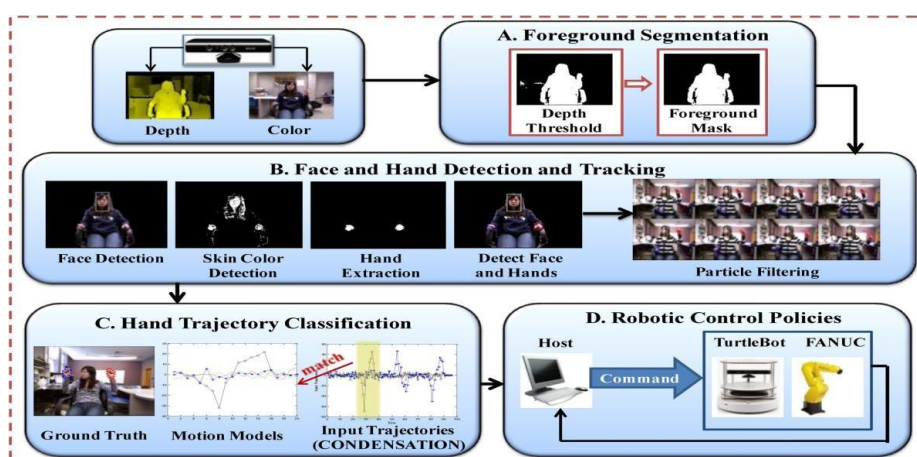


Fig 5: System Overview

Miguel A. Simao et al. (2013) [7] Proposed a new method for gesture segmentation which can accurately identify static and dynamic segments from continuous data stream. The ability to interact with machines is always been with some programming input or by some gestures or visual controls but the problem that we face in this method is the existing

modalities which are used are neither intuitive nor reliable. For an industry-based robot, teaching him with traditional methods is time-consuming and tedious.

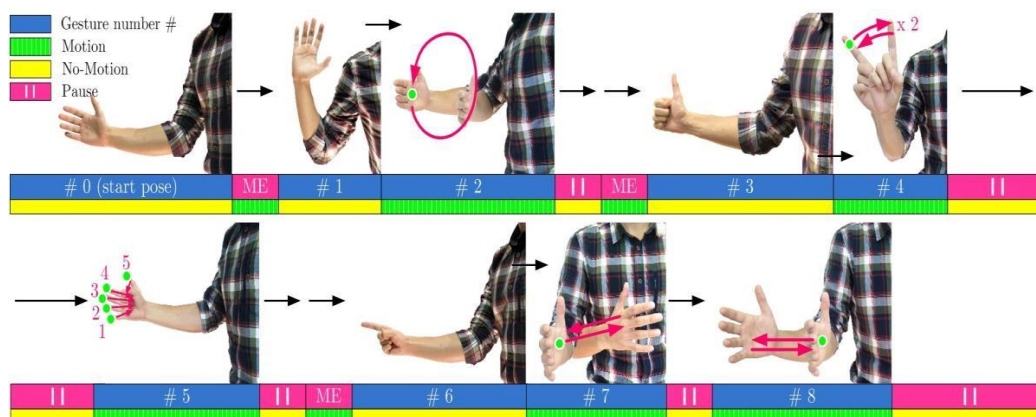


Fig 6: Gestures Performed for Creating the dataset

Peijun Bao et al. (2014) [9] proposed a Deep Convolutional Neural Network variation to identify Hand gesture only rather than which is not an area of hand. As hand gestures play an important role in Human Computer Interaction (HCI) so to overcome this part where other human parts also come in consideration while only Hands are required, this vary network is proposed. Discarding other features is important and that is what is tried here by using deep convolution network. Mobile phones or webcam for recording purpose and a threshold for understanding and training the neural network to analyse the pattern properly and many more. The real - time gesture that can command over electrical devices etc is also used.

To perform hand gesture recognition two different methods are used shown in Fig:

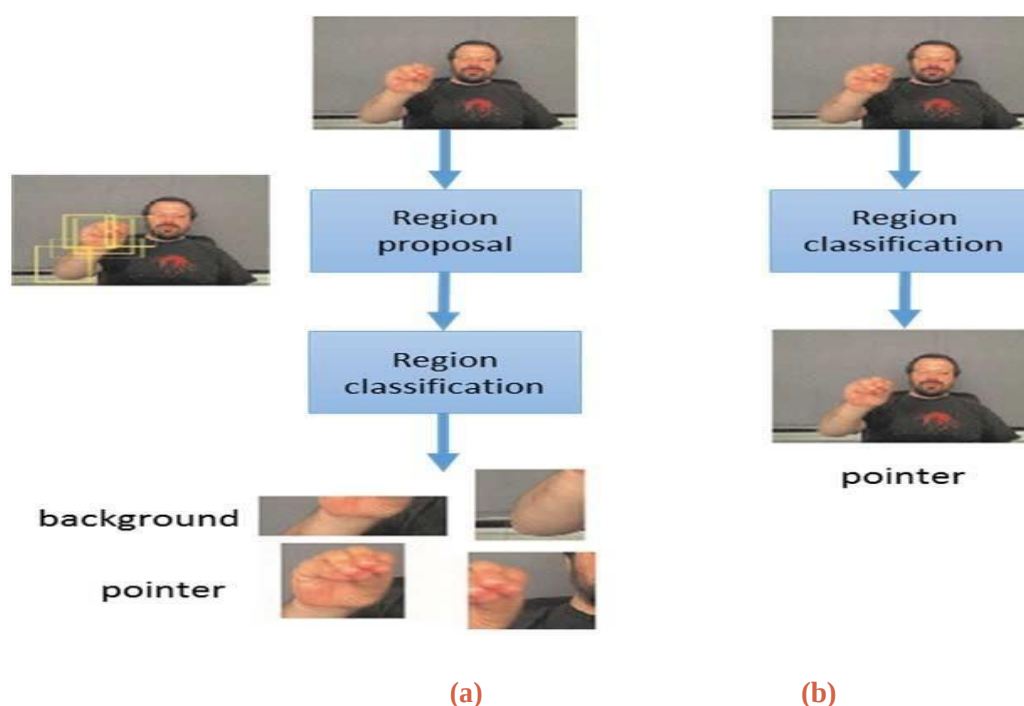


Fig 7: Two different methods

Jung–HwaKimetal.(2011)[11]proposeanovelinteractionsystemwhereusers can interact with Internet connected Things (IOT) by just Gazing at it or doing some gestures. By doing hand gesture a command will be generated which IOT platform will analyze as being a platform and then the output will be generated. For providing a more user-friendly approach for healthcare departments, TransportservicesandHomeautomationetc.AsIOTisatrendingtechnology and making it more user friendly by using a common gesture i.e., Hand gesture is a more feasible way. The techniques will be helpful for a user to understand their intentionorwecansayemotionsasthisisacomplexprocessandimprovementhas to be continued in thisaspect.

Architecture of proposed framework:

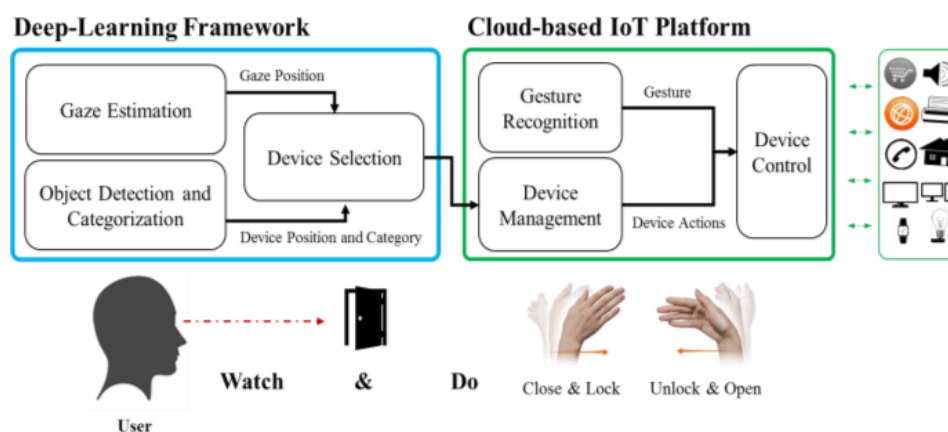


Fig 8: Architecture

3. Proposed Work

The potential applications of the developed system recognising static hand gestures are: recognition of sign language, controlling media players in laptops, controlling Tv. While developing the system we encountered some problems which can be used for further researchers as improvements to the system. They are as follows:

1. **Dynamic gesture Recognition:** To make human computer interaction more effective and intuitive it must have ability to capture gestures such as waving or wagging a finger.
2. **Using both hands in virtual Reality:** the applications in which a particular gesture say right hand's index finger is used to map the command "move forward", at the same time left hand's index finger could be mapped to "control the speed".
3. **Usage of flow menus to practically use the hand gestures in Human Computer Interaction,** more gestural commands will be needed. Menus can be used to create gesture command sets. Some kinds of commands would be more reasonably input by static hand postures.

Flow Chart of Proposed Work:

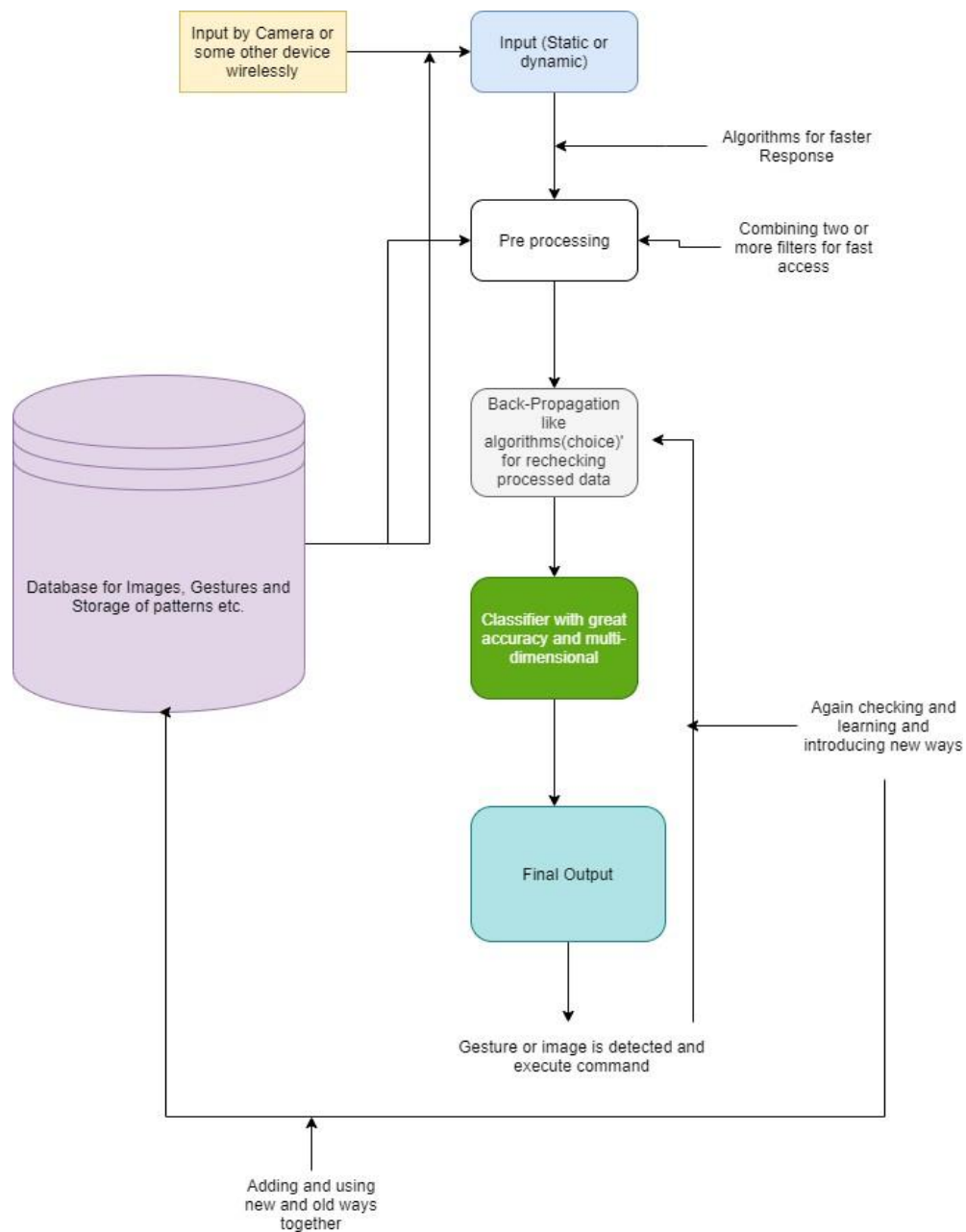


Fig 9: Flow Chart of proposed work

If enough time is provided, we would like to implement this work as shown in the flow chart for a smarter and faster recognition system.

4. Conclusion

Based on the observation, it can conclude that it is quite difficult to make a system which can recognise all the hand gestures accurately. This is because of the varying conditions of complex background and other noises that are being captured as well and vary from user to

user in terms of transition and rotation by specific angles.

This system is based on supervised multilayer feed forward neural network on two features: hand contour and hand complex moments. This system does not require any kind of hardware such as gloves. Many New devices are used indifferent papers but they are not versatile so we look upon these to work on the problems justified and work on them.

5. References

- [1] Lalit Gupta and Suwei Ma “Gesture-Based Interaction and Communication: Automated Classification of Hand Gesture Contours”, IEEE transactions on systems, man, and cybernetics—part c: applications and reviews, vol. 31, no.1, February 2001
- [2] Claudia Nolkner and Helge Ritter: Visual Recognition of Continuous Hand Postures – IEEE Transactions on Neural Networks, Vol. 13, No. 4, July 2002
- [3] Hee-Deok Yang, Stan Sclaroff, Seong-Whan Lee: Sign Language Spotting with a Threshold Model Based on Conditional Random Fields – IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 31, No. 7, July 2009
- [4] Hairong Jiang, Bradley S. Duerstock and Juan P. Wachs: A Machine-Vision Based Gestural Interface for People with Upper Extremity Physical Impairments – IEEE Transaction on Systems, Man, and Cybernetics: Systems, Vol. 44, No. 5, May 2014
- [5] Nasser H. Dardas and Nicolas D. Georganas: Real Time Hand Gesture Detection and Recognition Using Bag-of-Features and Support Vector Machines – IEEE Transactions on Instrumentation and Measurement, Vol. 60, No. 11, November 2011
- [6] Hairong Jiang, Bradley S. Duerstock and Juan P. Wachs: A Machine-Vision Based Gestural Interface for People with Upper Extremity Physical Impairments – IEEE Transaction on Systems, Man, and Cybernetics: Systems, Vol. 44, No. 5, May 2014
- [7] Miguel A. Simao, Pedro Neto and Olivier Gibaru: Unsupervised Gesture Segmentation by Motion Detection of a Real-time Data Stream – IEEE Transactions on Industrial Informatics
- [8] Jungpil Shin and Cheol Min Kim: Non – touch Character Input System Based on Hand Tapping Gestures Using Kinect Sensor – IEEE Access
- [9] Peijun Bao, Ana I. Maqueda, Carlos R. del-Blanco and Narciso Garcia: Tiny Hand Gesture Recognition Without Localization via a Deep Convolutional Network – IEEE Transactions on Consumer Electronics
- [10] Donq – Liang Lee and Wei – Shiuan You: Recognition of Complex Static Hand Gestures by Using the wristband - based Contour features – IET Image processing
- [11] Jung-Hwa Kim, Seung-June Choi and Jin-Woo Jeong: Watch&Do – A Smart IoT Interaction System with Object Detection and Gaze Estimation – IEEE Transactions on Consumer Electronics