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Usama Sayed
Department of Electrical Engineering, Faculty of Engineering, Assiut University, P.O. Box 71516 Assiut, Egypt, zenab_elzohry@yahoo.com

Mahmoud A. Mofaddel
Department of Math and Computer Science, Faculty of Science, Sohag University, P.O. Box 82524 Sohag, Egypt, zenab_elzohry@yahoo.com

Samy Bakheet
Department of Math and Computer Science, Faculty of Science, Sohag University, P.O. Box 82524 Sohag, Egypt, zenab_elzohry@yahoo.com

Zenab El-Zohry
Department of Math and Computer Science, Faculty of Science, Sohag University, P.O. Box 82524 Sohag, Egypt, zenab_elzohry@yahoo.com

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Human Hand Gesture Recognition

Usama Sayed[1], *Mahmoud A. Mofaddel*[2], *Samy Bakheet*[2] *and Zenab El-Zohry*[2,*]

[1] Department of Electrical Engineering, Faculty of Engineering, Assiut University, P.O. Box 71516 Assiut, Egypt
[2] Department of Math and Computer Science, Faculty of Science, Sohag University, P.O. Box 82524 Sohag, Egypt

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Abstract: A Human Computer Interaction(HCI) between computers and human understands human language and improve a user friendly interface. Gestures a non-verbal form of communication supplies the HCI interface. The aim of gesture recognition is to make a system which can recognize specific-human gestures and employ them to convey information or for device control. Real-time vision-based hand gesture recognition is attempting to be more and more suitable for HCI with the assistance of the latest advances in the area of computer vision and pattern recognition. The gesture will able to reduce the use of most Prominent hardware devices which are used to control the activities of the computer. In this paper we introduces a mechanism for human computer interaction utilizing open source OpenCV. The proposed algorithm consists of preprocessing, segmentation and feature extraction.In segmentation we are used threshold BINARY-INV+threshold OTSU.Then make use of contours, convex hull and convexity defects to find the hand gesture.The hand gesture images are captured by a camera. That is used as the input to the algorithm. The proposed algorithm is able to recognize the number of fingers present in the hand gesture.

Keywords: Computer vision, OpenCV, hand gesture, human computer interaction (HCI)

1 Introduction

Hand gestures are routinely used in daily life and they are natural, innovative for nonverbal communication. Gestures are the actions that convey the meaningful messages. It is more convenient and comfortable way of communication.Number of systems provide techniques for human computer interaction, most commonly used input systems are mouse, keyboard, etc. From past three decades, we are using the same techniques for communicating with the computer system. In the early years, there were numerous techniques used for gesture recognition and tracking. For example, instrumented gloves, optical markers, etc. These techniques have their own advantages and drawbacks [1,10,11]. The instrumented gloves contain a number of sensors in it, which gives the information about hand location, orientation and finger tips. They have high accuracy. But, they are too expensive and they need a wired connection. Optical markers work with infrared light, which is the complex process. These systems require complex configuration.This paper introduces a hand gesture recognition system which uses only hand gestures to communicate with the computer system [2,7,11,14]. This algorithm divided into three parts: preprocessing, segmentation and feature extraction. In feature extraction, we will find moments of the gesture image, the centroid of the image and Euclidean distance to find the finger count. We make use of contours, convex hull and convexity defects to find the hand gesture [1,2,13,15]. The paper is organized as follows: section 2 cover related works on hand gesture, section 3 describes the technologies used for the proposed method, section 4 describes the implementation for the hand gesture, section 5 describe the experimental results, and section 6 describes the application we can apply to it our proposed method. Finally, in section 7 we summarize the paper.

2 Related Work

Over the last little years, numeral of researches are performed to hand gesture recognition for human computer interaction using MATLAB and OpenCV. Several performance comparisons are performed to improve the technique. Here is the survey on a few papers. In papers [4,6,7,12], for unobstructed surroundings real time hand gesture appreciation is

* Corresponding author e-mail: zenab_elzohry@yahoo.com

introduced in order to identify the hand gestures. In order to make out the hand gestures in genuine time three phases are introduced, they are real time hand tracking, learning of gesture, via applying Hidden Markov models identify the gesture [8,9,11]. In charge to follow the hand in real time Kalman filter and furnish blob analysis is used. The second phase is to educate the gestures and preserve the record. The third phase is to recognize the gesture, shape based on the American Sign Language In paper [5], earlier to silent backgrounds, endless gestures are acknowledged. In this paper four phases are introduced to make out the endless gestures they are Tracking real time in hand and extracting to locate the unremitting hand and region of hand extraction. The second phase is taking out of feature by means of Fourier Descriptors. Third phase teaching the hand gestures with a hidden Markov model. And the last phase is to know the gesture. In paper [3], vision based hand gesture relations are discussed. To trigger hand detection a precise sign is required by means of tracking, afterwards based on the movement and color cues hand is segmented. In paper [6], for lively environments and real time hand, gratitude algorithm is discussed to cooperate with robots. Bymeans of a cascade of boosting classifiers the discussed algorithm detects hand based going on hand positions ,velocitiesand static gestures [7,9].

3 Used Technologies

OpenCV (Open Source Computer Vision Library) is a library which mainly focuses at real-time computer vision. It is free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. It provides basic data structures for image processing with efficient optimizations. [2]

4 Proposed Model Implementation

Following steps are involved in implementation of our algorithm. This methodology needs good camera and fast processor to execute it in real time.

4.1 Image Acquisition

Input Image is captured via camera. It grabs a frame from live video and then use the specific image for the required task.

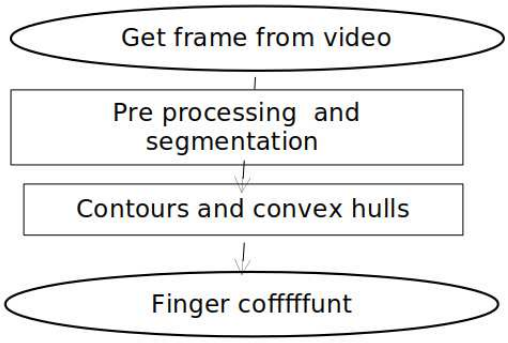

Fig. 1: Flowchart for steps of hand gesture implementation

4.2 Hand Image Segmentation

In this part, hand segmentation is utilized to evolve the hand image from the background. There are various methods for segmentation. The significant step in segmentation is processing and thresholding. Segmentation divide an image into distinct regions containing each pixel with similar attributes. To be meaningful and useful for image analysis and interpretation, the regions should strongly relate to depicted objects or features of interest. In this algorithmic program, the BGR image taken by a camera is taken into account as input to the algorithmic program. The BGR image is remodeled into grey-scale image.the grey-scale image is blurred to urge the precise boundary. The blurred image is threshold to the actual worth.

$$\begin{cases} IF \quad f(x,y) > t, \quad f(x,y) = 0 \\ ELSE \quad f(x,y) = 255. \end{cases} \tag{1}$$

We used threshold BINARY-INV+threshold OTSU.

4.3 Hand Detection Contours

Contours square measure the curves change of integrity all the continual points on the boundary, having same color or intensity. The contours square measure a great tool for form analysis and object detection and recognition. The contour is drawn on the boundary of the hand image that is found once thresholding.

4.4 Convex Hull

The convex hull is the set of continuous points in the Euclidean space that is connected to contours. Convex hull is drawn around the contour. Contour points within the convex hull. Convex hull works as an envelope around the hand.

Fig. 2: detected contour of the image

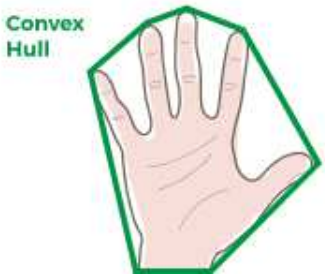

Fig. 3: detected convex hull

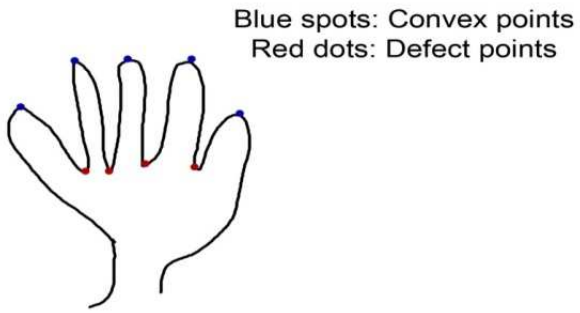

Fig. 4: Detected convex and defect points in the image.

4.5 Convexity Defects

When the convex hull is drawn round the contour of the hand, it fits set of contour points of the hand within the hull. It uses minimum points to make the hull incorporate all contour points within or on the hull and maintain the property of convexity. This causes the formation of defects within the convex hull with relation to the contour drawn to be had.

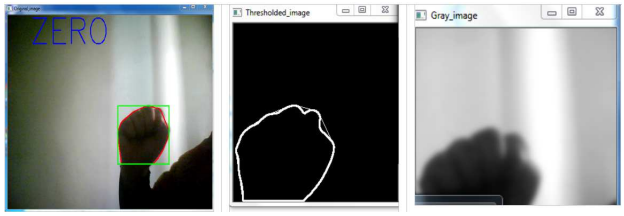

Fig. 5: Show input frame count zero and threshold image and gray image

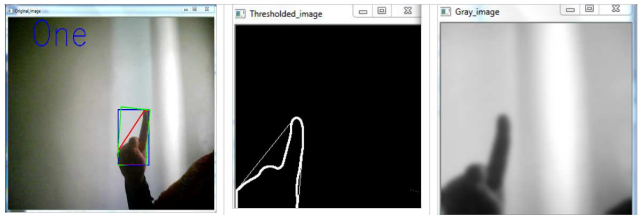

Fig. 6: Show input frame count one and threshold image and gray image

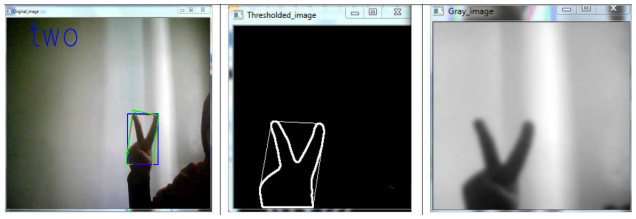

Fig. 7: Show input frame count two and threshold image and gray image

4.6 Finger Count

In this methodology, the amount of fingers gift within the hand gesture is set by creating use of defect points gift within the hand gesture.

5 Experimental Results

In real time by using web camera the input video is taken and converted into frames than some of the steps are carried out as shown in the figure 1 to count the number of fingers. The experimental results are shown below.

6 Proposed Model Applications

1.Hand gesture controlled robot for physically challenged.

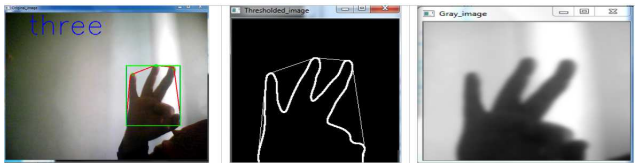

Fig. 8: Show input frame count three and threshold image and gray image

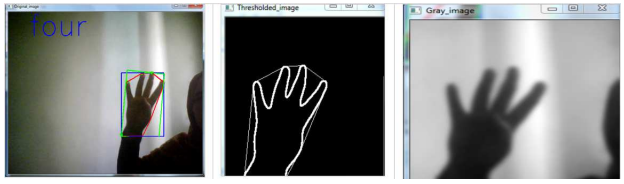

Fig. 9: Show input frame count four and threshold image and gray image

Fig. 10: Show input frame count five and threshold image and gray image

2.Hand gesture controlled doors and vehicles.
3.Hand gesture controlled keyboard and mouse to interact with computer.
4.Gesture controlled appliances like air conditioner.

7 Conclusion

This paper conferred a way to search out the amount of fingers gift within the hand gesture. They are used in numerous applications. The more analysis studies are occurring concerning this subject to get the mandatory demand.

References

[1] Meenakshi Panwar and Pawan Singh Mehra , Hand Gesture Recognition for Human Computer Interaction, in Proceedings of IEEE International Conference on Image Information Processing(ICIIP 2011), Waknaghat, India, November 2011.

[2] Amiraj Dhawan, Vipul Honrao, implementation of hand detection based techniques for human computer interaction, in International Journal of Computer Applications (0975 8887)

[3] Yikai Fang, Kongqiao Wang, Jian Chengand Hanqing Lu,'A real time hand gesture recognition method', 1-4244-1017-7/07 2007 IEEE.

[4] Nguyen Dang Binh, Enokida Shuichi, Toshiaki Ejima,' Real time hand tracking and recognistion system',GVIP 05 Conference, 19-21 December 2005, CICC, Cairo, Egypt.

[5] Feng-Sheng , Chih-Ming Fu, Chung-Lin Huang, 'Hand gesture recognition using a real time tracking method and hidden morkev models', Received 15 January 2001; received in revised form 2 January 2003; accepted 20 March 2003.

[6] M. Correa, J. Ruiz-del-Solar1, R. Verschae1, J. Lee-Ferng1, N. Castillo, 'Real time hand gesture recognistion for human robot interaction'.

[7] Rautaray, Siddharth S., and Anupam Agrawal. "Vision based hand gesture recognition for human computer interaction: a survey." Artificial Intelligence Review 43.1 (2015): 1-54.

[8] Liu, Hongyi, and Lihui Wang. "Gesture recognition for human-robot collaboration: A review.' International Journal of Industrial Ergonomics 68 (2018): 355-367.

[9] Lin, Hsien-I., Ming-Hsiang Hsu, and Wei-Kai Chen. 'Human hand gesture recognition using a convolution neural network.' Automation Science and Engineering (CASE), 2014 IEEE International Conference on. IEEE, 2014.

[10] Feng, Kai-ping, and Fang Yuan. 'Static hand gesture recognition based on HOG characters and support vector machines. Instrumentation and Measurement, Sensor Network and Automation (IMSNA), 2013 2nd International Symposium on. IEEE, 2013.

[11] Palacios, Jos Manuel, et al. 'Human-computer interaction based on hand gestures using RGB-D sensors.' Sensors 13.9 (2013): 11842-11860.

[12] Chaquet, Jose M., Enrique J. Carmona, and Antonio Fernndez-Caballero. 'A survey of video datasets for human action and activity recognition.' Computer Vision and Image Understanding 117.6 (2013): 633-659.

[13] Cheng, Guangchun, et al. 'Advances in human action recognition: A survey.' arXiv preprint arXiv:1501.05964 (2015).

[14] Borges, Paulo Vinicius Koerich, Nicola Conci, and Andrea Cavallaro. 'Video-based human behavior understanding: A survey.' IEEE transactions on circuits and systems for video technology 23.11 (2013): 1993-2008.

[15] Bhuyan, M. K., P. K. Bora, and D. Ghosh. "Trajectory guided recognition of hand gestures having only global motions." World Academy of Science, Engineering and Technology 21 (2008): 753-764.

Usama Sayed received his B.Sc. and M. Sc. degrees from Assiut University, in 1985 and 1993, respectively, and his Ph.D. degree from Czech Technical University in Prague, Czech Republic, in 2000. From November 2001 to April 2002, he was a post Doctoral Fellow with the Faculty of Engineering, Czech Technical University in Prague, Czech Republic. He authored and co-authored more than 100 scientific papers. His research interests include image coding, speech coding, telecommunication technology, statistical signal processing, blind signal separation, wireless communication network, video coding, and RFID.

Samy Bakheet received the Engineering doctoral degree (Dr.-Ing.) in Technical Computer Science from Otto-von-Guericke University Magdeburg, Germany in 2013. Since September 2013, he has become an Assistant Professor of Computer Science at Sohag University, Egypt. His research interests are geared towards high-level recognition problems in machine vision, such as human activity/event recognition, human pose estimation, object/scene recognition, etc. He also works on various multimedia related applications, such as visual surveillance, content-based image/video retrieval, video summarization, and semantic video annotation. Bakheet has authored/coauthored roughly 40 reviewed technical papers in well reputed international journals and conference/symposium proceedings in the fields of computer vision, machine learning, pattern recognition, medical imaging, and robotics.

Mahmoud A. Mofaddel received his B. Sc. and M. Sc. Degrees from Assiut University in 1985 and 1991 respectively, and his Ph. D. degree from Rostock University, Germany in 1999. Currently, he working as an associate professor at Mathematics and Computer Science Department, Faculty of Science, Sohag University, Egypt. He authored and co-authored more than 23 scientific papers. His research interests include high performance computing, and image processing.

Zenab El-Zohry received her BSc. and MSc. degrees from South Valley University and Sohag University in 2005 and 2012, respectively. From June 2012, she has served as a Lecturer at Faculty of Science, Sohag University, Egypt. Her primary research interests include network security, genetic algorithms, image processing and pattern recognition.