Gesture Movement Detection Based on IoT

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ABSTRACT

There are sick people who cannot move, operate and extinguish things easily and flexibly or use the computer correctly so we seek to facilitate the topic by using gestures and transferring them to a specific server and give orders for electrical tools in the room so, traditional devices like mouse and keyboard became unsuccessful for a valid interaction between human and the application of environment. Natural devices provide more efficient interaction between humans and the computer to send order signal environment. One of the natural devices is the "Hand Gesture" form has lately become of considerable interest. The fundamental goal of the research is to construct a method that can realize and utilize human gestures to rule an application and devices. In this paper, hand gesture means static structure movement that is especially critical form interaction between humans and computers. The paper understands the hand gesture recognition using the skin colour model to segmentation and SVM, KNN classifiers to detect the number of fingers[1][2]. In this method, after taking the image and segment the image from the background then by using the SVM the fist gesture detected from other gesture and then the other gesture (one, two, three, four and five fingers) are detected by using KNN classifiers. The proposed system achieves a 7% average error while succeeded in detecting hand gestures with the accuracy of up to 93%.

Keywords: hand gesture segmentation, hand gesture recognition, SVM, KNN classifier.

1. Introduction

computer devices are growing in our lives every day, and there is the patient that has a problem in weighing the movement and use the mouse and keyboard correctly which increased requests for those devices increased the use of practical and easy interfaces. For this mention reason, we must change the traditional devices such as mouse and keyboard with more practical interaction ways such as hand gestures. Because there are different hand gestures and also hand gestures have been used in different fields, such as UAV, sign language, games and so on[3][4]. In this consideration, so it is important to study on recognition of hand gestures. The system in this paper is composed of segmentation of hand and then hand gesture recognition. When speaking about the segmentation of anything (here the hand) it means cutting the relevant special gesture from one video frame, it is the initial step to recognition of hand gesture. It based on skin colour, motion information, edge detection. The paper assumes a merging algorithm to recognize the hand segmentation in a complicated environment. When speaking about gesture tracking, it means tracking the hand gesture location in real-time base on some hand gesture features. In gesture tracking phrase, it means detection of hand gesture in real-time(in the video) base on several features of the hand. Hand tracking guarantees that our target is not gone. Actually, for tracking the hand gesture there are mean-shift algorithm, optical flow or Kalman filtering, and here according to the condition for real-time imitation and precision the paper chooses the Camshaft[2]

algorithm. 10 gestures ranging from 1 - 5 in the convoluted background are selected in the workout, with the 75 pictures are gathered to the training set, and 25 hand gesture pictures are collected for the test set.

2. RELATED WORK

In the present method, there are various procedures that are utilized to gesture recognition for different goals.

Izuta, Ryo, et al. in (2016) [5] In this paper, the researcher prepares a system using an accelerometer. In this way successively counts the area among the input data and training data to gesture recognition in the first stages with high accuracy. In this system, the output has a high scale of dependability by counting the proportional area.

Hursale, Sagar, et al. in (2015) [6] In this paper, the researcher uses the accelerometer of the mobile phone to take the capture for hand gesture and use this as system input, and carefully put in image or text could improve the experience of the user. The capability of writing without looking at the mobile offer more advantage.

Iyer, Darshan, et al. in (2016) [7] In this paper, the researcher's objective is to introduce wearable technologies for manufacturing workers like mining workers and firefighters, etc by using IMU (wearable sensor). That will prepare them to implement their work safety and reduce the injuries risk. They used a device that is wrist-worn for communication by gesture between workers. This device detects the gesture of the user and transmits this gesture by BLE to a hub.

Mohammed, Assad, et al. in (2016) [8] In this paper, the researcher used smart clothing for direct communication with some smart WiFi using CoAP for enabled lightbulbs that help for detection contrast with another IoT protocol. They in the first step develope a wristband, that will be inserted into a bigger clothing piece such a sweatshirt. their proposal includes the integration of the present microcontrollers and sensors like Arduino.

Shu, Jiayu, Rui Zheng, and Pan Hui. in (2016) [9] In this system, they utilize a library named OpenCV to face detection and tags. They stratify Faster R-CNN for training their model for gesture detection. After that (detection the hand gesture and tag) the program will execute identical procedures on the face with a flag on their proportional position.

Beke, Aykut, Ahmet Arda Yuceler, and Tufan Kumbasar in (2017) [10] present a novel system that rule-based a fuzzy recognition gesture to build an HMI interface so an employer by utilizing a smartphone can interact with Sphero 2.0. The result of the experimental presented display that the execution of the architecture of the proposed system is acceptable.

Hatori, Ayaka, and Hiroyuki Kobayashi in (2017) [11] Here the researcher described their study of recognition of the gesture by acceleration. they detect four types of gestures and used the accelerometer in the phone for scaling data motion, they also using SVD for getting feature vector and used SVM for recognition with 82.5% accuracy.

Sun, Jing-Hao, et al. in (2018) [3] This research carried out a set of gesture recognition overall flow. For segmentation of hand gesture using classifier named AdaBoost. Using CamShift algorithm for tacking hand gesture based on the movement of gesture and deformation features include acquiring area of hand gestures in real-time, lastly, the hand gesture segmented is distributing by the neural network.

Hosono, Satoshi, et al. in (2019) [12] introduced the system in this research used deformation sensors of optical muscle. This system conforms machine learning by using 8 canals of deformation optical muscle by putting them on the forearm that doesn't bother the hand movement. They confirm the number of gestures that can be known statically and how kind of finger movement recognition is difficult. Finally, they find that accuracy will be higher when to use SVM for logistic regression.

3. k-nearest neighbour

Classification in the k-nearest neighbour method is a model of classification that you can by using it modify nearest neighbours and distance metrics. In this method training data saved by the classifier, we use the model to calculate resubstitution predictions[13].

4. Support Vector Machine

A support vector machine is an algorithm used in machine learning for analyzing data for regression and classification[2]. This is a supervised method that sort data into two categories as an output. There is the linear and nonlinear classification by working on the kernel trick. SVM also used in image classification, text categorization, handwriting recognition, and other sciences.

5. Suggested system

In the suggested system, there is two-part first-hand gesture recognition and then the Internet of things. For the internet of things we use app designer for reducing effort. The servant uses her hand gesture to operate the light in the interface designed by app designer. (software in the Matlab language that uses to interface designing and simulation). There is five light. Each light will open depending on the gesture. If the hand gesture shows one finger the first light will be on, if two-finger gesture the second light will be on and so on.

5.1. Proposal system algorithm

general implementation of the proposal system
Input: Image from the data set
Output: The detected reaction from finger counting
Begin **Step 1:** Prepare the dataset. **Step 2**: Extracting hand from the image by YcbCr. **Step 3**: Elimination distortion. **Step 4**: Feature extraction from hand to test it. **Step 5**: Detecting if the gesture is fist or not by using SVM **Step 6**: Counting the number of fingers by using KNN classifier. **Step 7**: On the extended light according to the number of fingers. **End**

5.2. Data

Collecting the data take one month and the data is collected from different people from Diwaniya city age between 18 to 50 years old. 25 person each person with 5 gesture, the total number of gesture become 100 gesture and we use 75 for training and 25 for testing the network.

5.3. Segmentation of hand gesture

Actually, there is some strategy to segmentation hand gesture. Based on the skin colour segmentation. This model is built to obtain a hand gesture. It works based on hand gesture skin colour and differences between it and the environment. The hand posture doesn't affect the pattern. The edge detection based segmentation can part the gesture of the hand according to the grey value discontinuity in the image margin area. Also, it is simple to be broken through the noise, on the other hand, it has a rigid requirement for the hand gesture background. The segmentation of hand gestures based on motion information, including background and frame difference methods and so on. Utilize the movement information of hand to segment the hand on the basis of a static background. The influence is well in the environment that is static while it's not good in the background that is dynamic. The segmentation of the hand gesture method according to the matching the statistical template is capable of immediately recognize the hand. By applying a training classifier of the feature gesture template can recognize the hand gesture.

Calculate the Gaussian Mixture Method by utilizing prior information

$$\text{weight}^{(t)} = \text{argmax}\ (Y, \theta^{(t)}\text{weight}^{(t-1)})$$

In the new iteration calculate the pattern parameter

$\theta^{(t+1)} = \text{argmax}\ (Y , \theta^{(t)}\ \theta^{(t+1)})$

The effect of hand gesture segmentation is displayed in the attached image

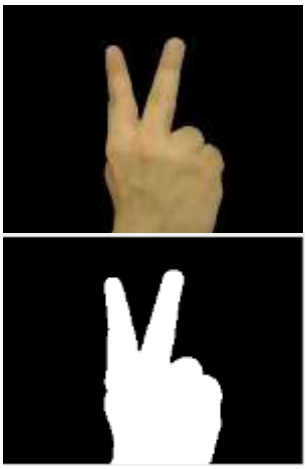


Fig1. Skin colour segmentation

5.4. Distortion elimination

After the segmentation will observe there are some holes in the hand. In this step the holes must be filled.

5.4. Feature Extraction

Feature extraction is converting the data to a series of features. If the extracted features are chosen carefully so, the set of features will resume the pertinent information of the input data. Here the height, area, and hand centroid and distance rely on. The theta between the centroid and the holes in the hand.

Feature vector = [H, W, Area, Hand Centroid].

5.5. Finger counting

For finger counting used SVM, KNN classifier.

SVM, There is a problem by fist and other gestures (one, two, three, four and five fingers). By using SVM the problem solved. SMV is a binary classifier. First must classify the gesture between fist and not the fist.

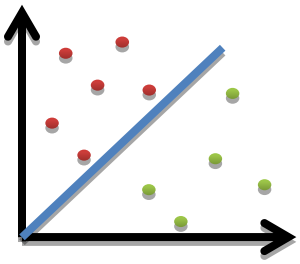


Fig2. SVM

KNN, after SVM if the gesture isn't fist it will transfer to the second step of the algorithm. The KNN classifier will work here and detect the gesture.

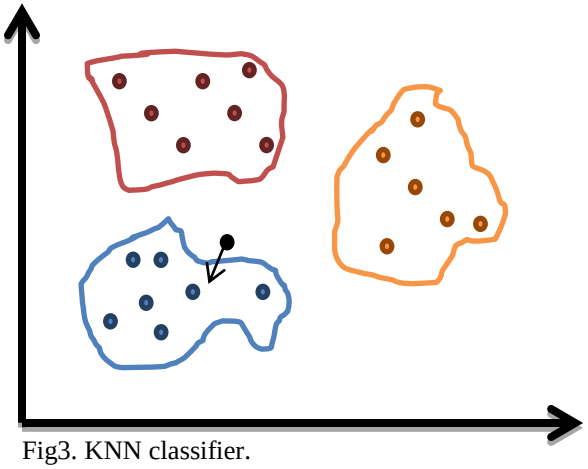
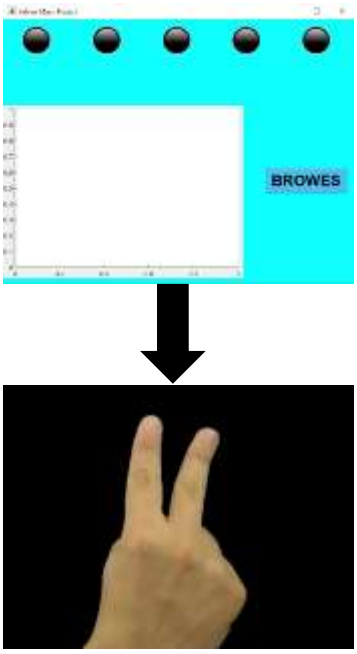
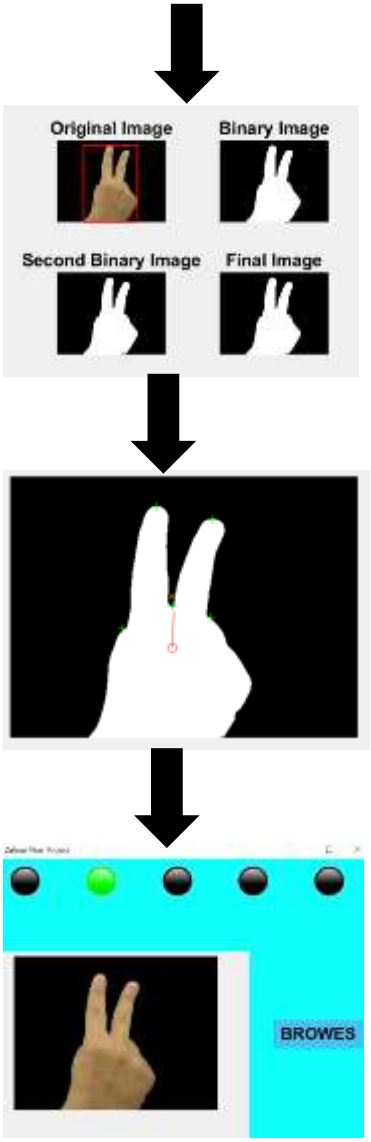


Fig3. KNN classifier.

5.6. Proposed system execution





5.7. Profile Summary

Generated 23-Jan-2020 12:48:21 using performance time:

Function Name	Calls	Total Time	Self Time*	Total Time Plot (dark band = self time)
finaltest	1	3.903 s	2.060 s	
subplot	1	1.532 s	0.959 s	
...asPlugin>CanvasPlugin.createCanvas	1	0.423 s	0.388 s	
imread	6	0.241 s	0.020 s	
imread>call_format_specific_reader	6	0.172 s	0.018 s	
imagesc/private/readjpg	6	0.154 s	0.032 s	
imagesc/private/readjpg>jpfif	6	0.121 s	0.093 s	
subplot>addAxesToGrid	1	0.089 s	0.076 s	
graph2d/private/subplot_parseargs	1	0.055 s	0.054 s	
ClassLabel>ClassLabel.loadobj	63	0.035 s	0.005 s	
...r.ToolbarController.ToolbarController	1	0.034 s	0.033 s	
ClassLabel>ClassLabel.ClassLabel	63	0.030 s	0.026 s	
imread>get_full_filename	6	0.022 s	0.022 s	
isremember	6	0.021 s	0.005 s	
SVMParams>SVMParams.loadobj	3	0.017 s	0.008 s	
imread>get_format_info	1	0.016 s	0.000 s	
imagesc/private/xmltype	1	0.016 s	0.011 s	
isremember>isremember/620123	6	0.016 s	0.007 s	

6. Conclusion

Gestures are a helpful method between people and also can be used between person and computer to connect. Here, we offered an innovative technique to detect the gestures and sending an order based on the gesture to the interface and according to gesture and number of the finger there are different lamp will be on. For future work, we want to apply this method in different fields.

7. References

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