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A Technical Seminar Report On

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Submitted by:

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CERTIFICATE

Certified that the **Technical seminar entitled "GESTURE RECOGNITION"** is carried out by **Mr. UZAIR AHMED [4RA16CS102]**, a bonafide student of **RAJEEV INSTITUTE OF TECHNOLOGY, Hassan** in partial fulfillment for the subject **TECHNICAL SEMINAR** in **COMPUTER SCIENCE AND ENGINEERING** of Visvesvaraya Technological University, Belagavi during the year 2019-2020. The technical seminar report has been approved as it satisfies the academic requirements in respect of technical seminar work prescribed for the said degree.

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ABSTRACT

Gesture Recognition for Real Time Human-machine Interaction system to handle the mouse event, media player, image viewer. Users have to repeat same mouse and keyboard actions, inducing waste of time. Gestures have long been considered as an interaction technique that can potentially deliver more natural. A fast gesture recognition scheme is proposed to be an interface for the human-machine interaction (HMI) of systems. The system presents some low complexity algorithms and gestures to reduce the gesture recognition complexity and be more suitable for controlling real-time computer systems. In this paper we use the webcam for capturing the image. After capturing the image, it converts into the binary image. A gesture is a specific combination of hand position.

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Chapter 1

INTRODUCTION

1.1. Overview

Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion or state but commonly originate from the face or hand. Current focuses in the field include emotion recognition from the face and hand gesture recognition. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, gait, proxemics, and human behaviors is also the subject of gesture recognition techniques. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse. Gesture recognition enables humans to interface with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

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cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

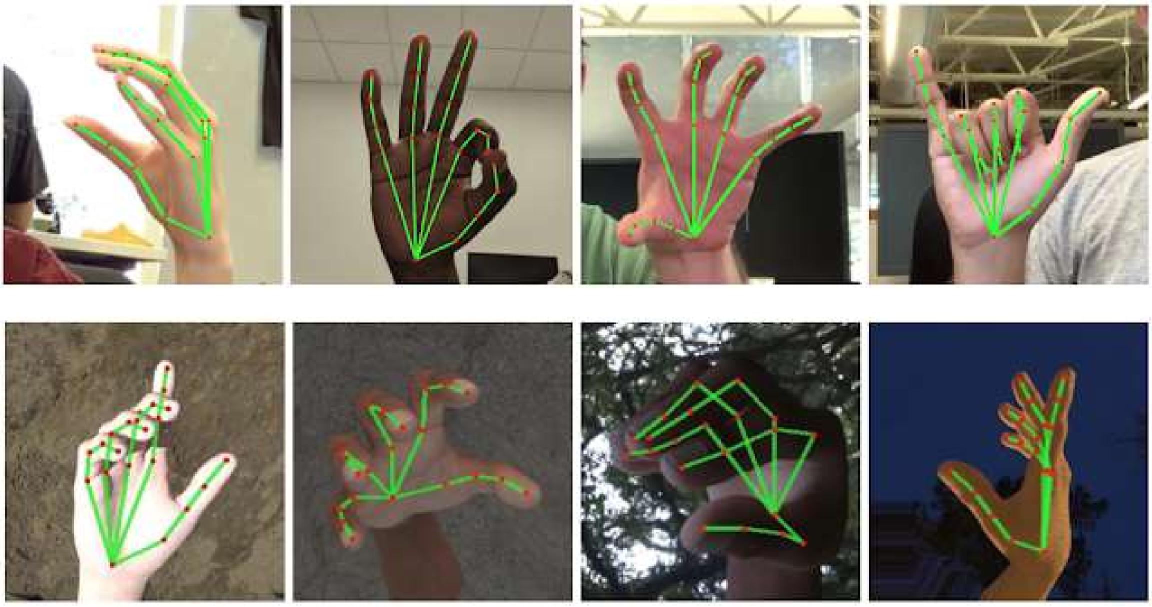

Figure 1.1: Hand gesture recognitions

Human-computer interaction, or HCI, has become an increasingly important part of our daily lives. It is widely believed that as the computing, communication, and display technologies progress even further, the existing HCI techniques may become a bottleneck in the effective utilization of the available information flow. For example, the most popular mode of HCI is based on simple mechanical devices— keyboards and mice. These devices have grown to be familiar but inherently limit the speed and naturalness with which we can interact with the computer. This limitation has become even more apparent with the emergence of novel display technology such as virtual reality. Thus, in recent years there has been a tremendous push in research toward novel devices and techniques that will address this HCI bottleneck.

1.2 Present Technology of gesture recognition

In recent decades, due to computer software and hardware technologies of continuous innovation and breakthrough, the social life and information technology have a very close relationship in the twenty-first century. In the future, especially the interfaces of consumer electronics products (e.g. smart phones, games and infota1inment systems) will have more and more functions and be complex. How to develop a convenient human-machine Interface (Human Machine Interaction/Interface, HMI) for each consumer electronics product has become an important issue. The traditional electronic input devices, such as mouse, keyboard, and joystick are still the most common interaction way. However, it does not mean that these devices are the most convenient and natural input devices for most users. Since ancient times, gestures are a major way for communication and interaction between people. People can easily express the idea by gestures before the invention of language. Nowadays, gestures still are naturally used by many people and especially are the most major and nature interaction way for deaf people. In recent years, the gesture control technique has become a new developmental trend for many human based electronics products, such as computers, televisions, and games. This technique let people can control these products more naturally, intuitively and in case of existing system. The objective of this paper is to develop a real time hand gesture recognition system based on adaptive color HSV model and motion history image (MHI). By adaptive skin color model, the effects from lighting, environment, and camera can be greatly reduced, and the robustness of hand gesture recognition could be greatly improved.

1.3 Gesture types in computer interfaces

There are two methods that were performed to perform the hand gesture recognition

- Online (real time) method
- Offline method.

1.3.1 Offline gestures:

Those gestures that are processed after the user interaction with the object. An example is the gesture to activate a menu.

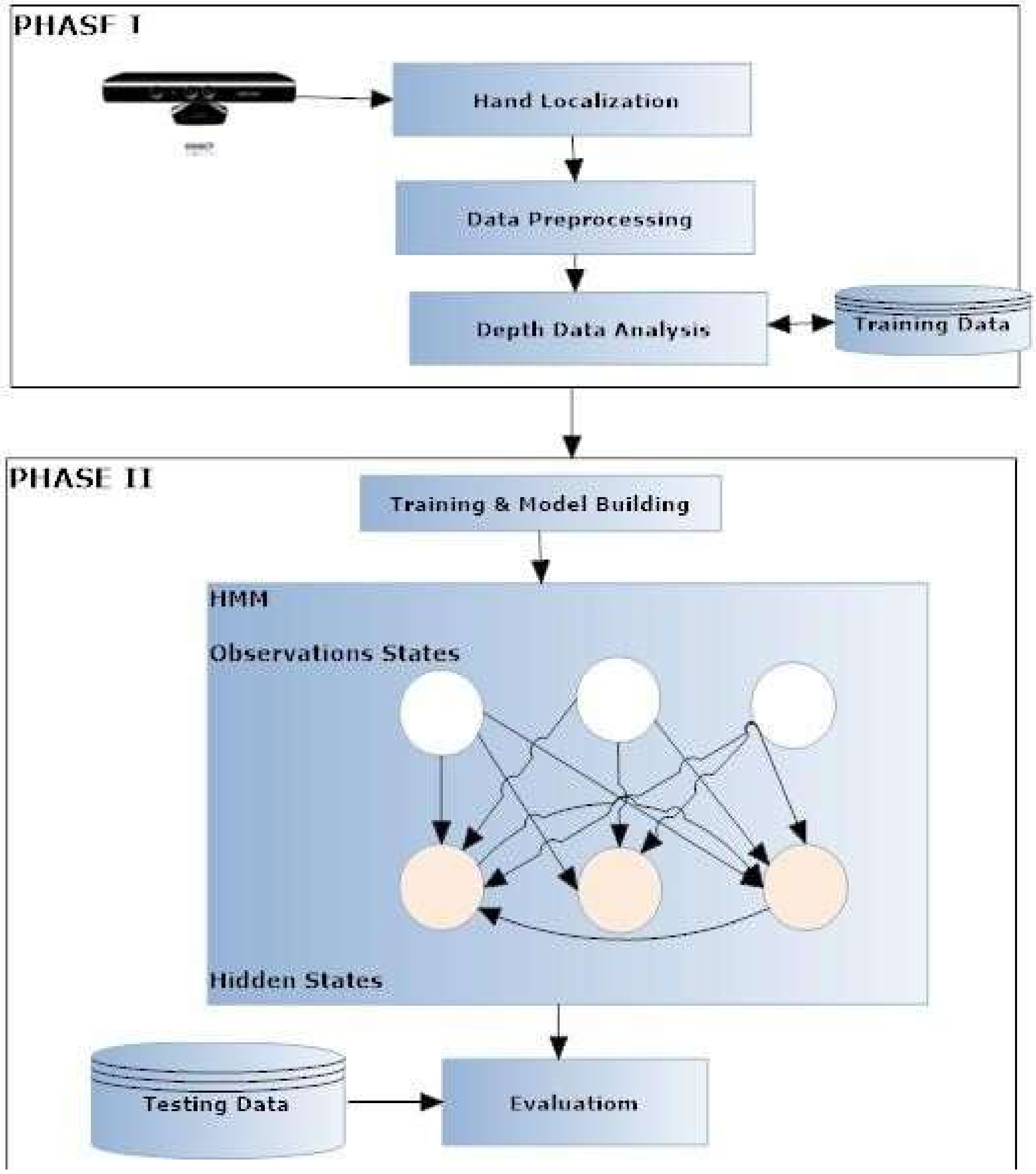

Figure 1.2. General Architecture of the "offline" hand gesture recognition method

A full body tracker will give us a roughly estimate of the hand's location. Then threshold was used based on depth data to differentiate between the hand pixels and the background ones. This involves estimating the depth value of the hand using the skeletal structure, and labeling those pixels whose z-value (depth) deviates too far from this estimated depth as background pixels. After hand localization each frame data is preprocessed and get the depth map for each state (frame) of the gesture. Finally, the system saves this data in XLS file sheet to use it in phase 2.

In phase 2 creation of the HMM , training and testing tasks are performed. Figure above shows the proposed framework for the offline hand gesture recognition. As an explanation example, we will apply the training on the circular gesture.

1.3.2 Online (Real Time) gestures:

Direct manipulation gestures. They are used to scale or rotate a tangible object.

Gesture library is created firstly in gesture recognition. Image pre-processing and feature extraction are done to obtain ideal gesture segmentation effect; and moment characteristic components are used as the feature vector of gesture image. Then the algorithm of support vector machine is used for the classification and recognition of hand gesture image, meanwhile, several common multi-class classification algorithms of support vector machine, multiple classification algorithm based on the posterior probability, and several traditional multiple classification methods are applied to gesture recognition, and the results are compared.

In order to search for the best model of support vector machine for hand gesture recognition, we have done many experiments, comparing the use of a variety of multi - class classification method and the classification accuracy of different kernel function. The experimental results are shown in Table 1. In the table, The "C" is the penalty parameter; "b", "d", "r" is the kernel function parameters. When testing the support vector machine classifier, the Hu moment feature vector of test samples are used as inputs, according to well trained model file, svmpredict application is used to do the classification and output and test sample's category.

Localizing the hand is a common module between the online and offline methods. The hand localization is the first step in the two proposed methods. A stream of hand points that record how a hand moves through space over time forms NITE gestures. Every hand point is the real-world 3D coordinate of the center of the hand, measured in millimeters. Gesture detectors are sometimes called point listeners (or point controls) as they analyze the points stream looking for a gesture. In Detecting Gestures technique the system starts by setting up a range of OpenNI nodes and NITE detectors, each with event listeners. After that it enters a loop which passes Kinect events arriving at OpenNI's context object to NITE's Session Manager. Mainly using a wave detector, push detector or circle detector

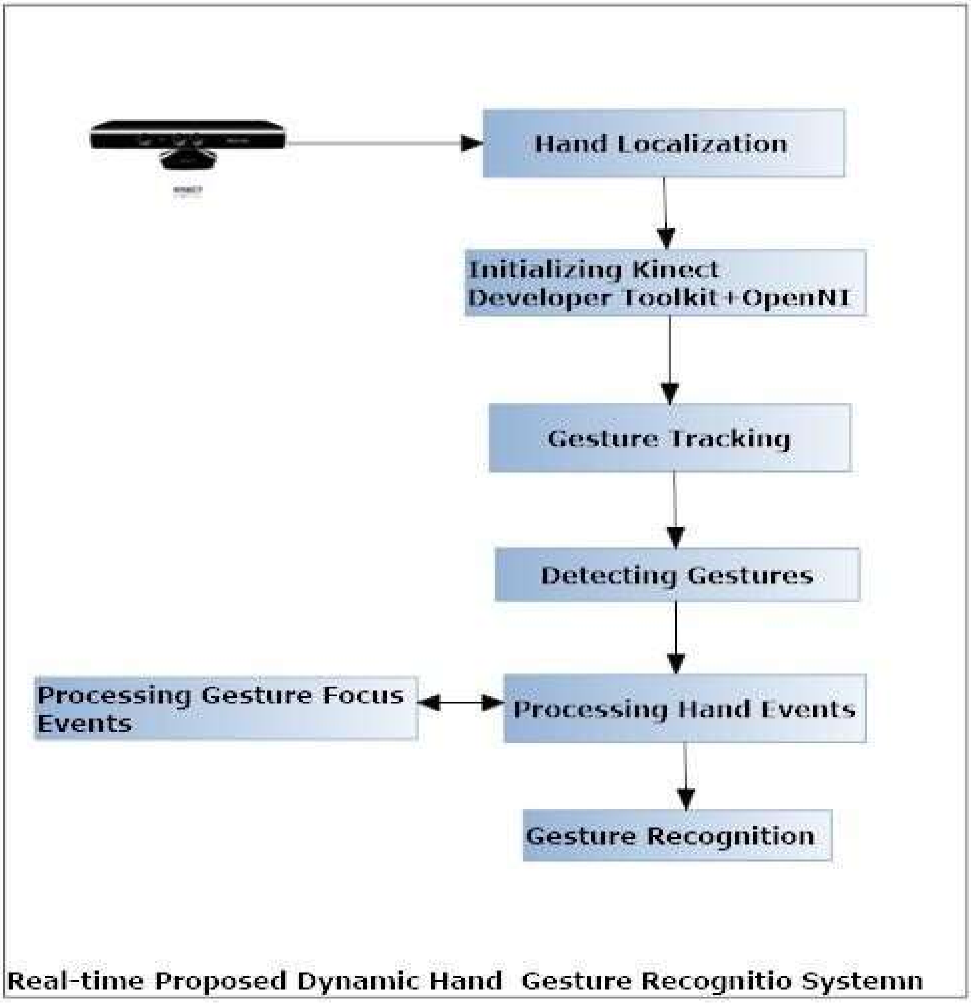

Figure 1.3. General architecture of the "real-time" hand gesture recognition method

Chapter 2

DESCRIPTION OF GESTURE REOGNITION

2.1. Gesture Tracking and Recognition System Based on Computer Vision

A general hand gesture tracking and recognition system based on computer vision is shown in Information and Computer Technologies 192 Figure 1. First, use the video camera to capture video data flow; to see if there are gestures in the stream interaction model, and segment the hand gestures from video signals. Then the image pre-processing and feature extraction are used to obtain ideal gesture segmentation effect. Choose the moment features as feature vector of gesture image; adopt the CamShift algorithm for real-time hand gesture tracking. The Hu moment feature and "one-to-many" radial basis kernel function SVM algorithm is applied to gesture recognition. The 10 digital sign simulation experiments are done, and then set up a simple gesture interactive system.

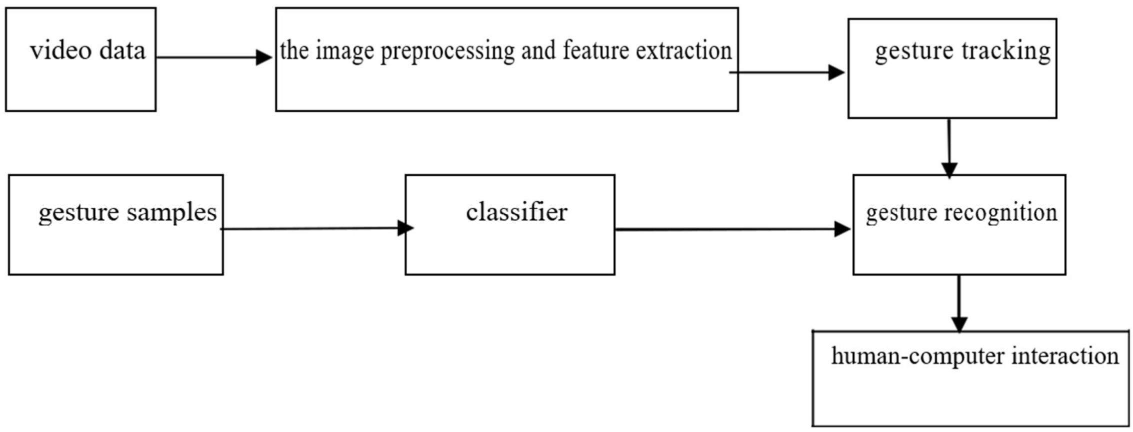

Figure 2.1. Hand gesture tracking and recognition system based on computer vision flow chart

2.2 Gesture Tracking Input devices

The ability to track a person's movements and determine what gestures they may be performing can be achieved through various tools.

- **Wired gloves:**

These can provide input to the computer about the position and rotation of the hands using magnetic or inertial tracking devices. Furthermore, some gloves can detect finger bending with a high degree of accuracy (5-10 degrees), or even provide haptic feedback to the user, which is a simulation of the sense of touch.

- **Depth-aware cameras:**

Using specialized cameras such as structured light or time-of-flight cameras, one can generate a depth map of what is being seen through the camera at a short range, and use this data to approximate a 3d representation of what is being seen. These can be effective for detection of hand gestures due to their short range capabilities

- **Stereo cameras:**

Using two cameras whose relations to one another are known, a 3d representation can be approximated by the output of the cameras. In combination with direct motion measurement (6D-Vision) gestures can directly be detected.

- **Controller based gestures:**

These controllers act as an extension of the body so that when gestures are performed, some of their motion can be conveniently captured by software. Mouse gestures are one such example, where the motion of the mouse is correlated to a symbol being drawn by a person's hand, as is the Wii Remote, which can study changes in acceleration over time to represent gestures.

- **Single camera:**

A standard 2D camera can be used for gesture recognition where the resources/environment would not be convenient for other forms of image-based recognition. Earlier it was thought that single camera may not be as effective as stereo or depth aware cameras, but some companies are challenging this theory. Software-based gesture recognition technology using a standard 2D camera that can detect robust hand gestures, hand signs, as well as track hands or fingertip at high accuracy has already been embedded in Lenovo’s Yoga ultra books.

2.3 Stages of Gesture Recognition

The most gesture recognition methods usually contain three major stages. The first stage is the object detection. Many environment and image problems are needed to solve at this stage to ensure that the hand contours or regions can be extracted precisely to enhance the recognition accuracy. Common image problems contain unstable brightness, noise, poor resolution and contrast. The target of this stage is to detect hand objects in the digital images or videos. Many environment and image problems are needed to solve at this stage to ensure that the hand contours or regions can be extracted precisely to enhance the recognition accuracy. Common image problems contain unstable brightness, noise, poor resolution and contrast. The better environment and camera devices can effectively improve these problems. However, it is hard to control when the gesture recognition system is working in the real environment or is become a product. Hence, the image processing method is a better solution to solve these image problems to construct an adaptive and robust gesture recognition system. The second stage is object recognition. The detected hand objects are recognized to identify the gestures. At this stage, differentiated features and effective classifiers selection are a major issue in most researches. The third stage is to analyze sequential gestures to identify users' instructs or behaviors where motion-based dynamic gesture recognition system for interaction between human and computer system is proposed.

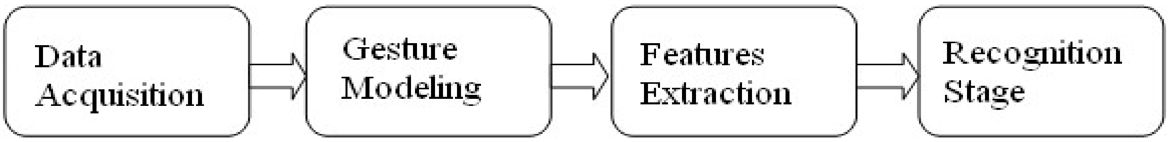

Figure 2.2: Block diagram of Gesture Recognition System

Gesture recognition system composed of several stages; these stages are varied according to application used, but, however, the unified outline can be settled, Figure 2.2 above fulfils this requirement.

- **Data Acquisition:**

  This step is responsible for collecting the input data which are the hand, Face or Body gestures and classifier classifies the input tested gesture into required one of classes.

- **Gesture Modeling:**

  This employed the fitting and fusing the input gesture into the model used; this step may require some pre-processing steps to ensure the successful unification.

- **Feature Extraction:**

  After successful modeling of input data/gesture, the feature extraction should be smooth since the fitting is considered the most difficult obstacles that may face; these features can be hand/palm/fingertips location, joint angles, or any emotional expression or body movement. The extracted features might be stored in the system at training stage as templates or may be fused with some recognition devices such as neural network, HMM, or decision trees which have some limited memory should not be overtaken to remember the training data.

- **Recognition Stage:**

  This stage is considered to be a final stage for gesture system and the command/meaning of the gesture should be declared and carried out, this stage usually has a classifier that can attach each input testing gesture matching class.

Chapter 3

PROCESS BEHIND GESTURE RECOGNITION

3.1.1 The Gesture Image Pre-processing and Feature Extraction

It is very important to establish a good sample database for statistical recognition. The gesture images obtained by the camera are segment into monochrome gesture images to set up a sample library. Specifically, the first step is to do sample collection. Limit the shooting background for monochrome background in the acquisition of gesture samples, but allow the light intensity changes. Set the gesture image normalized to the 200×240 pixel size. The samples selected are preserved in corresponding folder according to certain rules. In this paper, the identification of 10 digital 0-9 gesture is made, as shown in Figure 2 and Figure 3. Figure 2 is the RGB image acquisition from the camera, figure 3 is the corresponding image segmentation, which is the gesture sample to be saved.

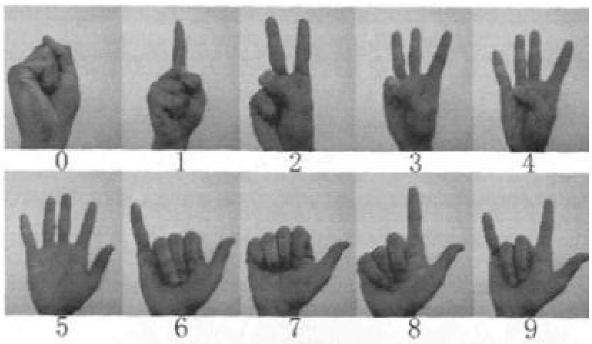

Figure 3.1. Digital gesture RGB image

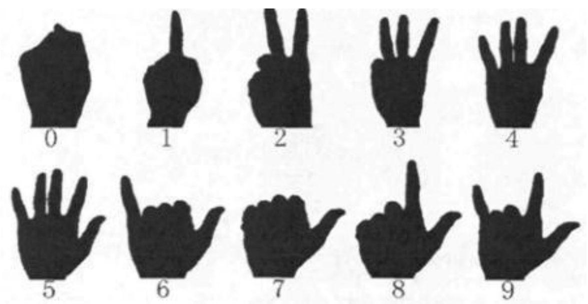

Figure 3.2 Schematic diagram of digital gesture segmentation

The gesture image transform from RGB space to the YCbCr space, using the characteristics of the luminance and chrominance separation of YCbCr colour space. To a certain extent, this method avoids the interference of light, and then use the Otsu method to make image processing on the image of Cb and Cr channels. The experimental results show that, Cb and Cr colour channel has better segmentation effect compared with the Y channel. The specific process of Otsu method is as follows :

1) The calculation of normalized histogram $h(i)$;
2) Calculate the mean grey-scale value $u_T = \sum_{i=0}^{255} i * h(i)$;
3) Calculate the histogram of zero order cumulant $w(k)$ and cumulative moment $u(k)$:

$$w(k) = \sum_{i=0}^{k} h(i) \quad k = 0,1,\ldots 255;$$

$$u(k) = \sum_{i=0}^{k} i * h(i) \quad k = 0,1,\ldots 255;$$

4) The calculation of separation index: $\sigma_B(k) = \frac{[\mu_T \omega(k) - \mu(k)]^2}{\omega(k)[1-\omega(k)]} \quad k = 0,1,\ldots 255;$
5) The k corresponding to $\max(\sigma_B(k))$ is the optimal threshold value T;
6) Get binary image according to the optimal threshold value:

$$g(x,y) = \begin{cases} 255 & f(x,y) > T \\ 0 & f(x,y) \le T \end{cases}.$$

In order to better the region extraction to obtain the gesture area accurately, grey projection method is used in the paper. Specific means is to use the grey projection method in the vertical direction and the horizontal direction respectively, so as to obtain the gesture coordinate range in X direction and Y direction. As shown in Figure 4, (a) RGB image is captured from real-time video in the hand, (b) is corresponding to the processed image of (a), (c) is hand region determined by grey projection.

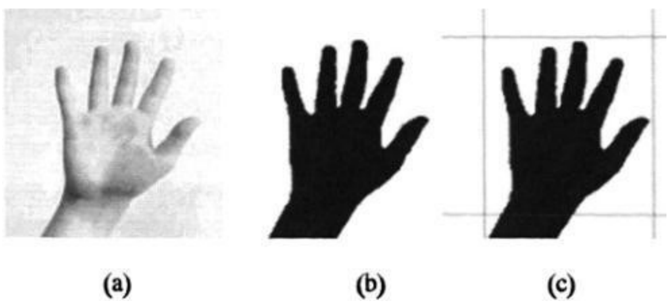

Figure 3.3. Hand region using grey projection method

3.1.2. Hand Tracking

Camshift is the Mean Shift algorithm of continuous adaption. It is the extension and improvement of Mean Shift algorithm, which can handle dynamic changes of target tracking. When the video sequence changes frame by frame, the Camshift automatically adjusts the search window size and position the tracked target. With the current known localization results, it can predict the target position in the next frame. This iteration of each frame image leads to dynamic tracking. The experimental results show that, CamShift algorithm does not have high requirements on system resources. It has better realtime interactive scene and robustness in the actual performance.

3.1.3. Real-Time Gesture Recognition

Gesture library is created firstly in gesture recognition. Image pre-processing and feature extraction are done to obtain ideal gesture segmentation effect; and moment characteristic components are used as the feature vector of gesture image. Then the algorithm of support vector machine is used for the classification and recognition of hand gesture image, meanwhile, several common multi-class classification algorithms of support vector machine, multiple classification algorithm based on the posterior probability, and several traditional multiple classification methods are applied to gesture recognition, and the results are compared.

In order to search for the best model of support vector machine for hand gesture recognition, we have done many experiments, comparing the use of a variety of multi - class classification method and the classification accuracy of different kernel function. The experimental results are shown in Table 1. In the table, The "C" is the penalty parameter; "b", "d", "r" is the kernel function parameters. When testing the support vector machine classifier, the Hu moment feature vector of test samples are used as inputs, according to well trained model file, svmpredict application is used to do the classification and output and test sample’s category.

3.2 Architecture of Gesture recognition system

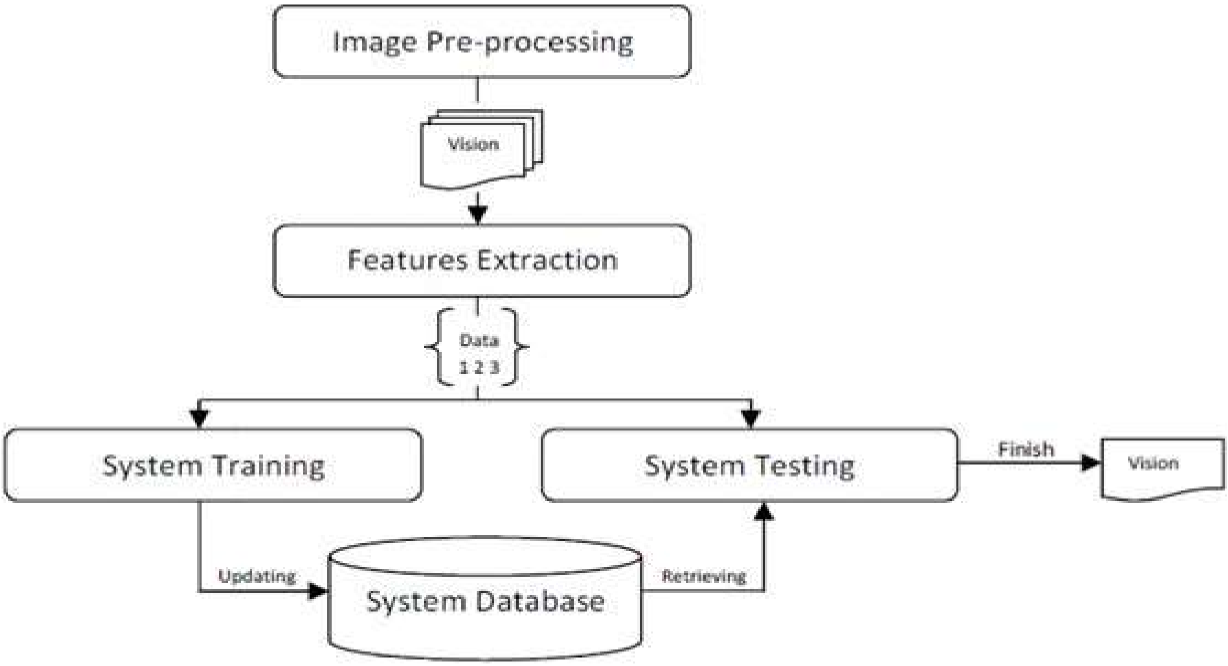

Figure 3.4. Architecture of gesture recognition system.

3.2.1 Extraction Method and image pre-processing

Segmentation process is the first process for recognizing hand gestures. It is the process of dividing the input image (in this case hand gesture image) into regions separated by boundaries . The segmentation process depends on the type of gesture, if it is dynamic gesture then the hand gesture need to be located and tracked , if it is static gesture (posture) the input image have to be segmented only. The hand should be located firstly, generally a bounding box is used to specify the depending on the skin color and secondly, the hand have to be tracked, for tracking the hand there are two main approaches; either the video is divided into frames and each frame have to be processed alone, in this case the hand frame is treated as a posture and segmented , or using some tracking information such as shape, skin color using some tools such as Kalman filter.

The common helpful cue used for segmenting the hand is the skin color , since it is easy and invariant to scale, translation, and rotation changes . Different tools and methods used skin and non-skin pixels to model the hand. These methods are parametric and non-parametric techniques, Gaussian Model (GM) and Gaussian Mixture Model (GMM) are parametric techniques, and histogram based techniques are non- parametric. However it is affected with illumination condition changes abs different races . Some researches overcome this problem using data glove and colored markers which provide exact information about the orientation and position of palm and fingers . Others used infrared camera , and range information generated by special camera Time-of-Flight (ToF) camera , although these systems can detect different skin colors under cluttered background but it is affected with changing in temperature degrees besides their expensive cost . The segmentation considered as an open issue problem itself . The color space used in a specific application plays an essential role in the success of segmentation process, however color spaces are sensitive to lighting changes, for this reason, researches tend to use chrominance components only and neglect the luminance components such as r-g, and HS color spaces. However there are some factors that obstacle the segmentation process which is ; complex background, illumination changes, low video quality. applied HSV color model which concentrates on the pigments of the pixel, used YCbCr color space. used normalized r-g color space. Some preprocessing operations are applied such as subtraction, edge detection, and normalization to enhance the segmented hand image . Figure 2 shows some segmentation method examples.

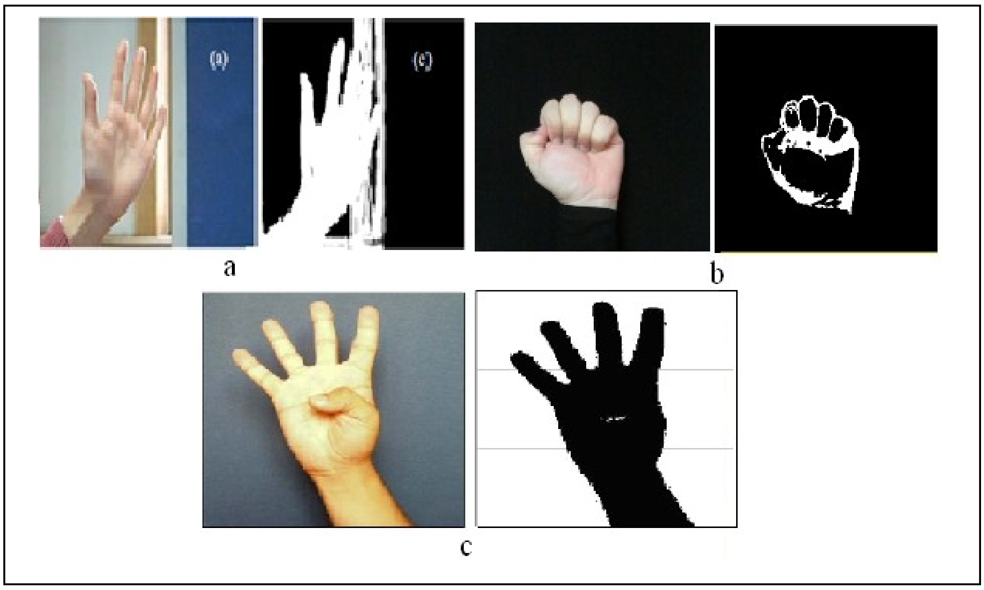

Figure 3.5. segmentation method. a) , b) , c) .

3.2.2 Features Extraction

Good segmentation process leads to perfect features extraction process and the latter play an important role in a successful recognition process . Features vector of the segmented image can be extracted in different ways according to particular application. Various methods have been applied for representing the features can be extracted. Some methods used the shape of the hand such as hand contour and silhouette while others utilized fingertips position, palm center, etc. created 13 parameters as a feature vector, the first parameters represents the ratio aspect of the bounding box of the hand and the rest 12 parameters are mean values of brightness pixels in the image. used Self-Growing and Self-Organized Neural Gas (SGONG) neural algorithm to capture the shape of the hand, then three features are obtained; Palm region, Palm center, and Hand slope. calculated the Center Of Gravity (COG) of the segmented hand and the distance from the COG to the farthest point in the fingers, and extracted one binary signal (1D) to estimate the number of fingers in the hand region. divided the segmented image into different blocks size and each block represents the brightness measurements in the image. Many experiments were applied to decide the right block size that can achieve good recognition rate . used Gaussian pdf to extract geometric central moment as local and global features. Figure 3 shows some applications of feature extraction methods.

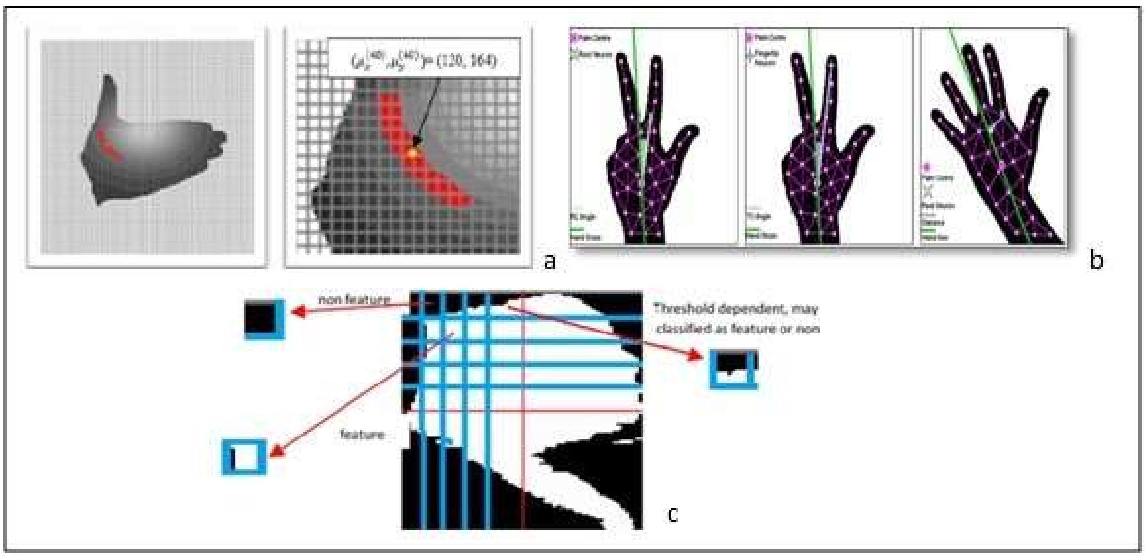

Figure 3.6 features representation.

3.2.3. Gestures Classification

After modeling and analysis of the input hand image, gesture classification method is used to recognize the gesture. Recognition process affected with the proper selection of features parameters and suitable classification algorithm . For example edge detection or contour operators cannot be used for gesture recognition since many hand postures are generated and could produce misclassification . Euclidean distance metric used to classify the gestures . Statistical tools used for gesture classification, HMM tool has shown its ability to recognize dynamic gestures besides, Finite State Machine (FSM) , Learning Vector Quantization, and Principal Component Analysis (PCA) . Neural network has been widely applied in the field of extracted the hand shape , and for hand gesture recognition . Other soft computing tools are effective in this field as well, such as Fuzzy C- Means clustering (FCM) , and Genetic Algorithms GAs . Figure 4 explain the architecture of classification system.

3.3 Algorithms to model a gesture

Depending on the type of the input data, the approach for interpreting a gesture could be done in different ways. However, most of the techniques rely on key pointers represented in a 3D coordinate system. Based on the relative motion of these, the gesture can be detected with a high accuracy, depending of the quality of the input and the algorthmic approach. Some literature differentiates 2 different approaches in gesture recognition.

1. 3D model based

2. Appearance-based.

3D model-based algorithms: The 3D model approach can use volumetric or skeletal models, or even a combination of the two. Volumetric approaches have been heavily used in computer animation industry and for computer vision purposes. The models are generally created of complicated 3D surfaces, like NURBS or polygon meshes. The drawback of this method is that is very computational intensive, and systems for live analysis are still to be developed. Skeletal-based algorithms: In skeletal representation of the body, a virtual skeleton of the person is computed and parts of the body are mapped to certain segments. The analysis here is done using the position and orientation of these segments and the relation between each one of them (for example the angle between the joints and the relative position or orientation)

Appearance-based models: These models don't use a spatial representation of the body anymore, because they derive the parameters directly from the images or videos using a template database. Some are based on the deformable 2D templates of the human parts of the body, particularly hands. Deformable templates are sets of points on the outline of an object, used as interpolation nodes for the object's outline approximation. One of the simplest interpolation function is linear, which performs an average shape from point sets, point variability parameters and external deformators. These templatebased models are mostly used for handtracking, but could also be of use for simple gesture classification

Chapter 4

APPLICATIONS AND CHALLENGES

4.1. Evolution of Gesture Recognition

Hand gesture recognition has proven to be an excellent means of Human Computer Interaction over other approaches through keyboards and mouse. This paper presents a review of the evolution of this excellent, easy and natural way of Human Machine Interaction. In this review article the advantages and disadvantages of various techniques that have come up with time and ongoing researches in this field have been discussed. Most of the researchers initially used gloves for the interaction, and then came the vision based hand gesture recognition for 2D graphical interface which uses colour extraction through optical flow and feature point extraction of the hand image captured. New ideas and algorithms have come for 3D applications for moving machine parts or humans. This evolution has resulted in developing a low cost interface device for interacting with objects in virtual environment using hand gestures. Finally, the future work that can be done in this field is also discussed

4.2 Application of Gesture Tracking and Recognition

- **Human-Computer Interaction**

In order to validate the gesture tracking and recognition algorithm, a simple Word digital input program is written based on Visual C++6.0 platform, realizing the operation of the Word document from camera input gesture. This system captures gestures and recognition through the USB camera, thus realize the simple operation of the Word. The functions of the gesture interactive system are shown as follows.

- **Sign language recognition.**

Just as speech recognition can transcribe speech to text, certain types of gesture recognition software can transcribe the symbols represented through sign language into text.

- **For socially assistive robotics.**

By using proper sensors (accelerometers and gyros) worn on the body of a patient and by reading the values from those sensors, robots can assist in patient rehabilitation. The best example can be stroke rehabilitation.

- **Directional indication through pointing.**

Pointing has a very specific purpose in our society, to reference an object or location based on its position relative to ourselves. The use of gesture recognition to determine where a person is pointing is useful for identifying the context of statements or instructions. This application is of particular interest in the field of robotics.

- **Control through facial gestures.**

Controlling a computer through facial gestures is a useful application of gesture recognition for users who may not physically be able to use a mouse or keyboard. Eye tracking in particular may be of use for controlling cursor motion or focusing on elements of a display.

- **Alternative computer interfaces.**

Foregoing the traditional keyboard and mouse setup to interact with a computer, strong gesture recognition could allow users to accomplish frequent or common tasks using hand or face gestures to a camera.

- **Immersive game technology.**

Gestures can be used to control interactions within video games to try and make the game player's experience more interactive or immersive.

- **Virtual controllers.**

For systems where the act of finding or acquiring a physical controller could require too much time, gestures can be used as an alternative control mechanism. Controlling secondary devices in a car, or controlling a television set are examples of such usage.

- **Affective computing.**

In affective computing, gesture recognition is used in the process of identifying emotional expression through computer systems.

- **Remote control**.

Through the use of gesture recognition, "remote control with the wave of a hand" of various devices is possible. The signal must not only indicate the desired response, but also which device to be controlled.

4.3 Challenges

Challenges There are many challenges associated with the accuracy and usefulness of gesture recognition software. For image-based gesture recognition there are limitations on the equipment used and image noise. Images or video may not be under consistent lighting, or in the same location. Items in the background or distinct features of the users may make recognition more difficult. The variety of implementations for image-based gesture recognition may also cause issue for viability of the technology to general usage. For example, an algorithm calibrated for one camera may not work for a different camera. The amount of background noise also causes tracking and recognition difficulties, especially when occlusions (partial and full) occur. Furthermore, the distance from the camera, and the camera's resolution and quality, also cause variations in recognition accuracy. In order to capture human gestures by visual sensors, robust computer vision methods are also required, for example for hand tracking and hand posture recognition or for capturing movements of the head, facial expressions or gaze direction.

"Gorilla arm" was a side-effect that destroyed vertically-oriented touch-screens as a mainstream input technology despite a promising start in the early 1980s. Designers of touch-menu systems failed to notice that humans are not designed to hold their arms in front of their faces making small motions. After more than a very few selections, the arm begins to feel sore, cramped, and oversized—the operator looks like a gorilla while using the touch screen and feels like one afterwards. This is now considered a classic cautionary tale to human-factors designers; "Remember the gorilla arm!" is shorthand for "How is this going to fly in real use?

4.4. Advantages

• **Reduce external Interface**

The Advantage of System is to Reduce External Interface like Mouse And Keyboard.

• **High Portability**

The proposed System reduce the working of external interface like keyboard and mouse so it makes it high portable

4.5 Drawbacks

In this section, drawbacks of some discussed methods are explained: Orientation histogram method applied in have some problems which are; similar gestures might have different orientation histograms and different gestures could have similar orientation histograms, besides that, the proposed method achieved well for any objects that dominate the image even if it is not the hand gesture. Neural Network classifier has been applied for gestures classification but it is time consuming and when the number of training data increase, the time needed for classification are increased too. In the NN required several hours for learning 42 characters and four days to learn ten words. Fuzzy c-means clustering algorithm applied in has some disadvantages; wrong object extraction problem raised if the objects larger than the hand. The performance of recognition algorithm decreases when the distance greater than 1.5 meters between the user and the camera. Besides that, its variation to lighting condition changes and unwanted objects might overlap with the hand gesture. In the system is variation to environment lighting changes which produces erroneous segmentation of the hand region. HMM tools are perfect for recognition dynamic gestures but it is computational consuming. Other system limitation as listed in where the gestures are made with the right hand only, the arm must be vertical, the palm is facing the camera, and background is plane and uniform. In System limitations restrict the application such as; gestures are made with the right hand only, the arm must be vertical, the palm is facing the camera, background is uniform. In the system could recognize numbers only from 0 to 9. While the system proposed in for controlling a robot, can counts number of active fingers only without regard to which particular fingers are active with a fixed set of commends.

4.6 Future scope

The future of this technology is hard to predict because with any technology, it is always changing. The horizon is a little blurry but one can make the assumption that it will only continue to develop and eventually turn into voice command technology. These two have already been integrated together but the point of technology is to be able to use it without thinking about it. Whatever that secret may be is what the future is going to be. Wearable tends to be the forerunner right now with Google glass becoming popular and the rumor of Apple releasing an iWatch next year. It will be interesting to see where technology takes us because it is just as important to remember to stay human. Google has also been talking about making a car and with the Siri integration in others; technology and our phones have entered into every part of our lives. Perhaps there will come a day we will be able to speak things and they will just happen all in part to devices being able to completely understand our meanings.

A Kinect based dynamic SL recognition system have been developed. This work described two dynamic SLR systems based on two different methods, real-time (online) and offline ones. These methods were developed for three different gestures; waving, pushing and circular. We used the Microsoft Kinect camera in this task. The hand localization is the first step in the two proposed methods. A full body tracker will give us a roughly estimate of the hand's location. Then threshold was used based on depth data to differentiate between the hand pixels and the background ones. In the real-time method, we tracked the points path of a hand gesture and detected the performed gesture. The point uses real-world coordinates, measured in millimeters, with the positive x-, y-, and z-axes. And finally we compared the two methods.

In the offline method, we captured the depth data of the gestures and saved them in an xls file. Then the offline phase begins, as the training and testing the data were performed based on the HMM. We made a comparison between the two methods and found that the recognition rate for the online hand gesture recognition is lower than the recognition rate for the offline one. They are 89% and 100% respectively. As a future work we will try to enhance the real time method performance, increase the number of the SL gestures and also, we will try to work on the continues sentences.

Gestures are destined to play an increasingly important role in human-computer interaction in the future. Area of Hand gesture based computer human interaction is very vast. Hand recognition system can be useful in many fields like robotics, computer human interaction and so make hand gesture recognition offline system for real time will be future work to do. Support Vector Machine can be modified for reduction of complexity. Reduced complexity provides us less computation time so we can make system to work real time.

CONCLUSION

The gesture control technology has become a new developmental trend for many human-based electronics products. The human-machine interface for users to control some service system just by their hands. The proposed scheme can be further applied to be HMI for other applications the Microsoft Visual C++6.0 development environment, using OpenCV open source library, gesture tracking and recognition algorithms of different stages based on computer vision are studied and validated. A simple Word digital recording system is developed, combining the gesture recognition in human-such as, intelligent televisions, playing games, robots, bulletin board and so on. computer interaction. Gesture technology needs to be improved in tracking and real-time recognition, also need to increase the kind of gestures, and further improve the recognition speed and accuracy.

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