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An Analysis of Vision Based Malaysian Sign Language Recognition Methods: A Review

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ABSTRACT: One of the interesting ways for showing natural human computer interaction is using the hand as input device. Glove based sensing is one of the famous technologies used as an input device for human computer interaction (HCI) in last 3 decade. Computer vision (CV) has provided a great potential for natural and non-contact solutions. In conclusion, using hand as an input device for HCI play a great research area in computer vision. We are going to focus at different technique have been used for Malaysian Sign Language (MSL) recognition. The main aim of this paper is review on hand detection, tracking and gesture recognition methods which are used for Malaysian sign language recognition applied by different researchers.

KEYWORDS: MSL**,** Image Processing, Gesture Recognition

I. INTRODUCTION

Information technology has done evolution in our daily life, so we can imagine that computer system have been merged into our society. This environment needs for new method of HCI, which can make our daily life more interesting and comfortable. Adapting HCI gives us ability for the development of a huge area of applications such as Argument Reality (AR) systems or Virtual Environment (VEs). By developing such systems we are facing challenging and interesting research problem which include inputs, output, an interaction and evaluation methods.

When we look at a human body, the hand is a most effective, general purpose interaction tool due to its dexterous functionality in communication and manipulation. The most interaction styles tend to import both modalities to allow intuitive and natural interaction.

Motion detection can be started as a way to understand human languages by computer so can begin to build relationship between human and machine. So far, the basic Hyper Text Markup Language (HTML) interface or graphical user interface (GUI) has been used and still mostly limited to keyboard and mouse input. Three approaches are commonly used to interpret gestures for human computer interaction.

A. Data Gloves Approaches

One of the interactive devices, which facilitate tactile sensing and motion control in computer vision application, is data gloves. Data gloves are one of several types of electromechanical devices used in haptic applications.

A tactile sensor is a device that measures information arising from physical interaction with its environment. Tactile sensors are generally modeled after the biological sense of cutaneous touch which is capable of detecting stimuli resulting from mechanical stimulation, temperature, and pain (although pain sensing is not common in artificial tactile sensors). Fine motion involves activity which occurs within comparatively small spaces. For example, positioning an end-effectors for precise grasping within a comparatively small space. This contrasts with gross-motion planning, which involves movement within comparatively large free spaces.

They have a several drawback in terms of casual use as they are very expensive, hinder the naturalness of hand motion, and require complex calibration and setup procedures to be able to obtain measurements.

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B. Color Glove Approaches

A deal is made between data glove based approaches and vision based approaches by the color glove based approaches. To realize the process of tracking and position of the palm and fingers, marked gloves or colored markers are the gloves which are used by the human hand with some different colors. These approaches will give us the capability to haul out geometric features necessary to form hand shape. Easiness in use, and cost low price comparing with an instrumented data glove is the convenience of this technology. Unnatural and not suitable for different applications with multiple users due to hygiene issues are some of the disadvantages.

C. Bare hand Approaches

Computer vision is a field that includes methods for acquiring, processing, analyzing, and understanding images and, in general, high-dimensional data from the real world in order to produce numerical or symbolic information. Natural interaction between humans does not involve devices because we have the ability to sense our environment with eyes and ears. In principle, the computer should be able to imitate those abilities with cameras and microphones.
This is one of the fields of robotics in which programs endeavor to recognize objects represented in digitized images offered by video cameras, thus enabling robots to "see." For object identification and location within a three-dimensional field of view, much work has been done on stereo vision as an aid. Figure1 shows different hand input technology.

(a) Data-Glove based (b) Color marker based (c) vision based

Figure1. Example of hand input technology

II. APPLICATION DOMAINS

Researches has designed and use of computer technology, focusing particularly on the interfaces between people (users) and computers. Researchers in the field of application domain focused on both which observe the ways in which humans interact with computers and design technologies that lets humans interact with computers in novel ways.

A. Medical Technologies

Gestures can be used for controlling diverse parts of hospital such as the giving out of resources in hospitals, interact with medical instrumentation, control visualization displays, and assist handicapped users as part of their rehabilitation therapy, gestures can be used.[1, 2] -many ideas have been oppressed to progress medical procedures and systems ; Hand gestures can be combined into doctor-computer interfaces, describing a computer-vision system that enables surgeons to perform standard mouse functions was implemented by Graetzel et al.[3].

B. Entertainment

Recently, computer game technology focus on rewarding field for interactive interfaces based on engaging nature of the interaction. new different models are demanded by different user in challenging games. Controlling device is delivered through the user's fingertips, in which fingers touching the screen; most significant is where the touch is made and the number of fingers used. In computer-vision-based, hand-gesture-controlled games ,[4] the organization must counter rapidly to user gestures, the "fast-response" requirement.

In the Mind-Warping augmented-reality fighting game,[5]where users interact with virtual opponents through hand gestures, gesture spotting is solved through voice recognition. The start and end of a temporal gesture is "marked" by voice—the start and end of a Kung Fu[5].

C. Crisis management and disaster relief

Natural disaster (like tornados and floods) and human caused disaster(such as terrorist attacks) can be handle by Command-and-control systems which help to manage public response. The large volumes of complex data can be accessed through traditional human-computer interfaces . One such system, the "Command Post of the Future," uses pen-based gestures.[6] Such hand-gesture interface systems must reflect the requirements of "fast learning," "intuitiveness," "lexicon size and number of hands," and "interaction space" to achieve satisfactory performance.

D. Human-robot interaction.

Hand gesture recognition is a critical aspect of robots that suggested by Korten kamp et al. First, Accuracy of gestures can improve by combining with voice commands. Second, directional robot tasks can be recognized by valuable geometric features of hand gesture. For example, the pointing gesture can represent the "go there" command for mobile robots. Chen and Tseng implemented human-robot interaction for the game industry in which three static gestures at multiple angles are used by a computer vision algorithm with 95% accuracy, satisfying the "accuracy" requirement.

E. Sign Language.

Sign language is one of the most important communication gestures. Since 20 years ago for sign language, there are many vision algorithms have been implemented. They can be a good way to inspire disabled to interrelate with computers. An example that has received considerable interest is sign language for a deaf.

III. HAND DETECTION APPROACHES

Many techniques are available for hand detection in the picked up image after preprocessing. Vision-based approach is a single way for freehand and bare handed interaction. Some image characteristics such as texture and color deal with vision based technology for obtaining data needed for gesture analyze.
The hand is a complicated object which is very rich in shape and movement with a lots features and textures. Static hand posture can be detected with some geometric features such as figure tips, finger direction and position of hand in the scene. Non geometric features such as textures, Silhouette and color, however, are not sufficient for posture and gesture recognition. Since it is not easy to specify the features explicitly, the whole image or transformed image is taken as the input and features are selected implicitly and automatically by the recognizer. The interest in this area has led to some of research which has been designed in number of Malaysian Sign Language recognition papers, see below Table1.

Table1. List of Malaysian sign Language papers.

Year	Author	Focus
2007	[7]	Malay Sign Language Gesture Recognition System
2007	[8]	Real time Malaysian sign language translation using color segmentation and neural network
2007	[9]	Wireless Data Gloves Malay Sign Language Recognition System
2007	[10]	A computer-aided Malaysian sign language dictionary with instructions in Myanmar language
2008	[11]	Extraction of Head and Hand Gesture Features for Recognition of Sign Language
2008	[12]	Comparison of Hand Segmentation Methodologies for Hand

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		Gesture Recognition
2008	[13]	MySlang–AN ELECTRONIC MALAYSIAN SIGN LANGUAGE DICTIONARY
2009	[14]	V2S: Voice to Sign Language Translation System for Malaysian Deaf People
2010	[15]	A Hybrid Method Using Haar-like and Skin-Color Algorithm for Hand Posture Detection, Recognition and Tracking
2010	[16]	A Phoneme Based Sign Language Recognition System Using Skin Color Segmentation
2011	[17]	Malay sign language courseware for hearing-impaired children in Malaysia
2011	[18]	Towards Malaysian sign language database
2011	[19]	Feature extraction from 2D gesture trajectory in Malaysian Sign Language recognition
2012	[20]	Malaysian Sign Language database for research
2013	[21]	Development Of a Prototype Vision-Based Malaysian Sign Language Recognition System
2013	[22]	A Model for Real-Time Recognition and Textual Representation of Malaysian Sign Language through Image Processing

A. Custom-made glove

(Akmeliawati) used custom-made gloves are normal gloves with exact color patches on each Fingertip and palm . This method has advantages over other methods which are cheap and non-restrictive towards motion.
Colors for right-hand glove were selected totally different from each other in RGB color and it can be easily realize from common background, skin and clothing color. The color purple is assigned to thumb tip, the red color is giving for index finger and ring fingertips, dark blue color for middle finger and little finger tips. See Fig 2.The left-hand glove is red color in palm and back of the hand.

Figure2.Glove for the signer (Akmeliawati)

B. Skin detection method

[19] and [12] and [23] used the skin color in their research. Above researches produced a dataset of more than 18000 images and created two 3D-model views of histograms in RGB space for skin and non-skin color distribution of images. Skin region contain half of the images and other half contain non-skin regions. Skin region are being segmented out by hand manually. RGB channel with 8^3 bins is used for representing the size of each histogram. Each bins mapped a specific R,G and B colors. Each bin is also rendered as a cube whose size is proportional to the number of counts it contains.
By following equation , discrete probability distribution *P (rgb)* calculated in equation 1,by converting the counts in histogram bins.

$$P(rgb) = \frac{C[rgb]}{T_C} \dots\dots\dots (1)$$

Where
$c[rgb]$= count in the histogram bins

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T_C =gives the total count obtained by adding all the bins in the histogram.
Bellow equation 2 and 3 present a pixel belongs to the skin and non skin classes.

$$P(rgb|Skin) = \frac{s[rgb]}{T_s} \dots \dots \dots (2)$$

$$P(rgb|Non - Skin) = \frac{n(rgb)}{T_n} \dots \dots \dots (3)$$

Where
$S[rgb]$ = the pixel count contained the bin rgb of the skin histogram,
$n[rgb]$ =the pixel counts from non-skin histogram,
T_s= total counts contained in the skin
T_n= the total counts contained in the non-skin histograms.

Other researchers used luminance and shadows for skin color detection (Tze and Kin 2011). With minimum variation in the luminance , RGB and HSV color space could be useful which produce minimum overlap between skin color and background color distribution space. Using YC_bC_r Color space, however, (Y) component contains illumination component while blue component is in C_b and red chrominance componenets concentrated in C_r respectively.
The difference between the blue , red component and reference values can be defined by C_b and C_r.
Gaussian model is used to presente a skin color region, which meansC_b, C_r and it is covariance matrix from the skin sample was calculated by using equations (4).

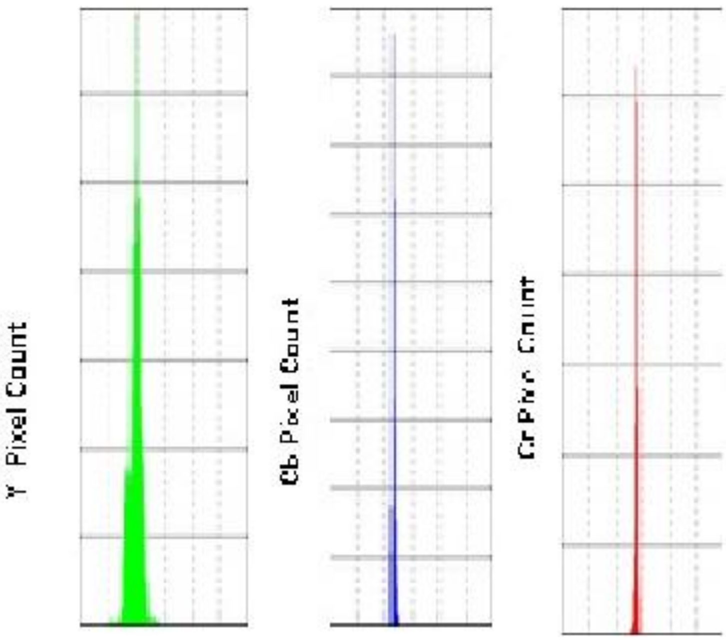
$$Covariance: E\big((x - m)(x - m)\big)T \dots \dots \dots (4)$$

Where
$r = Cr,$
$b = C_b$
x= real or complex variable.
Histogram shown in figure 3.

Skin segmentation calculated by converting original color image to skin likelihood image. This is done by transforming every RGB pixels in color image to YC_bC_r color space thus determine the likelihood value based on equation (5) .

$$P(r, b) = exp[-0.5(x - m)T\ C - 1\ (x - m)] \dots \dots \dots (5)$$

Where
$x = (r, b)T$



Y Gray Level C_b Gray level   Cr Gray level

Figure3.Histogram of R,G and B channel

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The original color image is transformed to a skin likelihood image before skin segmentation is carried out. This is done by transforming every RGB pixel in color image to YC_bC_r Color space, thus determine the likelihood value based on equation (6).

$$P(r,b) = exp[-0.5(x-m)T\ C-1\ (x-m)] \dots \dots \dots (6)$$

Where

$x = (r,b)T$

C. Blobs Labelling

(Bilal, Akmeliawati) extracted face and hands and labeled each blobs. For each blob obtained characteristics, such as area, dimension and orientation of each blob. In her application head is presented at the top and both hand appear below. . This condition can ease the identification of the head from the two hands. Thus, blob labelling has been achieved by applying the y axis labelling approach rather than using the size and the perimeter. Using different colors such as red, green, and blue to identify face ,left hand and right hand respectively. Look at figure 4 below.

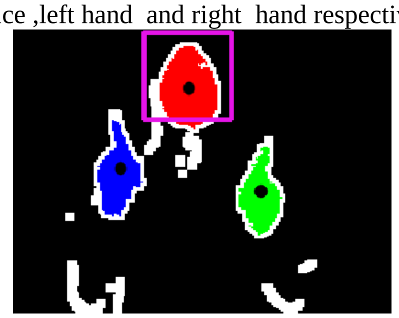

Figure4.Blobs labelling using different colours

D. Boundary Extraction Algorithm

[24] obtained hand region by using boundary of a hand. This method contain 4 steps. 1) Binary image must scan in two directions, from top to button and left to right to find 255 pixel as a starting point and save the position into arrays. Let starting pixel be 0 .Direction number for 8-connectivity is shown in figure 10. 2) it had defined I as a direction of current pixel and J is direction number for next pixel. (I,J)=[(O,6),(1,7),(2,O),(3,1),(4,2),(5,3),(6,4),(7,5)]. Figure-5 is showed illustration of boundary extraction algorithm. 3) it scanned clockwise until first pixel value and save position of x and y into array. 4) continue step 4 and 5 until first pixel value same as a starting value. Figure-6 is showed extracted hand by using boundary extraction.

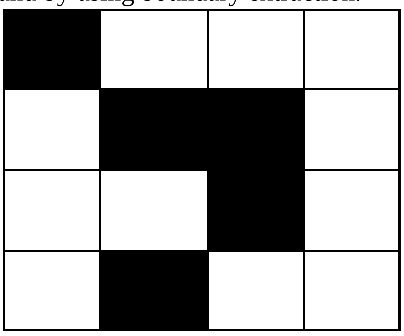

Figure 5.Illustration of boundary extraction(Hsieh)

Figure 6.Extract Boundary of the Hand(Hsieh)

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E. Face /Hand Detection using Haar-Like and AdaBoost

Haar-like feature for hand detection strategy has some advantages rather than other methods such as raw pixel values. It can encode ad-hoc domain knowledge , which is hard to explain by using a finite quantity of training data. It makes classification easier. Furthermore, Haar-like feature can operate much faster by using integral image faster compared to other methods. In addition to the above advantages, the Haar-like features are really robust to lighting changes . (SaraBilal). Figure 7 shown set of Haar_like features.

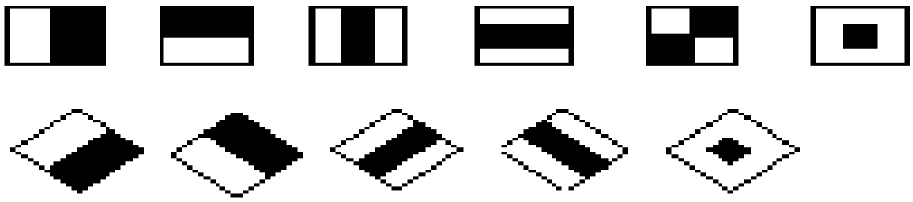

Figure7. Set of Haar-Like features(sarabillal)

Table 2: Hand Detection Model Base Techniques

Work	Methodology	Advantage	Disadvantage
Akmeliawati,2007	Custom-made glove	Very different pose always map to different image	Reduce possibility natural image
Tze and Kin 2011	Skin detection method	Fast detection process	Problem with lighting condition
Bilal, Akmeliawati	Blobs Labelling	good approximation of hand articulations	Not included global hand motion
Hsieh	Boundary Extraction Algorithm	Fast detection process	Occlusion problem
sara Bilal	Haar-Like and AdaBoost	calculation speed, robust to noise and lighting changes	Complicated learning, it is hard for any machine learning to learn join behavior in reliable way.

IV. TRACKING APPROACHES

The system must be able to track face and hands in different direction after detection hand and face region. Either hands cross each other or overlap with face, it should be able to track separately each blobs without considering single blob in each frame. Different methods such as deformation, strain and optical flow applied to track each blob in sequence frame.

A. Repeating consecutive images

[8] had tracked hand by using colored gloves. Location of the Centroid glove is used as a starting point for estimation location of hand. Yellow color is designed for segmentation of center of mass. By using consecutive method for sequence frames , a set of changing centroid location is obtained. In figure below, three consecutive centroid is plotted on final image.

B. Kalman Filter

[15] used Kalman Filter for MSL recognition. This method is based on linear dynamical system and it modeled on Markov chain built on a linear operator perturbed by Gaussian noise. Kalman filter is a recursive filter which means that for estimate current state need to calculate only estimate state from previous time state and current measurement state. The measurement information for current time step is used to refine this prediction to arrive at new and more

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accurate estimate. Performance of Kalman filter is great when target dynamic is linear and matches the model is used by equation 7 and 8.

$$X_k = AX_{k-1} + BU_{k-1} + W_{k-1} \dots\dots\dots (7)$$

State Equation:

$$\boldsymbol{y_k = CX_k + Z_k \dots\dots\dots (8)}$$

Where A,B, and C are matrices describing stares and input;
k =time index,
X = the stare if the system;
U = input;
y = the measured output ,
w = process
Z = measurement noise respectively.

Table 3: Hand Tracking Model Base Techniques

Work	Methodology	Advantage	Disadvantage
Akmeliawat, 2007	Repeating consecutive images	This approach can handle occlusion and misdetection error	it is not suitable for points lying on isolated objects moving in different directions
Bilal,2010	Kalman Filter Algorithm	faster convergence in terms of iterations compared to traditional methods	cost of each iteration is higher

V. GESTURE RECOGNITION

One of the interesting and challenging areas in computer science and language technology is gesture recognition. The main aim of gesture recognition is to deal human interaction with system via mathematical algorithm. Many approaches have been made using cameras and computer vision algorithms to interpret sign language. Recently, human can communicate with machines without using any mechanical device. For example, closing and opening hand form screen so that screen can zoom in and zoom out. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.

A. Artificial Neural Network

[16] used Artificial Neural Network (ANN) which provides other form of computing which attempts to copy the functionality of the brain . Artificial Neural Network contains 3 layers which are input, hider and output layer. This network model has 34 input neurons, 20 hidden neurons and 4 output neurons. It starts with initial weight between 0 and 1. Above researcher used 270 features vector, 162 samples and tested with remaining 108 samples.

A back propagation algorithm is used for train ANN. Following statements shows the steps of back propagation (Lippman)

1. Choice the first training pair and implement the input vector to the net.
2. Compute the net output.
3. Evaluate the actual output with the corresponding target and find the error.
4. Modify the weights so as to reduce the error

These steps are repeated until the error falls within the accepted limit. The developed ANN has a multi-layer feed forward structure as shown in Figure 13 below[25].

[11] A simple neural network models is developed for sign recognition using the features computed from the video stream. The Neural Network architecture has three layers consisting of an input layer, one hidden layer and an output layer. To classify the different gestures a simple neural network model using error back propagation is developed. The neural network model has 45 input neurons and 6 output neurons. It also has one hidden layer with 32 hidden neurons. The initial weights for the neural network are normalized between 0 and 1 and randomized. The performance of the network model is determined using different sets of initial weights.

B. Hidden Markov Model

[8] and [23] and [26] and [23] used Hidden Markov Model (HMM) which is common methods used by many researchers with finite state .
HMM which is a popular approach for modeling processes with finite state that have transition in time , The process is in one state in each discrete time and create observation symbol according to current state. There are two probabilities between each state as mention bellow. [27] and [9].

I. Probability for undergoing the transition provides by transition probability.
II. Output probability, which defines the conditional probability of emitting an output symbol from a finite alphabet when given a state.

The entire model for HMM is expressed as $\lambda = (Z, B, \pi)$ and is defined as follows:

I. Z = State transition probability.
Z= Prob (s_j at $t+1|s_i$ at t), for $1\leq i, j\leq N$
II. N = Number of hidden states ($s_1, \ldots, s_N$)
III. q = Set of state (q= $1, 2 \ldots. N$)
IV. k = Number of discrete symbols $(ds1, \ldots, dsk)$
V. ds = Set of symbol $(ds1, \ldots, dsk)$

Where
a_{ij} = the transition probability from state S_i at time t to state s_j at time t + 1

VI. B =Observation probability distribution $B = (b_{jk})$,

Where
b_{jk} i= the probability of generating symbol dsk from state sj

VII. π-= Initial state distribution: π=(π_j), j = 1, 2, . . .,N,

Where
π_j= Prob (s_j at t= 1).
HMM is a fully connected structure, where any state can connect from any other state.
S_1= The start state
S_N= final state
N=5;
The state transition coefficients, a_{ij}= 0 if $j < i$, $N_{j=}1$, a_{ij}= 1.

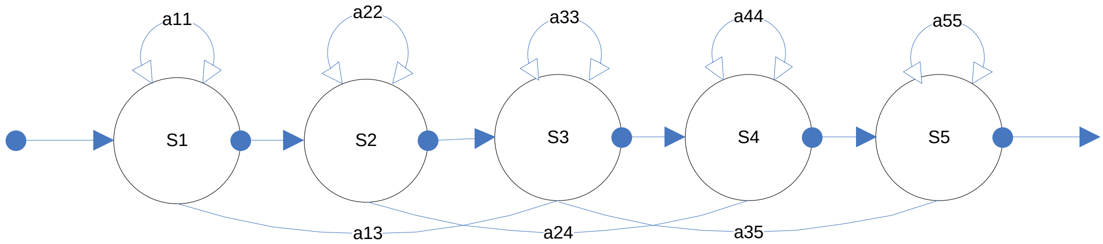

Figure 14: HMM states

HMM is evaluated by Viterbi algorithm and changed by considering only the maximum path at each time step instead of all paths HMM .
Meanwhile, using Baum-Welch algorithm, use *forward-backward algorithm to find* unknown parameters by making use of *forward-backward algorithm*. HMM shows the following conditions of observation from a data set of gesture [28, 29]

i. Evaluation: determining the probability that the observed sequence was generated by the model (Forward–Backward algorithm).
ii. Training or estimation: adjusting the model to maximize the probabilities (Baum–Welch algorithm).
iii. Decoding: recovering the state sequence (Viterbi algorithm).

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Table 4:HMM advantages and disadvantages(Sara bilal)

No	Advantages	Disadvantages
1	The flexibility of manipulating the training and verification processes in addition to its smooth mathematical and theoretical analysis of the results and processes.	Due to multiple local maxima the model may not reflect truly optimal parameter set. HMM only reflects if there is good training set and having many training set may not give good accuracy.
2	Using HMM it is possible to make use of individually distinct functional units (Modularity).	A lot of parameters must be fixed and modified based on the application
3	HMM provides a transparency of the model, which helps to read and understand the model easily as well as use of prior knowledge into the architecture and to constrain the training process.	
4	HMM offers the advantages of being able to segment a data stream into its constituent signs implicitly. So it by passes the difficult problem of segmentation entirely	

Table 5: Gesture Recognition Model Base Techniques

Work	Methodology	Advantage	Disadvantage
Paulraj, 2007	Artificial Neural Network	ability to implicitly detect complex nonlinear relationships between dependent and independent variables	greater computational burden.
Akmeliawati,2007	Hidden Markov Model	it is possible to make use of individually distinct functional units	A lot of parameters must be fixed and modified based on the application

VI. INTRODUCTION TO KINECT

Kinect is a gaming system introduced by Microsoft with Xbox 360 console, which enable user to play games, video and music without separate input controller like a joystick or keyboard.
The controller-free gaming environment provided by Kinect makes it possible for sensors to process basic gestures, facial characteristics, sounds and even full body motion activities such as jumping and kicking.
Following development under the Codename "Project Natal," Microsoft chose the official name for its Kinect gaming device as a blend of the words "Kinetic" and "Connect." Microsoft first launched Kinect in November 2010 and sold more than 8 million units in the device's first two months.

Figure 15: Kinect device

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VII. KINECT APPLICATIONS

Kinect is the worldwide most known and used solution for detecting user movements with no need of physical sensors located on the user. Numerous developers are researching possible applications of Kinect that go beyond the system's intended purpose of playing games. For example, Philipp Robbel of MIT combined Kinect with iRobot Create to map a room in 3D and have the robot respond to human gestures, while an MIT Media Lab team is working on a JavaScript extension for Google Chrome called depth JS that allows users to control the browser with hand gestures.. In following section we have explained different categories which have been used by Kinect technology.

A. Health and medicine

Chris Niehaus ,director of U.S. public sector innovation at Microsoft, blogged at length about Kinect application in a number of areas, i.e, telemedicine ,neurological processes , physical therapy and medical training. Niehaus motive is to highlight best of Kinect, and his post explores it's concept well.R.O.G.E.R. shows kinect's applications to post - stroke patients.Stories about veterans undergoing "Wii-hab"or cyber therapy pilots that are under way at various militaries gives a sense of how motion gaming has made a major impact in this direction.

B. Special needs children and adults

The story of Kinect& John Yan"s 4 years old autistic son is a real world example that suffices well enough to explain the ability of different interfaces opening up new worlds. Computerized gaming and autism, research in these fields, reveals the potential for mirroring applications that improve facial recognition . Kinect hacks can take this further as well.

C. Exercise

Exercise does not have enough technical aspects at all in this case, and anticipating that moves by Kinect, Wii&PlayStation will get overweight children moving is a little too hopeful. Although, the given rates of children obesity, moving kids from a sedentary lifestyle to an active one would be a clear win.

D. Education

Electronic publishing, learning management systems, new models for virtual degrees earned online have helped majority in the growth of educational technology. The fact that Kinect video and interface might help in distributed teaching remains speculative at this point but education is definitely an area to watch for.

E. Participatory art

The interactive Kinect -based puppet prototype constitutes just beginning with maturity in Kinect platform, groups of people dancing in public and private spaces will be able to explore new out forms that blend virtual and physical spaces .

F. Advertising and e -commerce

The Kinect can delete multiple people in field .The X box 360 enables users to watch live & recorded sports on ESPN. It's intelligence keeps getting incorporated at advanced levels into the platform combining those two capacities can go far beyond changing channels. It can lead to recognizing different users /profiles and creating a more interactive watching experience .Early integration with social networking sites such as Twitter and Face book is a good start although they do not provide this complete socializing experience.

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G. Navigating the web/exploring digital spaces

To familiarize with the concept of gestural interfaces, one can watch "minority report" or a video of oblong industry's spatial operating system. Kinect could move this concept to another level and transform if into reality, in fact a team from MIT'S media has already developed a Kinect hack that allows gesture -driven web surfing.

VIII. ADVANTAGES OF KINECT CAMERA

A. Works fine in the dark area
B. Find the exact dimensions of the human body
C. A complete sensor for image processing
D. Exact depth information can be obtained easily
E. Kinect camera is very useful for many HCI applications

IX. SING LANGUGE RECOGNITION USING KINECT CAMERA

Over the past few years, we have seen the rapid development of gaming consoles like Microsoft Kinect, Nintendo Wii, and Sony PlayStation etc. The ability of these consoles to capture body movement information through 3D depth sensors has made them very popular not just among general public but in academia as well. A very major use of these sensor technologies is in gesture recognition and in tracking body movement. A popular application of gesture recognition is in the area of Sign Language Recognition which would provide the differently-abled with a platform to express their views. A vast amount of research has already be done in the area of recognizing Sign Languages mostly using techniques like body part tracking, neural networks, Hidden Markov Models, skeleton detection etc. Other prominent techniques include utilizing the motion history information associated with gestures, motion capturing gloves and computer vision combined with different colored gloves.

X. CONCLUSION

In this paper, we have tried to present different techniques used for hand detection, tracking and gesture recognition used by researcher for Malaysian sign language**.** A good gesture recognition system must be able to match and compare the input gesture trajectory to each of the prototype gesture trajectories contained in database with lower error rate. We have to note that, the most important application domain is human–machine interaction. The application range from mars to earth and sign language recognition through virtual reality. When we are focusing on sign language we can come out with some issues for gesture recognition systems.

- Choice of application
- Hand motion trajectories, hand shape and position features
- Choice of recognizer

However, implemented system with high accuracy for static sign and continues sign is still an unsolved problem. The area of research is still open for HCI and new method can be developing to overcome the pitfalls of existing approaches.

XI. FUTURE DIRECTION

In the future work we have plan to use Kinect camera for recognition of Malaysian sign language recognition. We have planned to implement stand-alone system to allow the deaf or hard-of-hearing people and normal people to communicate with each other easily and fluently. We purpose a model for recognizing Malaysian Sign Language and converting the visual information into textual information at real-time by using Kinect. In order to implement a real time hand gesture recognition system, video footage will be obtained from Kinect camera, then hand position and location will be marked and cropping will be done to isolate them. Then the hand gestures will be recognized through video processing and Kinect processing then matched to a prebuilt database of gestures which will be used for textual conversion on the screen. In the final step the normal person will type the text and its equivalent animation of hand

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gestures will be presented. Through this system, real-time recognition of Malaysian Sign Language and textual representation is done, giving more accurate results at least possible time. It will not only benefit the deaf and dumb people of Malaysia but also could be used in various applications in the technology field. This system provides the flexibility to learn Malaysian Sign Language at personal pace, at anytime and anywhere at home or at workplace.

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