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# Analysis on Hand Gesture Recognition Using Artificial Neural Network

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**ABSTRACT**: Hand gesture recognition system can be used in different area, for example, HCI remote control, android regulator, computer generated truth and so forth. Needle gesture recognition system is for the most part the investigation of identification and acknowledgment of different arrow motions like American Sign Verbal hand gestures, Danish Sign Language hand motions and so on by a processer system. This work is centered on three fundamental issues in building up a motion acknowledgment framework. This work is centered on three fundamental issues in building up a motion acknowledgment framework. Human Computer Interaction requires using various modalities (for example body position, speech, hand motions, Lip development, Facial articulations, and so on.) and coordinating them together for an increasingly vivid client experience. Hand signals are a natural yet ground-breaking correspondence methodology which as not been completely investigated for Human Computer Interaction The most recent computer vision, image processing methods make vision based hand gesture recognition plausible for Human Computer Interaction (HCI).Training includes data collection and feature extraction. Second, the artificial neural network (ANN) method is used to classify the training data. To adopt the best classifier, this paper compares the accuracy of all of the above technologies, demonstrates that the efficiency and effectiveness of the proposed system result performance are compared to the existing work by 90% and analyzes the algorithm% Cases achieve the highest accuracy.

**Keywords:** Human Computer Interaction, Gesture Recognition System, ANN, Hand Gesture Recognition System, Feature Extraction

## I INTRODUCTION

Computer system and interfaces are the emerging technologies and are dispersed in various fields rapidly. Human ability in adopting computer and information System is an expanding research topic. This interdisciplinary domain relating the human attitude and computer is termed as Human Computer Interaction (HCI). Hence a primary objective of HCI is generating methods that amalgamate the attitude of the human and the computer to produce interactive system, shifting the technology from processer centric user computer-interface to human-centred multimedia, multi-mode co-operative skill, incorporating lip reading, tracking of head movements, recognition of hand gestures, facial recognition, body interaction recognition etc. Lacking dedicated devices for tracking, amongst the biggest concerns for the system becomes accurate assessment and validation of hand movement through vision detecting sensors and hardware. A tracking procedure utilizing vision-based input requires only an appropriate vision sensor, essentially a camera. Generally, the overall framework of this approach should ideally be simpler and lighter as compared to the Data Glove procedure, and should facilitate interaction without requiring any complementary hardware. This sort of interaction can be difficult in the context of computer pattern and vision analysis, given its natural associated complexities with algorithmic issues, i.e. segmentation of images, extraction of features, and calibration of the camera device etcetera. The HCI is generally dependent over the finger point detection or depending on the finger point position which confines the normal means of manipulation using hands and results in complicating the easy task. One best example is the usage of computer mouse which requires the clinking of the mouse and moving it in the 2D space. The rotation operation of the mouse to control the cursor movement is not direct for humans to realize.

## II RELATED WORK

Every nation has its very own Sign language. Irish Sign Language is unique in relation to British Sign Language or American Sign Language. Asoflate, there has been a huge measure of research on hand signal acknowledgment. A portion of the prior motion acknowledgment frameworks endeavoured to recognize gestures utilizing glove-based gadgets that would quantify the position and joint points of the hand. Notwithstanding, these gadgets are extremely awkward and as a rule have numerous links associated with a PC. This has delivered the inspiration of utilizing nonintrusive, vision-based methodologies for perceiving gestures. Vision-based methodologies include utilizing at least one camcorders to catch an individual signalling and utilizing PC vision procedures to decipherer very

specific motion. Adream based motion acknowledgment framework can be separated into three fundamental segments: hand signal displaying, hand motion examination, and hand motion acknowledgment. The signal model portrays how the hand motion is to be spoken to. The kind of utilization wanted significantly affects the sort of model that must be Picked. On the off chance that an application with just few gestures is required, at that point a

Straightforward model can be utilized. Be that as it may, in an application with a vast motion set, for example ,gesture based communicational knowledgment ,a progressively point by point model will be required. Notwithstanding, there are exchange offs in picking an increasingly mind boggling model as will be examined later. In the wake of picking a model, the investigation is performed to register the model parameters from the picture includes that are separated from the video input streams. The investigation organize is trailed by the acknowledgment stage, which orders the model parameters, delegate of a particular motion while thinking about the model and at times sentence structure. The objective of the investigation arranges is to identify and gauge highlights from the video succession pictures so as to appraise the model parameters. The investigation stage would thus be able to be separated into two noteworthy segments: include discovery and parameter estimation.

## III METHODOLOGY

The methodology of the overall view of the motion gesture recognition. The webcam captures the live video streams of the hand. Segmentation using skin colour or the motion or both together is carried out to detect the hand. Detect the finger or the colour caps on the finger. As the focus is on the motion gesture recognition, the finger tips are to be detected accurately to trace the pattern drawn in the air. Hence the marker has to be detected accurately. Here two markers are used. One of the markers is used to guide the pattern and another to indicate start and stop operation. Two solutions exist for detection of the marker: i. Detection of the finger tip, utilizing it as a the primary marker in collaboration with the thumb, ii. Cladding the two fingers with different coloured caps. Both procedures shall be tested for efficiency and accuracy, whilst the superior one based on the results will be selected. The marker coordinators in following frames is assessed and utilized to convert over to binary image. Morphological operations and filtering is performed to remove the unwanted noise. The important features are extracted from the pattern drawn by the figure. The classifier is trained to Artificial Neural Network (ANN) classifiers are tested and the best is used The recognized pattern is used to perform relevant operation like hand mouse and to assist patient on bed in special ward

## PROPOSED METHODOLOGY

The neural network approach is based on the elementary processors called neurons. Each neuron takes many efforts or produces one crop. All effort is related with a mass and the harvest is the prejudiced amount of inputs. The production purpose may be separate or constant.

The inputs are represented as v1 , v2, v3.....and the bulks are represented by w1, w2, w3 ..... The sum of all inputs to a neuron is given by

$x = \sum vini=1\ wi$

Where is the threshold of a neuron. A transfer function f(x) is defined with a neuron which gives an output. These neurons are interconnected such that they take number of external inputs and deliver some number of outputs. The applications of these networks are classification, auto association and general association.

$E = \sum \sum (yj\ i - dj\ i\ )\ 2$

Where $yji$ is the actual production of the output node and $dji$ is the wanted output of the similar output node of the network Steepest gradient descent technique is applied to update the weights of the network

$$wi,j\ (k + 1) = wi,j\ (k) - \eta\ \partial E(n)/\ \partial wi,j$$

**FEED - FORWARD NETWORKS:** A neural network without feedback loops is termed as feed forward neural networks or perceptions. The previous perceptions training algorithm converges if a solution to a problem exists. This limitation showed to be uncertain necessitating that the classification has to be linearly distinguishable. This drawback was surmounted by Back propagation algorithm. This algorithm trains layered networks. In layer network, one layer exists between input and output. A feed forward network is shown in figure 6.2, where data are applied at the input nodes and proceeds toward the output node.

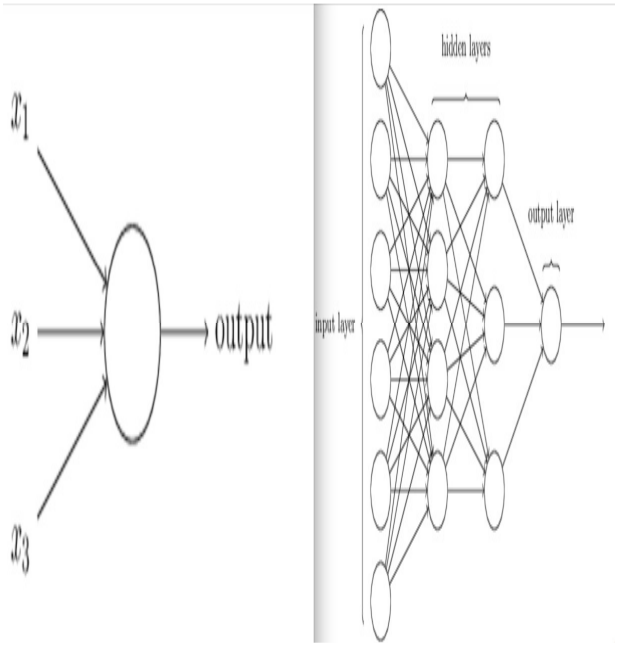



Fig 1 One layered neural net structure.

Nodes 1, 2 and 3 are input nodes, nodes 4 and 5 are hidden nodes and nodes 5 and 6 are output nodes. Back Propagation Algorithm (Steepest Gradient Technique) is the most common Neural Net algorithm which is a multilayer network. The algorithm applies a weight modification based on the sigmoid function. Back propagation is a supervised learning where excepted output is known. The Back propagation algorithm is an evolution of Windrow-Hoff

algorithm. It employs the gradient descent technique to reduce the minimum square error. The minimum square error is mainly due to the difference among real and trained output from the net. In the Back propagation algorithm, the input is applied to input nodes of the network. The input propagates through the hidden nodes towards the output nodes of the network. The response of the each input node is thus obtained at the output node. The actual output of each output node is then compared with the trained or the desired output. If there is no difference the training of the network stops else the iterative process of changing the weights of the nodes are performed until the difference between the actual and the trained outputs is minimized.

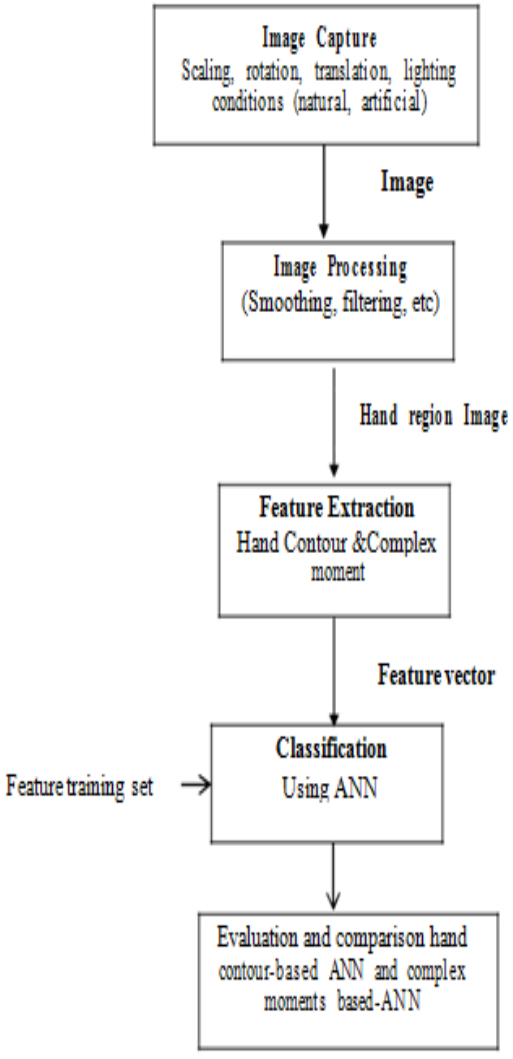



Fig.2 proposed Flow Chart

**MODULE**

Input Image
Pre Processing
Feature Extraction
Classification

**RESULT DISCUSSION**

Subsequent to displaying and examination of the input hand picture, gesture classification technique is utilized to perceive the gesture. Recognition process influenced with the correct choice of highlights parameters and appropriate arrangement calculation. For instance edge identification or shape administrators can't be utilized for signal acknowledgment since many hand stances are created and could deliver misclassification. Euclidean separation metric used to group the gestures. Factual instruments utilized for signal characterization; HMM device has demonstrated its capacity to perceive dynamic gestures moreover, Finite State Machine (FSM), Learning Vector Quantization ,and Principal Component Analysis(PCA).Neural system has been generally connected in the field of removed the hand shape ,and for hand signal acknowledgment. Other delicate registering apparatuses are viable in this field also, for example, Fuzzy C-Means bunching (FCM), and Genetic Algorithms GA. The implementation and performance evolution of proposed algorithm is done in MATLAB software. There are many software that can be used to simulate the proposed work like Visual Studio, SQL Server, C#, etc. their Image processing simulator are basically used to test, visualize, mathematically compute the performance between proposed algorithm and original algorithm. MATLAB provide us the environment which is similar to real world network

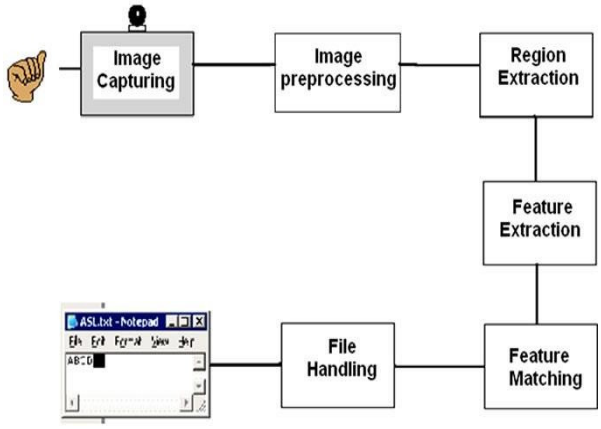



Figure 3: System architecture for hand gesture recognitio

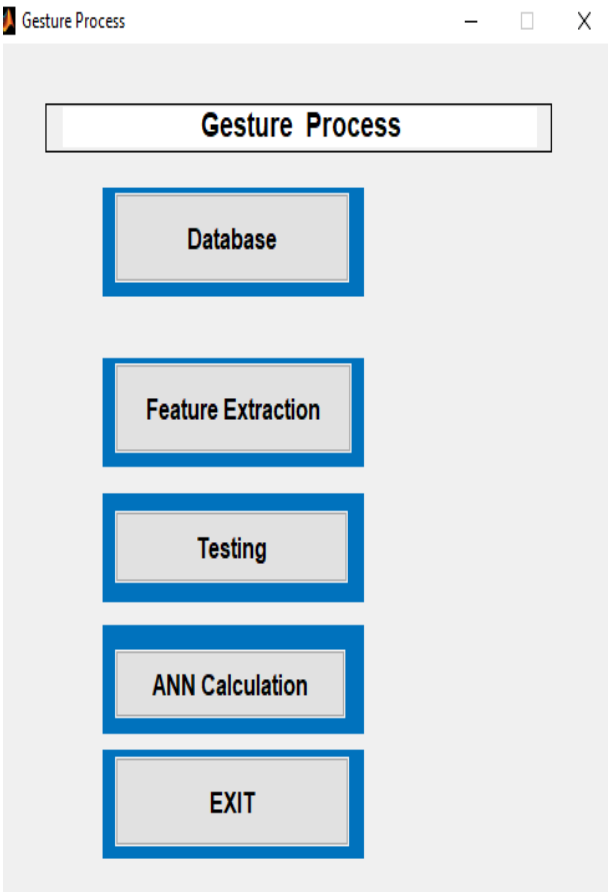
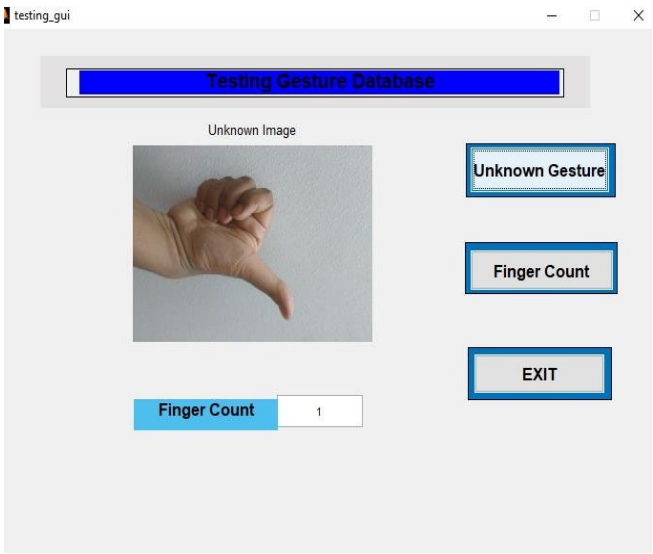



Figure 4 Hand Gesture Process

Salt-and-pepper noise is a form of noise sometimes seen on images. It is also known as impulse noise. This noise can be caused by sharp and sudden disturbances in the image signal. It presents itself as sparsely occurring white and black pixels. An effective noise reduction method for this type of noise is a median filter or a morphological filter. For reducing either salt noise or pepper noise, but not both, a contra harmonic mean filter can be effective.



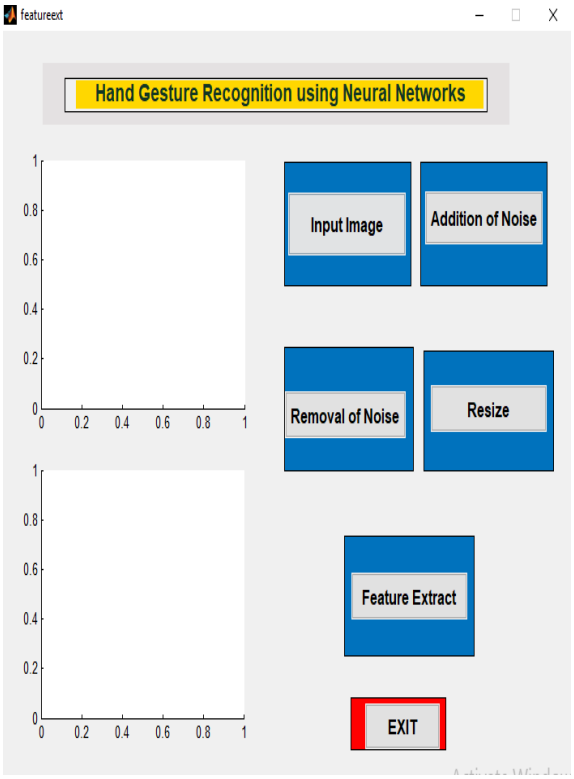




Figure 4Hand Gesture feature extraction figure count

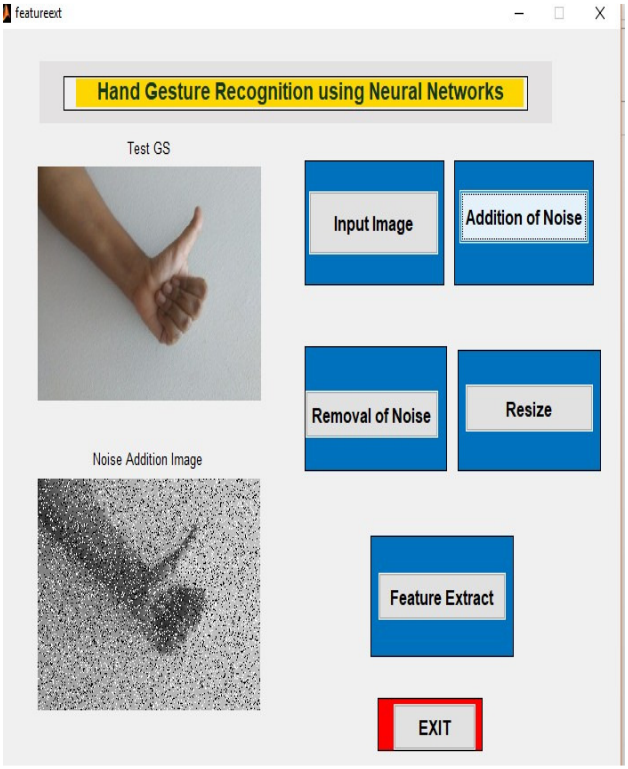



Figure 5 Hand Gesture noise additions noise

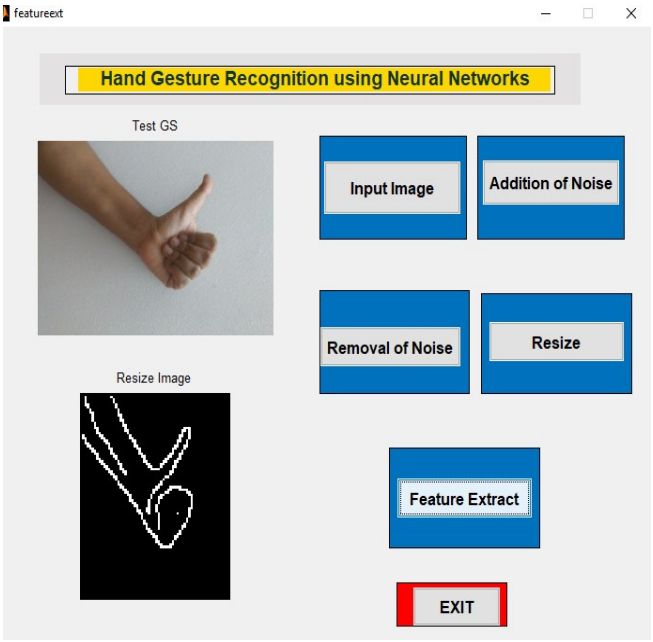



Figure.6 Hand Gesture feature extraction

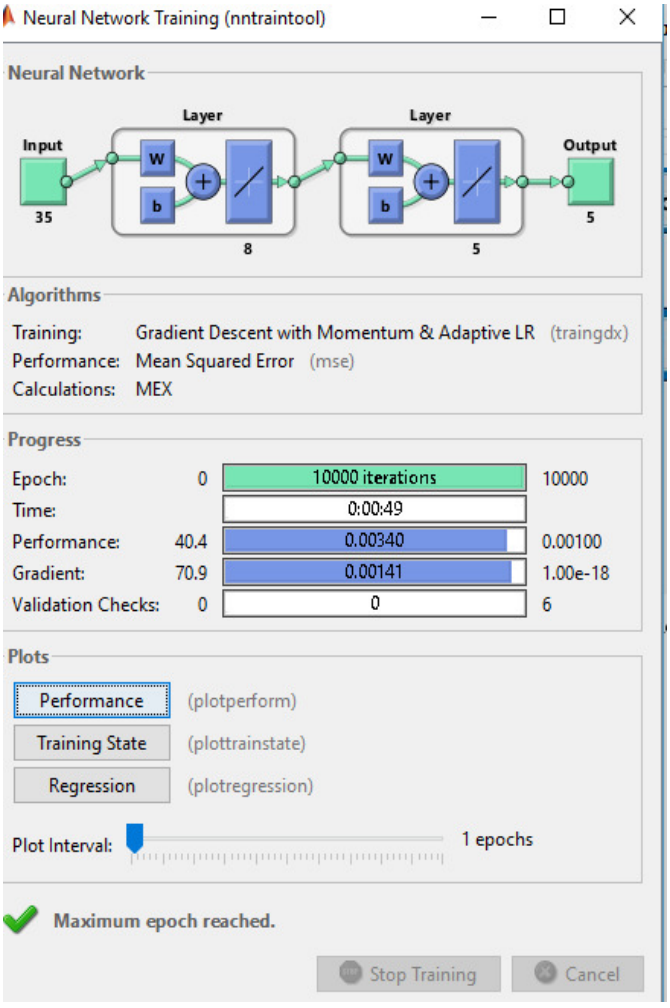



Figure.7 ANN Calculation

**Table:1 Feature extracted from input image**

| S.no. | Input | Addition of Noise | Feature Extraction |
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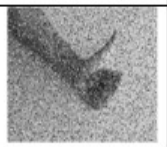
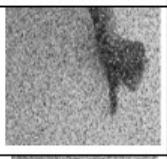
| 1 |  |  |  |
| 2 |  |  |  |
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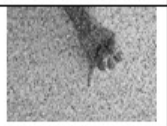
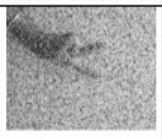
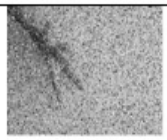
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
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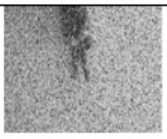
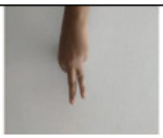
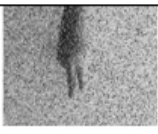
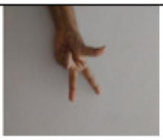
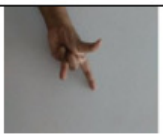
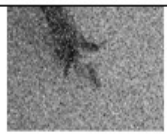
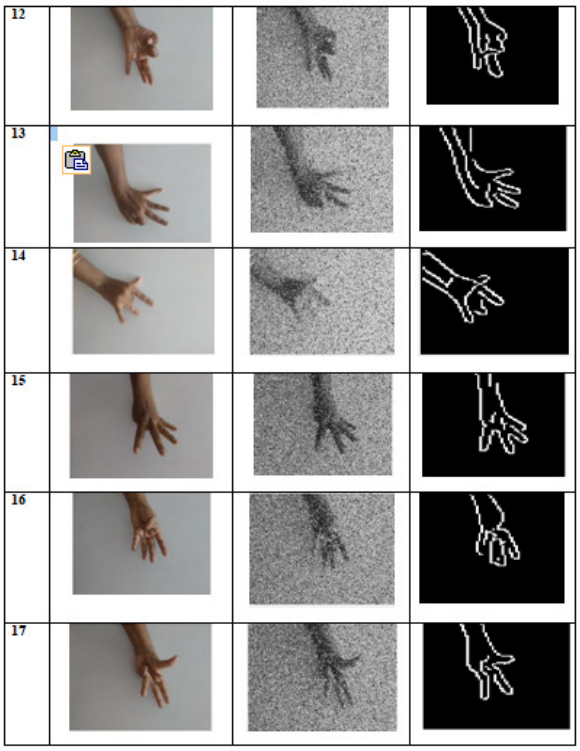
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |



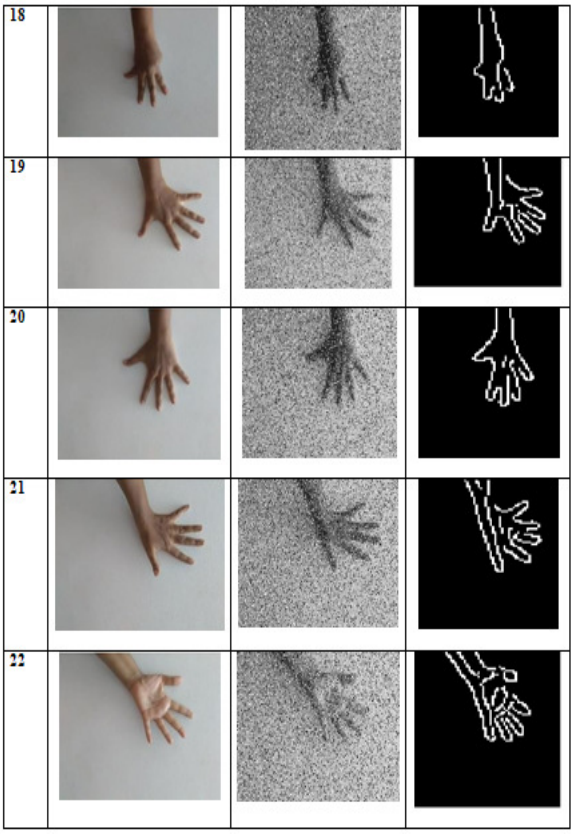
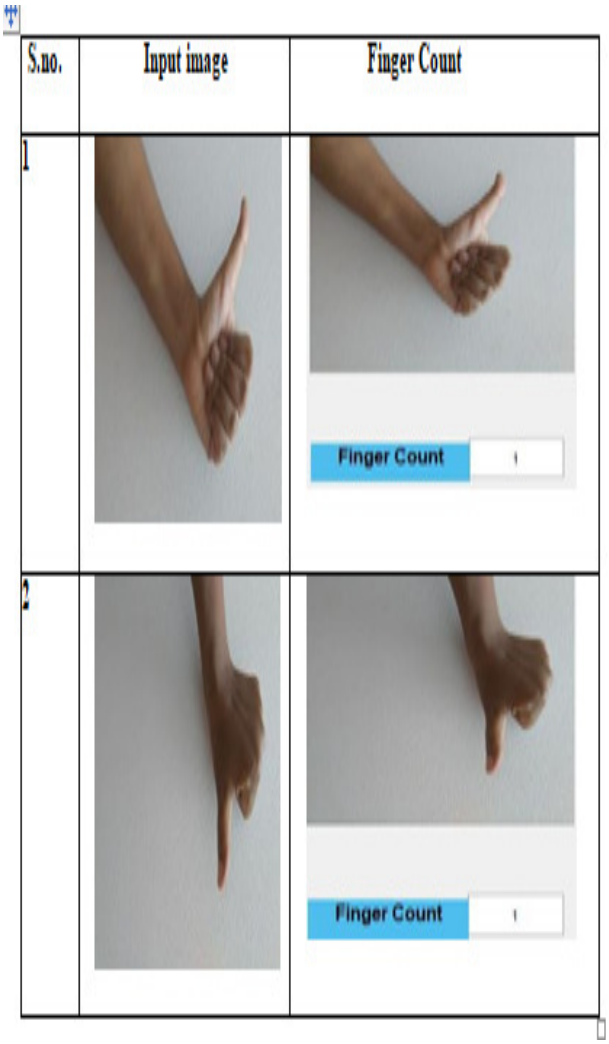




Table: 2 Detailed Accuracy Measure for Gestures

| Gesture | No. of image | Correctly classified image | Incorrectly classified image |
|---|---|---|---|
| One Finger | 4 | 4 | - |
| Two Finger | 5 | 5 | - |
| Three Finger | 4 | 3 | - |
| Four Finger | 5 | 4 | 1 |
| Five Finger | 4 | 4 | - |
| TOTAL | 22 | 21 | 1 |

**Accuracy= 22-1 /22 *100 95.4%**

**Table: 3 Finger count from input image**



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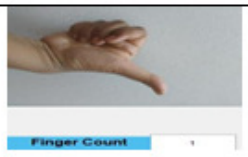
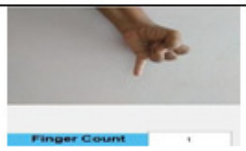
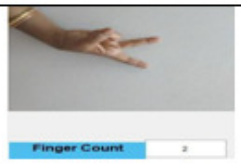
| 3 |  |  |
| 4 |  |  |
| |  |  |
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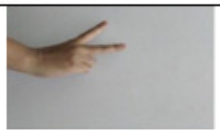
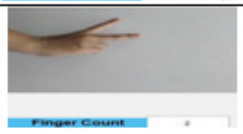
| 7 |  |  |
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| | | |
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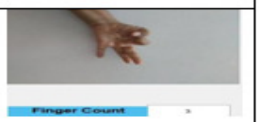
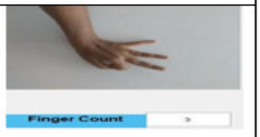
| 12 |  |  |
| 13 |  |  |

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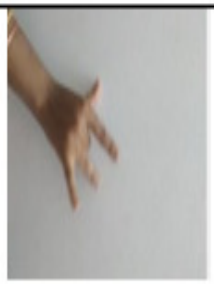
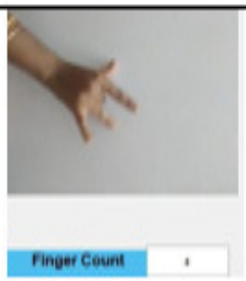
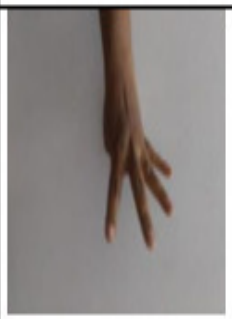
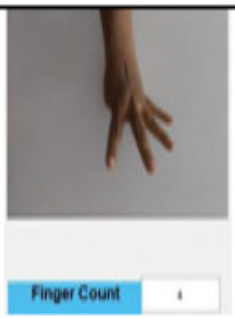
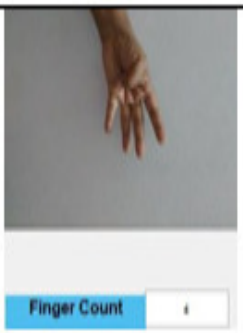
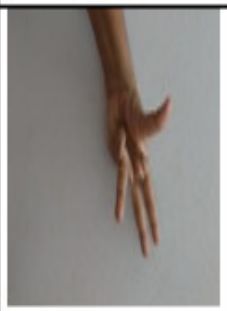
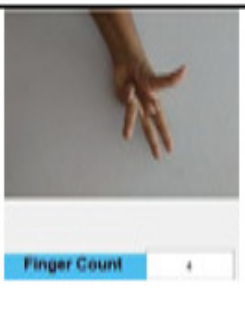
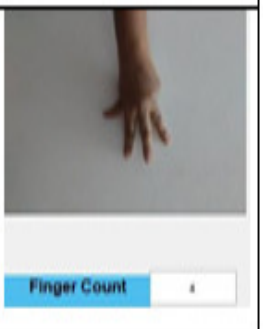
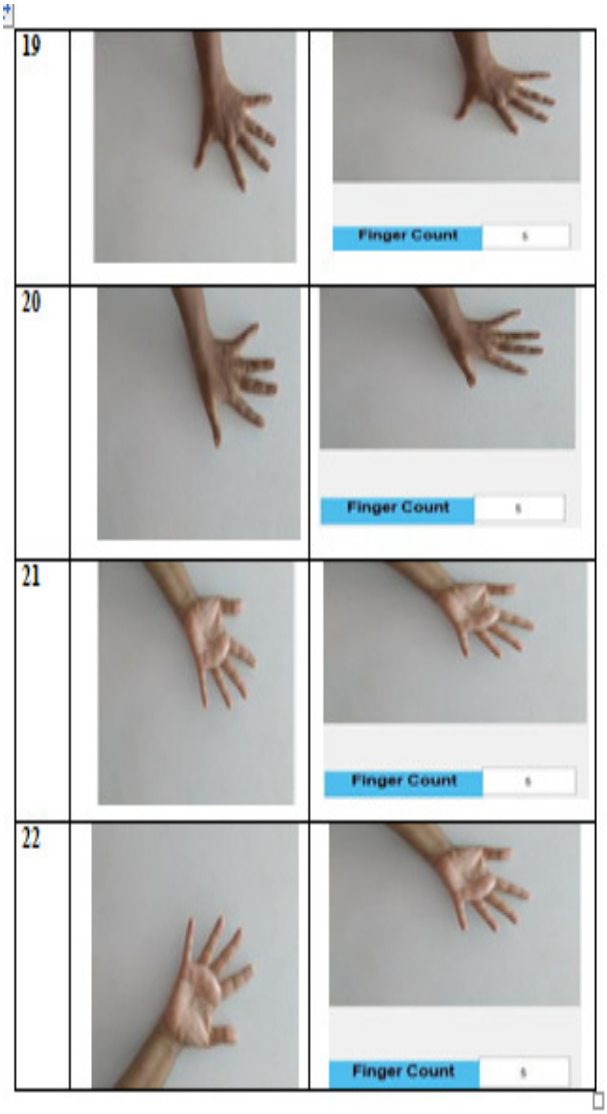
| 14 |  |  |
| 15 |  |  |
| 16 |  |  |
| 17 |  |  |
| 18 |  |  |



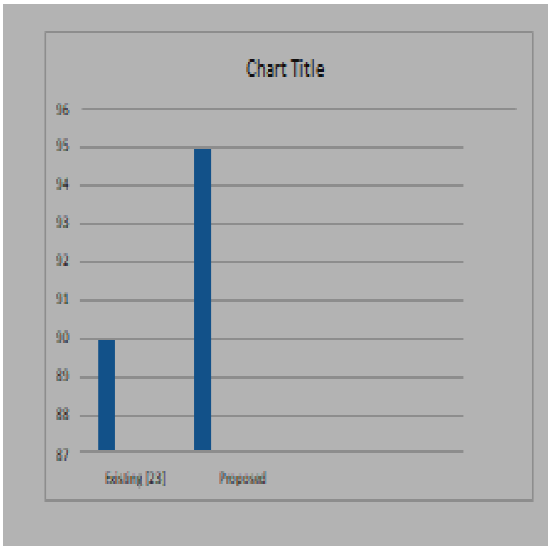




Table: 3 Detailed Accuracy Measure for Gestures

| Gesture | No. of image | Correctly classified image | Incorrectly classified image |
|---|---|---|---|
| One Finger | 4 | 4 | - |
| Two Finger | 5 | 5 | - |
| Three Finger | 4 | 3 | - |
| Four Finger | 5 | 4 | - |
| Five Finger | 4 | 4 | - |
| TOTAL | 22 | 22 | 0 |

**Accuracy= 100%**

## IV CONCLUSION

In this Research work, propose a strategy for arranging static hand gestures utilizing hand picture form where the main highlights are that of low-level calculation. Utilizing Skin shading division give great outcomes to disengage forefront from foundation This strategy vigorous against comparable static gestures in various light conditions .The significant objective of this examination is to build up a framework that will help in the cooperation among human and PC using hand gestures as a control directions. Additionally after the option of commotion it shows motion result. Hand signal acknowledgment based man-machine interface is being grown vivaciously as of late. Signal acknowledgment is likewise significant for creating elective human PC communication modalities. It empowers human to interface with machine in a progressively common manner. MATLAB gives the better answer for hand signal acknowledgment. Sign Gesture Recognition has been effectively done in MATLAB. In view of the proposed strategy the normal acknowledgment rate is high contrasted with the current strategies. Hand gestures acknowledgment was performed for 22 subjects by fixing the camera at fixed tallness. Great lighting was furnished utilizing ablaze light with nun mistakable white foundation for both the picture handling techniques. Subjects were told to indicate fingers looking like the checkof1,2,3,4 and 5.The hand gestures were perceived productively with least mistake rate by the picture preparing strategy, utilizing ANN calculation. To indicate the potency and effectiveness of the proposed system results performance are compared with existing work with 90% and it's been analyzed that the proposed algorithm had achieved highest accuracy with95%. Future work will incorporate execution, execution examination and improvement of structured systems for extended database, with bigger number of tests and gestures, different foundations and hand space introductions.

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