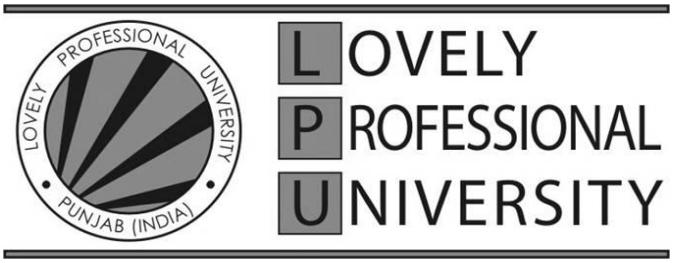

Human Behaviour Identification System Based on Body Language

A Dissertation Proposal

submitted

By

Naveen Kundu

(11003097)

To

Department of Computer Science and Engineering

In partial fulfilment of the Requirement for

the

Award of the Degree of

Master of Technology in Computer Science and Engineering

Under the guidance of

Mr. Prateek Agrawal

(May 2015)

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DISSERTATION TOPIC APPROVAL PERFORMA

Name of the Student: Naveen Kundu	Registration No: 11003097
Batch: 2010	Roll No. RK2006A03
Session: 2014-2015	Parent Section: K2006
Details of Supervisor:	Designation: Asst. Professor
Name: Prateek Agrawal	Qualification: Mtech-CSE
U.ID : 13714	Research Experience: 5 yrs

SPECIALIZATION AREA: Intelligent System **(pick from list of provided specialization areas by DAA)**

PROPOSED TOPICS

1. Human behavior identification system based on body language.
2. NLP
3. Image segmentation

Signature of Supervisor 13714

PAC Remarks:

Topic 1 is approved. Research later is selected as one of the outcome.

APPROVAL OF PAC CHAIRPERSON: Signature: 18/9/14 Date: 18/9/14

*Supervisor should finally encircle one topic out of three proposed topics and put up for approval before Project Approval Committee (PAC)

*Original copy of this format after PAC approval will be retained by the student and must be attached in the Project/Dissertation final report.

*One copy to be submitted to Supervisor.

CERTIFICATE

This is to certify that **Naveen Kundu** has completed M.Tech dissertation proposal titled **Human Behavior Identification System Based on Body Language** under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of the dissertation proposal has ever been submitted for any other degree or diploma. The dissertation proposal is fit for the submission and the partial fulfillment of the conditions for the award of M.Tech Computer Science &Engineering.

Date: 4 May 2015

Signature of Advisor
Name: Prateek Agrawal
UID: 13714

ABSTRACT

Body gesture recognition is very essential issue to detect the behaviour of the user or human being. The behaviour and character of human can be judged from their body gesture. The image of human is taken by the system then by detecting the body posture or gesture then it will pick the behavior of the human accordingly. To recognize the behaviour based on the body gesture is defined in the fuzzy system. The different If Then rules are defined in the database which is used to produce the result after mapping the actual image with the image stored in the database as per the already defined condition. Then the result is produced in the form of classes which tells the behaviour and other characteristics of the person.

It is a causal rule based human behavior identification system whose "IF" part truly causes the "THEN" part to happen as a result. This system can be used to analysis the behavior of person. This system can also be used to analysis psychological behavior of the person and helps in different medical treatments.

ACKNOWLEDGEMENT

"Thanks to the almighty for showering his blessings"

I am very thankful to my Computer Department for all their valuable technical advices. I am also thankful to my mentor Mr. Prateek Agarwal of Computer Dept. who guides me and made me think everything logically. . His guidance was crucial for formulation of problem statement. I attribute the level of my Master's degree to his consolation and effort and without him this proposal, would not have been composed.

I would like to acknowledge Mrs. Mangla Verma for numerous discussions and talks on associated topics that help me to classify my data. I take the opportunity to present a vote of thanks to all those guideposts who really acted as lighting pillars to enlighten our way to this Dissertation Part-II that has led to the completion. I would like to thank my friends, who were always willing to help and give their best suggestions. My research would not have been possible without their help.

Finally, I would like to thank my parents. They were always there cheering me up and stood by me through the good times and bad.

DECLARATION

I hereby declare that the dissertation proposal entitled, An automated tool for Human behavior identification based on body language submitted for the M.Tech Degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

Date: 4 May 2015 **Naveen Kundu**

Reg No - 11003097

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CHAPTER 1
INTRODUCTION

Human behavior is the term that is used to describe a person, his action and conduct. Observing and understanding human behavior is a crucial part of psychology. The behavior of human can be judged from their body language. One can read others thoughts and mind by their body gestures. An intelligent system (IS) can be designed that can tell the behavior of human being by seeing or by capturing the human gesture like hand gesture, leg gesture etc. The main challenge of IS is to make the computer system on which we rely so much more intelligent. On the other hand one wants system to be more autonomous, robust and adaptive.

The system should be able to support users in solving complex problems.

1.1 Intelligent Systems

Intelligence system is defined as the capability to complete the task. IS achieves the goal in an indefinite environment. An intelligent system is a machine with an embedded computer that has the capacity to gather and analyze data and communicate with other systems. Characteristics of intelligent systems are:

I. the reasoning process of IS is like human
II. Learn from past experiences or training data or set.
III. Capability to extract the information and to store the information
IV. Intelligent System (IS) deals with imprecise expressions of facts.
V. It produces accurate modeling and prediction of the relevant data.
VI. Finds the solutions through processes similar to natural evolution
VII. Adaptability.[4]

Intelligence systems can demonstrate human-like intercommunication abilities by using NLP(natural language processing),image processing speech and pattern recognition. Almost all the intelligent systems, in today's world are based on the rule based system that comes under the field of AI.these rule based methodologies are expert system and soft computing. Soft computing is most emerging field in artificial intelligence.

1.2 Expert System

Expert systems are the computer systems that act in all regards, with the decision-making capabilities of a human expert. Expert system consists of 3 main components:

I. **Knowledge based**: This component contains the information learned by the interviewing experts and formal logic that regulate how the data or information is implemented.

II. **Inference engine**: It explains the problem against the logic and formal rules of information that is stored in the first component.

III. **User interface**: The interface that allows the person to express the problem in formal language that the user can understand such as English.[3]

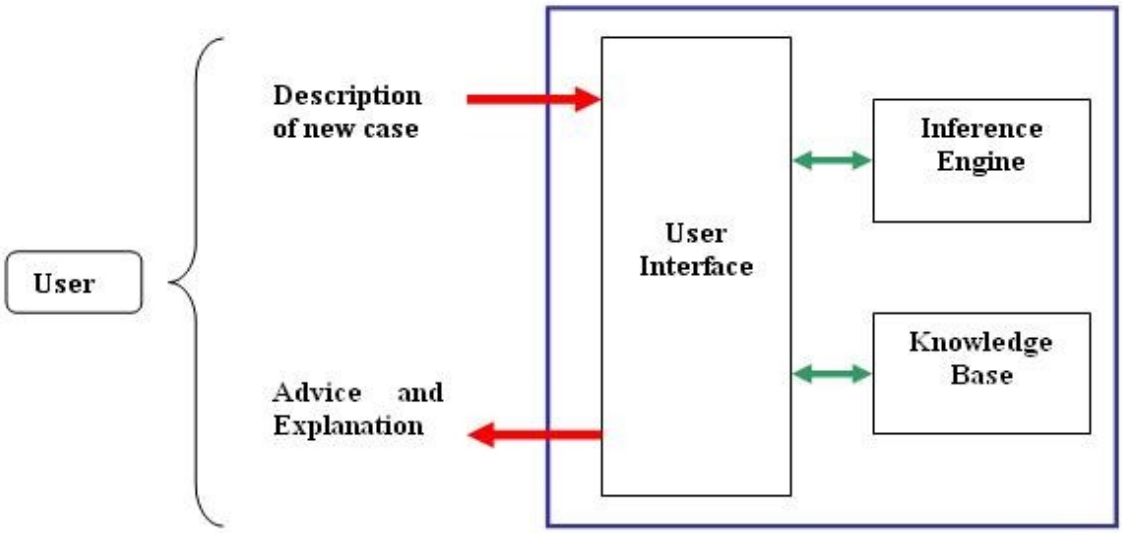


Figure 1.1 Component of Expert System

The merits of expert system are:

I. It reduced the cost and danger.

II. Fast response

III. Expert systems are unemotional and complete responses at all times

IV. Permanence

V. Explanation[7]

The examples of expert system are DENDRAL, MYCIN, and EMYCIN.

1.3 Fuzzy System

Fuzzy logic constructs on a set of user provided human language rules similar to if then rules. then fuzzy system changes these if else rules to their mathematics equivalents. It reduces the task of computer and system designer. This produces the results in much more correct way that it behaves in the real world. Fuzzy logic is very simple and flexible. It can manage the problems that are related to the imprecise and incomplete data. Fuzzy logic maps the non linear functions of arbitrary complexity. Bob Varley, a Senior Engineer at Harris Corp, says that if you don't have a good toy model, or if the system is changing, then fuzzy will produce a better solution than conventional control techniques.

A fuzzy inference system, that is the fuzzy logic model, contains a number of conditional "if-then" rules. For the designer who knows about the fuzzy system he can easily write, and as many rules as essential can be supplied to describe the system adequately.

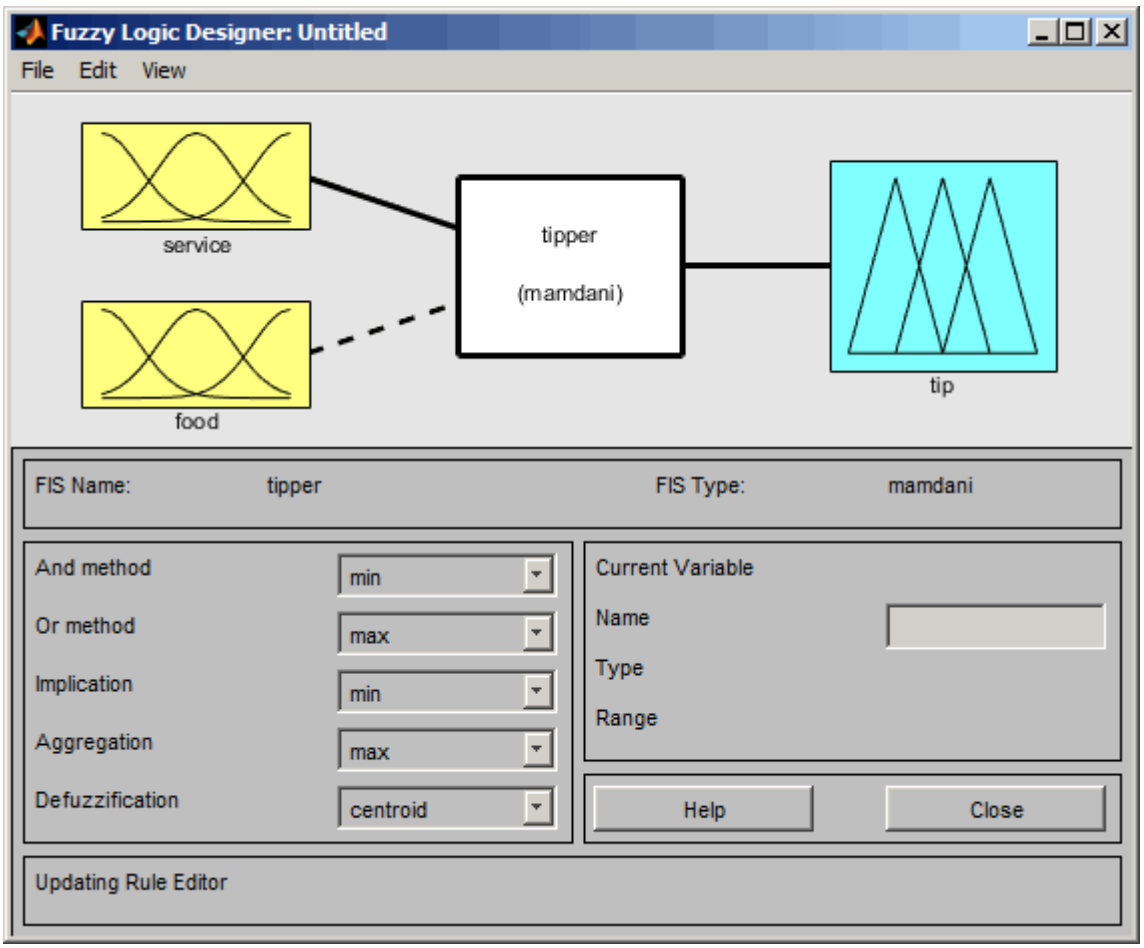


Figure 1.2 Fuzzy Logic Designer

Fuzzy system depends upon the membership function. Then the membership function demonstrates the correct calculation between 0 and 1 to the computer. In fuzzy system, true value of any fuzzy statement is depicted by a value that lies between 0 and 1. The

main merit of the fuzzy system is its rule-based approach and the flexible membership function scheme. These merits make fuzzy system straightforward. It also simplifies the design of the system. With the help of fuzzy system you can update and maintain the system over time. [16]

Fuzzy inference is the process in which input and output are mapped using fuzzy logic. The mapping of input and output then produces a base from which decisions or rules can be made. This process of fuzzy inference makes use Membership Functions, and If-Then Rules, and Logical Operations.

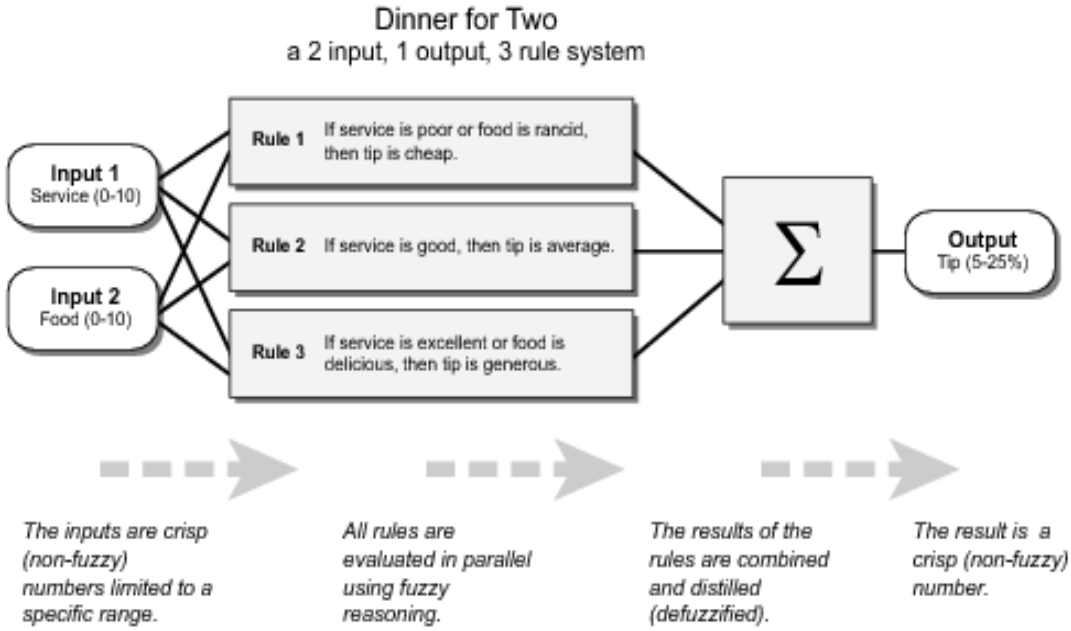


Figure 1.3 Process of fuzzy interface system

In this figure, 2 inputs are there and one output. The information flows from left to right. Rules are designed using If-Then. The whole process of fuzzy interface system follows five steps:

Step 1. Fuzzify Inputs

The very first step is to take the inputs and decide the degree to which they belong to each of the particular fuzzy sets via membership functions. In Fuzzy Logic Toolbox, the input is always a crisp numerical value bounded to the universe of discourse of the input variable and the output is a fuzzy degree of membership in the linguistic set that always lies between 0 and 1.

Step 2. Apply Fuzzy Operator

After first step, the degree of all the inputs and the output is known. Rule contains two parts antecedent and consequent. If the antecedent of a rule has more than 1 part, the fuzzy operator is applied to get one number that depicts the result of the antecedent for the particular rule. This number is devoted to the output function. Two or more membership values that are obtained from fuzzified input variables are the input to fuzzy operator and the output is a single truth value.

Step 3. Apply Implication Method

Before step 3, rule's weight must be determined. Every rule has a weight that lies between 0 and 1. After assigning the weight to each rule, the implication method is applied. A consequent is a fuzzy set depicted by a membership function, which weights suitably the linguistic characteristics. The consequent is refashioned using a function combined with the antecedent that is a single number. A single number given by the antecedent is the input to the implication method, and the output is a fuzzy set. Implication process is implemented for every rule in rule editor. This process supports two built-in methods, and they are the same functions that are used by the AND method: minimum (min), which round down the output fuzzy set, and product (prod), which scales the output set.

Step 4. Aggregate All Outputs

All decisions are based on the testing of all of the rules in a FIS. Aggregation is the process in which all the input fuzzy sets that depict the outputs of the rules are combined into one fuzzy system. Aggregation only happens once for each output variable. The input of this process is the list of output functions obtained by the implication process for each rule. The output of the aggregation process is one fuzzy set for each output variable.

Three in built methods that are supported by fuzzy:

I. Maximum method(denoted by max)
II. Probabilistic OR method(denoted by probor)
III. Sum of each rule's output set method(denoted by sum)

Step 5. Defuzzify

The input for the defuzzification process is the output of step 4 that is a fuzzy set and the output is a single number. The most familiar defuzzification method is the centroid calculation, which returns the center of area under the curve.

There are five in built methods that are supported by defuzzify:

I. Centroid method,
II. Bisector method,
III. Middle of maximum method,
IV. Largest of maximum method and
V. Smallest of maximum method.[8]

In this thesis, there are two fuzzy system are used to identify the behavior. First fuzzy system takes all the gestures as input and produces the result in the form of different behaviors like confident, submissive, dominant and brave so on.

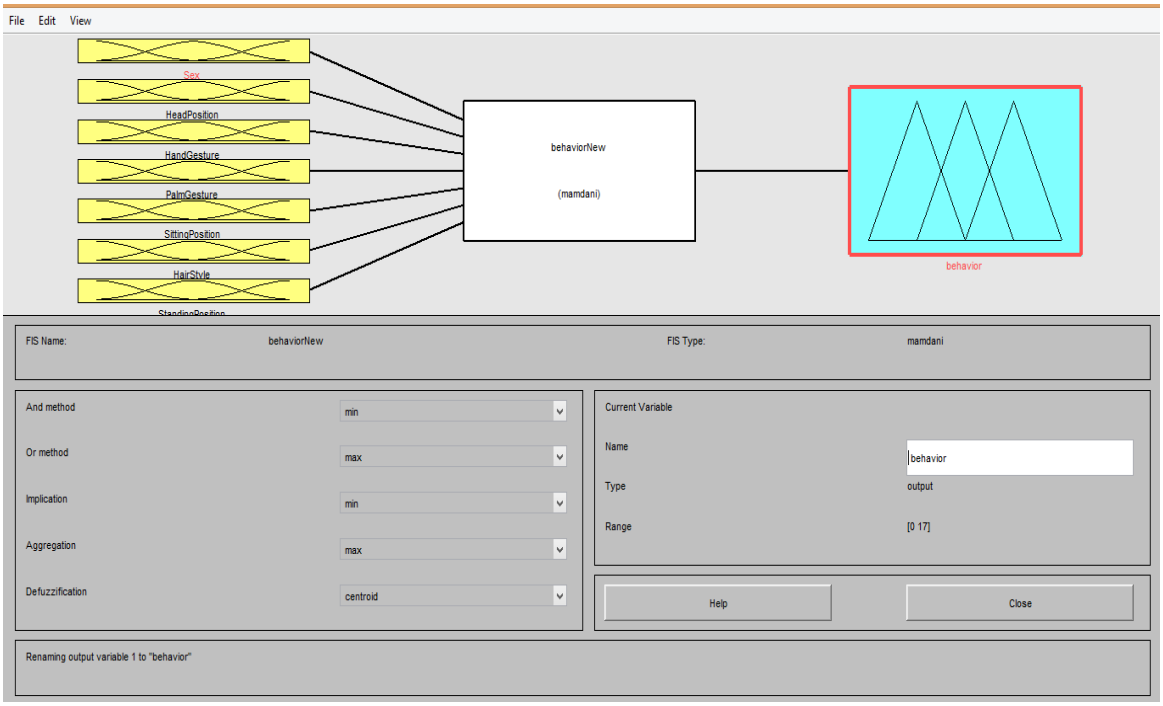


Figure1.4 BehaviorNew fuzzy system.

These behaviors are taken as input to the second fuzzy system which defines the classes as positive attitude, negative attitude and neutral attitude.

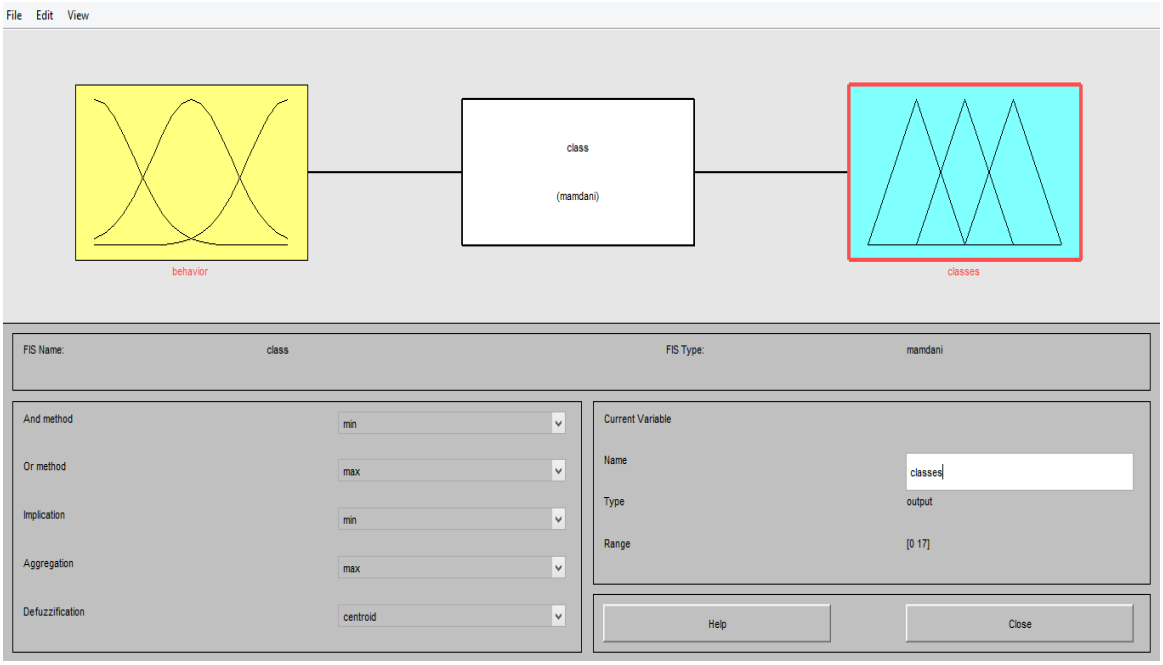


Figure 1.5 Class fuzzy system.

1.4 MATLAB

The full form of MATLAB is matrix laboratory. It is a tool used for doing the numerical computations with matrices and vectors. MATLAB also used for technical computing. There are a number of field where MATLAB is used:

I. For math work and computation
II. Can be used for developing the algorithms
III. Modeling, simulation, and prototyping
IV. Data analysis, visualization and exploration
V. Used in engineering graphics

MATLAB has strong graphic tools and can reproduce accurate images in both 2Dimensional and 3Dimensinal. MATLAB is also a programming language or we can say that one of the easiest and simple programming languages for writing the mathematical programs. It also has some tool boxes useful for signal processing, optimization, image processing etc. Because of MATLAB's toolboxes, MATLAB is used to implement this thesis. Toolboxes allow you to *learn* and then *apply* specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. It also contains others image processing and fuzzy system toolboxes.

1.5 Human Behavior

Human behavior means the array of every natural act and noticeable emotion combined with human beings. Some behavior may change with the time and age. Sometime one's personality remains almost consistent; other behaviors will morphs as one person moves from childhood through adulthood. Behavior can be dictated by thoughts and feelings which show other things attitudes and values. Social behavior tells about the social interaction and the culture. Additional characters include rapport, ethics, hypnosis, authority, coercion and persuasion. Human behavior falls within wide range with some behavior being uncommon, some usual, some grateful, and some outside the acceptable limits. In sociology, human behavior usually contains actions or act having no meaning. Human behavior is more advanced social act so doesn't compare or mix it with social actions.

The acceptability of behavior relies greatly upon social models and is directed by several means of social control. Human behavior is learned by the specialized academic instructions of psychology, psychiatry, social work, sociology, anthropology and economics. Human behavior is practiced throughout one's entire life. It contains the way the person acts based on many different factors such as social norms, attitude, core faith, and genetics. Behavior is impacted by fixed traits each person has. The traits vary from individual to individual and can show different acts or behavior from each individual. Social norms also affect behavior. Due to the inseparably conforming character of human society in common, humans are distressed into following different rules and show fixed behaviors in society, which states the way people act. Different behaviors are judged to be either unacceptable or acceptable in different cultures and societies. Core belief can be seen through the philosophy and religion of that person. It regulates the way an individual thinks and this in turn arises in many different human behaviors. Attitude can be explained as "the degree to which an individual has an unfavorable or favorable valuation of the behavior in question." person's attitude is really a reflexion of behavior she or he will depict in particular situations. Thus, human behavior is highly influenced by the attitudes that a person uses on a daily basis. Human behavior is the term that is used to describe a person, his action and conduct. Observing and understanding human behavior is a crucial part of psychology. The behavior of human can be judged from their body language. One can read others thoughts and mind by their body gestures.

An attitude is an expression of disfavor or favor toward an event, place, individual, or thing. The exciting thing about human beings and attitude is that it varies between each person. Every person has a different attitude towards different stuffs or things. The major factor that limits attitude is dislikes and likes. The more one person likes someone or something the more one is ready to or willing to open up and accept all the offers given by that person. When one person dislikes something or someone, person is more likely to get defensive and shut down. The simple example of how someone's attitude affects the individual's human behavior could be as simple as taking a child to the doctor or to the park or garden. Child knows he has fun at the garden so their attitude becomes positive and willing, but when the name of doctor comes, the child shut down and become unhappy with the thought of ache. Human beings with uniform attitudes want to stick together as their hobbies and interests are common. But it does not mean that the individuals with different attitudes don't interact. They do interact with each other. Attitude has a lot to do with someone's mind which highly refers to human behavior. The way a person behaves depends a lot on how he or she looks at the condition and what he expects to gain from it. All know that Positive attitudes are better than negative attitudes as negativity can carry on negative emotions that are mostly avoided by everyone. It is up to human beings to make their attitudes positively reflect the behaviors they want to show. [17]

1.6 Body Language

Body language means the non verbal signals of human being that we all use to communicate with each other. According to the researchers, the non verbal signals or gesture make up a large part of daily communication. These body gesture and signals define the nature and attitude of the human being. According to many experts, body language is thought to account for between 50 to 70 percent of all inter communication. It is very essential to understand body language but it is important to remember to note other cues and to check other signals as a group rather than focusing on a particular gesture. The acceptability of behavior relies greatly upon social models and is directed by several means of social control. Human behavior is learned by the specialized academic instructions of psychology, psychiatry, social work, sociology, anthropology and economics.

One can get benefit if he or she has the knowledge about body language like:

I. We can change our gesture according to the situation.
II. We can able to send our message.
III. We can easily understand the message from others.
IV. We can able to read the signals that the other person is sending.[9]

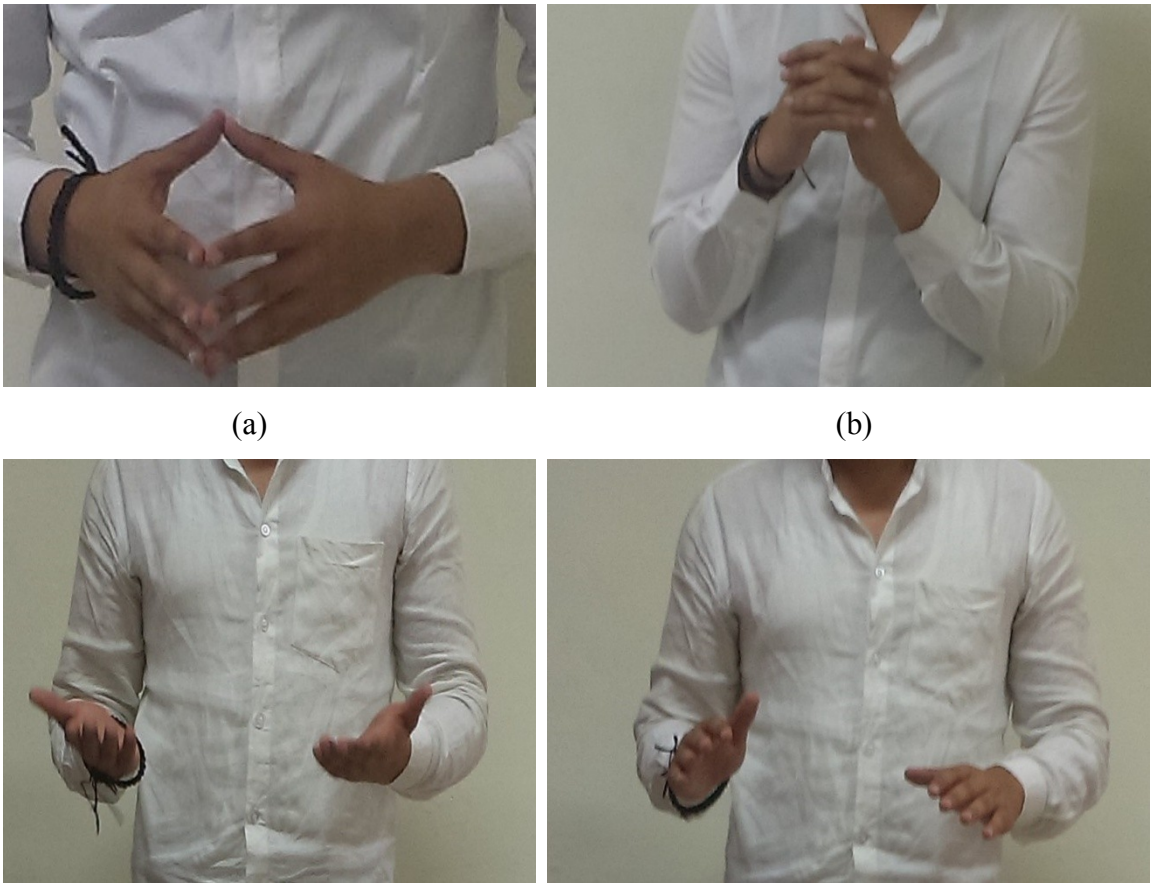
An attitude is an expression of disfavor or favor toward an event, place, individual, or thing. The exciting thing about human beings and attitude is that it varies between each person. Every person has a different attitude towards different stuffs or things. The major factor that limits attitude is dislikes and likes. The more one person likes someone or something the more one is ready to or willing to open up and accept all the offers given by that person. When one person dislikes something or someone, person is more likely to get defensive and shut down.

1.6.1 Hand Gesture:

There are a lot of hand gestures that describe the human behavior like:

I. **Steepling Hands**: Figure 1.6(a) shows the steepling gesture. This gesture shows that the person is confident enough.
II. **Hands clenched together**: Figure 1.6(b) shows clenched hand gesture. This is a gesture showing frustrated or hostile attitude.
III. **Arm crossed over chest**: this example of hand gesture can indicate that a person is defensive or the person is disagreeing with the opinion of other individuals with whom he is communicating.
IV. **Palm Up**: Figure 1.6(c) shows palm up gesture. This shows the person is submissive in nature.
V. **Palm Down**: Figure 1.6(d) shows palm down gesture This gesture shows that the person is dominant.

There are some other hand gestures that describe a person like rubbing palm together, rubbing thumb and finger, different type of palm gestures etc.[5]



(a) (b)

(c) (d)

Figure 1.6 Hand Gestures (a) steepling together gesture (b) clenched gesture

(c) palm up gesture, (d) palm down gesture.

1.6.2 Head Position:

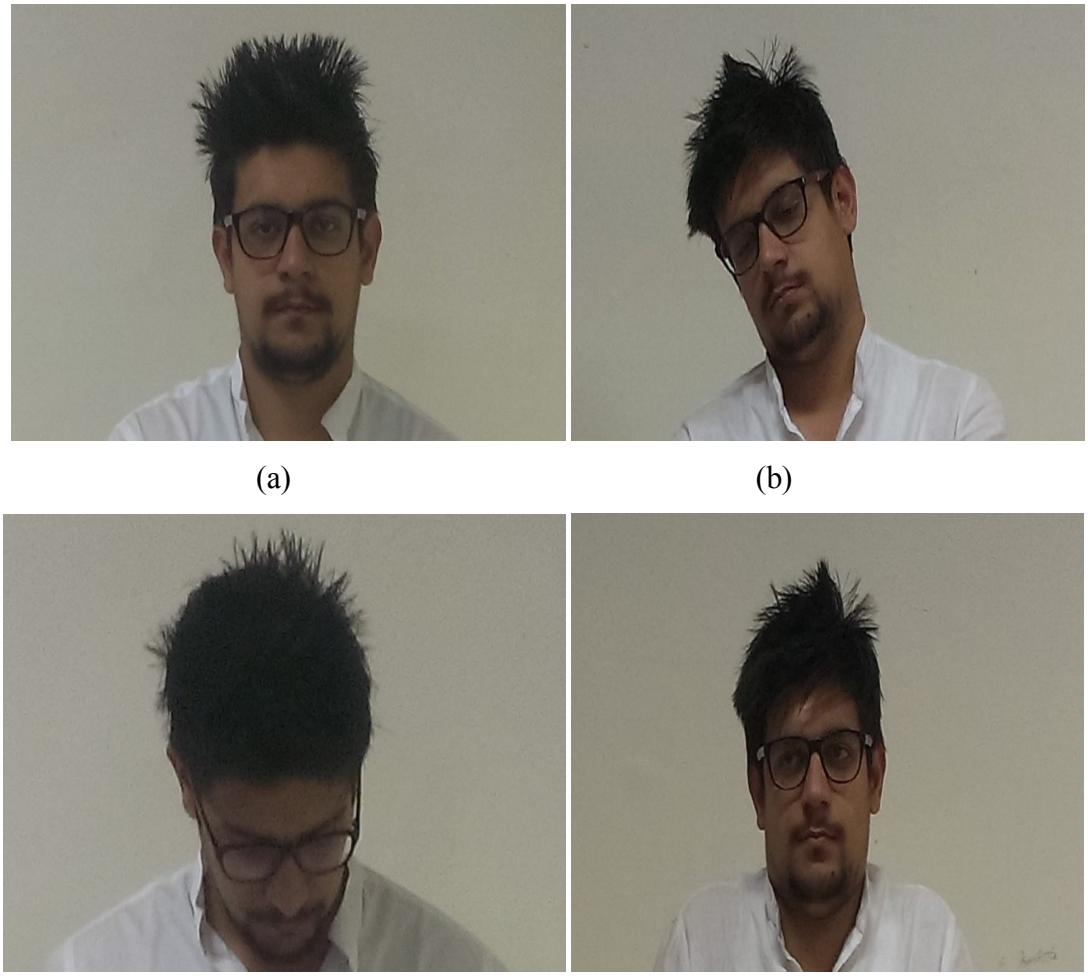
There are 3 types of head position that are:

I. **Head up**: Figure 1.7(a) shows the head up position. This gesture tells that the person is superior, fearlessness and has neutral attitude.

II. **Head tilt**: Figure 1.7(b) shows the head tilt position. This gesture shows the submissive nature of the person. If anyone is interested in someone then he/she tilt his/her head towards that person.

III. **Head down**: Figure 1.7(c) shows the head down position. This gesture shows the negative attitude or aggressive attitude.[6]

IV. **Head shrug**: Figure 1.7(d) shows this gesture. Head shrug gesture shows that the person is submissive.



(a) (b)

(c) (d)

Figure 1.7 Head Positions (a) head up (b) head tilt (c) head down (d) head shrug

1.6.3 Leg Gestures:

There are many different standing positions which define the human like:

I. **Attention**: this gesture shows the neutral attitude and a person shows respect. Figure 1.8(a) shows this gesture.

II. **Foot Forward**: We point our lead food at the most interesting or attracting person but when we want to leave we point our feet at the nearest exit. Figure 1.8(b) shows this gesture.

III. **Ankle Lock Gesture**: crossing the legs tells that a negative or defensive attitude exists. Figure 1.8(c) shows this gesture.

IV. **Legs Apart**: this gesture predominantly a male gesture or we can say that the person is confident enough. Figure 1.8(d) shows this gesture. [9]

(a) (b)

(c) (d)

Figure 1.8 Standing positions (a) Attention (b) Foot Forward (c) Ankle Lock (d) legs apart

There are many different sitting positions which define the human like:

I. **Standard Leg Cross:** this sitting gesture tells that the person is nervous or reserved type guy. This gesture also shows that the person has defensive attitude. Figure 1.9(a) shows this gesture.

II. **American Style:** this gesture shows that the person has competitive attitude. Person is confident. Figure 1.9(b) shows this gesture.

III. **Ankle Lock:** this gesture tells that the person is reserved and emotional. Figure 1.9(c) shows this gesture.

IV. **Standard Leg Apart:** the person is dominant, neutral and open minded. Figure 1.9(d) shows this gesture

(a) (b)

(c) (d)

Figure 1.9 Sitting positions (a) Standard Leg Cross (b) American Style (c) Ankle Lock (d) standard legs apart.

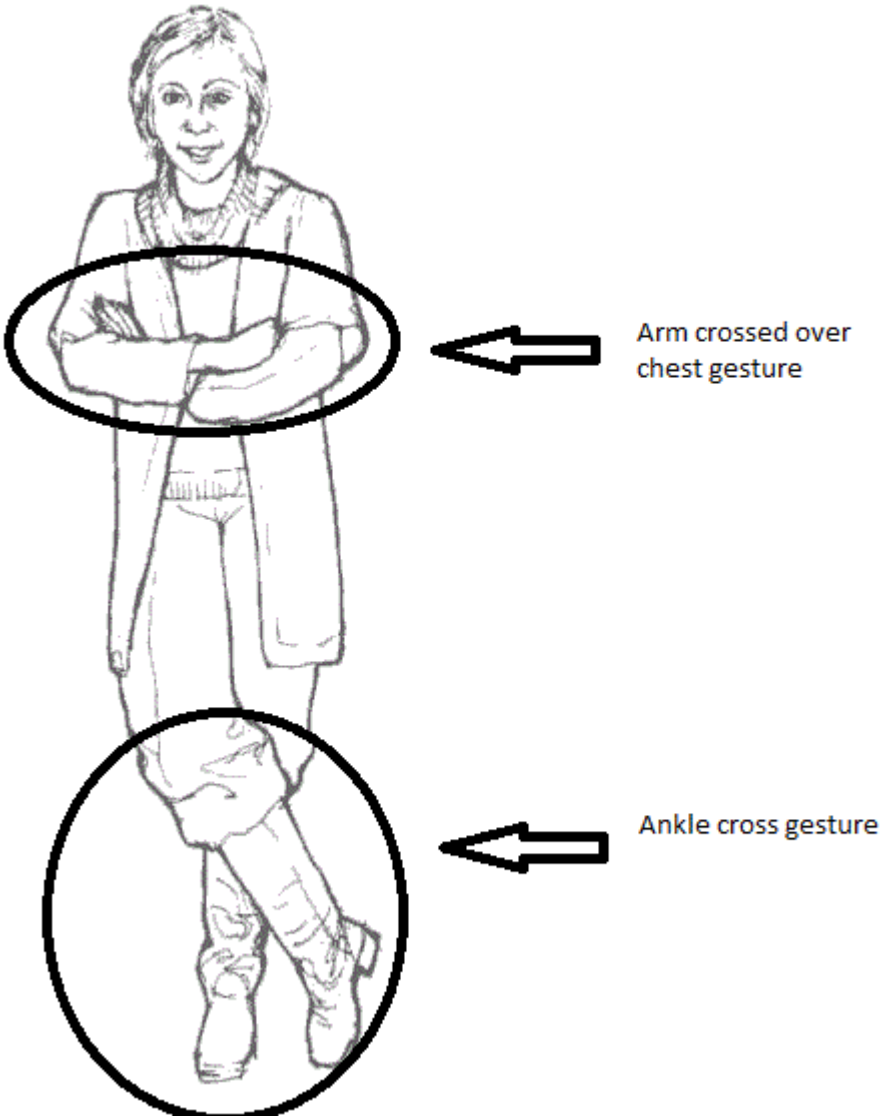


Figure 1.10 Ankle crossed gesture and arm crossed over chest.

In figure 1.10, the hand gesture of the person is arm crossed over chest and the leg gesture is ankle crosses gesture and roughly, I can say that this person is defensive or the person is disagreeing with the opinion of other individuals with whom he is communicating.

1.7 Histogram:

Histograms are the fundamental of image processing. Histograms play a major role in image enhancement, image description, image segmentation and image compression. It is used to find out similarity between two images by obtaining normalized histogram. Suppose input image is the digital image whose intensity levels are I in the range [0, L] then histogram of the image is defined as

$$\mathbf{H(r_k) = n_k}$$

Where $\mathbf{r_k}$ **:** kth intensity level in the interval [0, L].

$\mathbf{n_k}$: number of pixels in image.

Normalized histogram is calculated by dividing all the elements of $H(r_k)$ by total number of pixels in the image.

$$\mathbf{P(r_k) = H(r_k)/ n}$$

or

$$\mathbf{P(r_k) = n_k / n}$$

In matlab, the syntax of histogram is

```
H= imhist(I);
```

I is the input image.

And the syntax for normalized histogram is:

```
P= imhist(I)/numel(I);
```

numel(I) gives the number of pixels(number of elements in an array).

In this thesis, to find out the similarity between two images normalized histogram is used. Suppose there are two images im1 and im2. Goal is to find out how much both the images are similar. [7]

First of all read the images and convert them in grayscale images. Now calculate normalized histogram of the images.

```
P1= imhist(im1) ./ numel(im1);
P2= imhist(im2) ./ numel(im2);
P3= imhist(im3) ./ numel(im3);
```

Suppose im1 is input image and im2 and im3 are in the knowledge base of the system. After that calculate the Euclidean distance by using this formula:

m(1)=sum((P1 – P2).^2);

m(2)=sum((P1 – P3).^2);

im1 is compared with both the images in database.

m(i) gives value between 0 and 1. If m(i) value is very small then both images are almost similar. Suppose that m(1) is 0.2 and m(2) is 0.11 then im1 is more similar im3 as compare to im2. Then a threshold is defined that is th is 0.35. after that m(i) value is compared with the th value.

If m(i) is less then th value the image is matched else image does not matched with the images in database.

CHAPTER 2
REVIEW OF LITERATURE

My selected topic is human behavior identification system based on body language. But I didn't find this topic directly. I studied lot of paper in literature review related to various field of human behavior analysis. I also studied various book related to the body language. I studied about the different type of gestures or postures of human being and what the particular gesture tells about the person. I only discuss only those paper which are somewhat related to my thesis topic.

Allan Pease,"*The Definitive Book of Body Language*"

The author has summarised many of the studies by the leading behavioural scientists and has combined them similar research done by people in other professions like sociology, zoology, education etc.

The main objective is to make the reader more aware of his own nonverbal cues and signals and to demonstrate how people communicate with each other by using their body gesture. This book separates and discusses each part of body language and gesture. Nonverbal communication is a difficult process involving people, words, body movements and tone of voice.

There are many people who show their nature or express the words that they want to say by their hands gesture. So body language becomes another means by which scientific learning can be used to work or govern other person by reading their thoughts.

A lot of gestures or postures are given with their meaning that describes the human behaviour. I pick body gestures like hand gesture, handshake, palm gesture, head position etc. This gesture information helps me in making If Then rules like if the head of a person is up and standing position is attention then the person is confident enough. [6]

Alberto Alvarez-Alvarez, Gracian Trivino, Oscar Cordon

The authors design a system that recognizes body posture with the help of genetic fuzzy finite state machine (FFSM). FFSM is the expansion of classical finite state machine. In this machine the inputs and the state are determined and these values are calculated with the help of fuzzy inference system. The condition for fuzzy system is that it handles the imprecise, incomplete and uncertain data. An automatic method is used to learn the

component. The component is based on the genetic algorithms and hybridization of fuzzy finite state machine because the knowledge base of fuzzy inference system is very complex work for the experts. This system learns automatically the formal rules. The membership functions of FFSM applied to body posture recognition while an expert explains the option states and allowed the transitions. In short their model is human friendly and accurate that identifies the posture of the user.[3]

Sitapa Rujikietgumjorn

In "Segmentation method for multiple body parts" the author tries to extract the specific body parts like legs, arms, head or hands. He used MATLAB for recognizing the body parts. The segmentation is done by using the watershed algorithm. This project took different images from the different angles and different resolutions and then by using the algorithm it identifies the body parts.[2]

Alex Pentland, Andrew Liu, proposed "Modeling and Prediction of Human Behavior". The author has proposed that the human behaviors can be exactly described as a set of dynamic sequence using Markov chain. After that these dynamic Markov chain or model is used to identify the behavior of human from the sensible data and to predict the behavior over a few seconds time. When the testing of this approach is done then it produced 95% accurate result.[1]

Víctor Ponce López proposed "Multi model body gesture recognition combining dynamic programming and probabilistic methods" This project focuses on the problem in which human gesture is recognized using human behavior analysis technologies. In this paper, gestures are commonly performed in normal way that produces a high variability between the different gestures. So, Human gesture recognition is very challenging topic. To recognize the gesture and the author splits the process in main 3 goals: Computing multi-modal feature spaces, probabilistic modeling of gestures, and clustering of Human Poses for sub- gesture representation. Each of these goals performs their own task. They are interconnected with 3 approaches: bag-of- visual-and-depth-words, probabilistic-based dynamic time warping, and sub-gesture representation. Author confirms the approaches on various data sets and shows the high performance. The technique used to recognize the gesture is BoVDW approach. [4]

Chaaraoui AA, Padilla-López JR, Ferrández-Pastor FJ, Nieto-Hidalgo M, Flórez-Revuelta F proposed "A vision-based system for intelligent monitoring: human behavior analysis and privacy by context". This paper outlines the vision at home project. The main goal of this article is to extend independent living at home for impaired and elderly people. By the means of vision-based monitoring, it provides safety and care services. Different kinds of ambient-assisted living services are supported, from the detection of home accidents, to telecare services. In this article, the specification of the system is represented, and novel contributions are made regarding human behavior analysis and privacy protection. By means of a multi-view setup of cameras, people's behavior is recognized based on human action recognition. For this purpose, a weighted feature fusion scheme is proposed to learn from multiple views. In order to protect the right to privacy of the inhabitants when a remote connection occurs, a privacy-by-context method is proposed. The experimental results of the behavior recognition method show an outstanding performance, as well as support for multi-view scenarios and real-time execution, which are required in order to provide the proposed services. [5]

CHAPTER 3
SCOPE OF THE STUDY

Scope of study directly relates with the question that why this thesis is done in intelligence system or say a system that identifies human behavior based on body language? The reason is simple that only because scope. The scope of the thesis topic is very wide. The actual meaning of scope is an area in which something acts or operates. Scope tells you that is there any feasibility of your work? Can it benefit us in real? Ultimately the thesis must have scope and we must aware that what will be expected outcomes. The hypothesis should be taken on the basis of some valid points or in other words it should have base idea from which I can assume the hypothesis.

This system can also be used to analysis psychological behavior of the person and helps in different medical treatments.

This system can be used to identify the behavior of a person. So it can be used to identify any criminals and terrorists. If 2 or 3 people are sitting in a building or banks and they seem like the terrorists then with the help of the system we can capture the images of these people and can find out their behavior and nature. If we get negative attitude of these people then with the help of system we can say that they all are criminals.

CHAPTER 4
OBJECTIVES OF THE STUDY

Objective of any research work means the goal which you intended to be attained or I would say which is believed to be attainable. In other words it is motive, hypothesis, aim that you want to achieve in your research work through some research methodology. Either it can be new methodology or it can be existing one in which you want to do dome optimization in any of the sense like in terms of speed, space or time. Objective should be clear so that your hypothesis can move in right direction. The objective is to design an automated system that may take image of human being as an input, recognize the body gesture and then tell the human behavior as an output.

The image of human is taken by the system as input. Then image is cropped so that cropped image contains only head or leg or hand. After that the difference between cropped image and the images that are in database is calculated by calculating histogram of images in MATLAB. If difference is small then assign the name of that folder in which the stored image lies, whose difference is small, to that cropped image. Then it will pick the behavior of the human according to the gesture. To recognize the behavior based on the body gesture is defined in the fuzzy system. The different If Then rules are defined in the database which is used to produce the result after mapping the actual image with the image stored in the database as per the already defined condition. Then the result is produced in the form of classes which tells the behavior and other characteristics of the person.

The final output of the system is the behavior of the person like he/she is confident, shy, has neutral attitude etc on the basis of the body gesture. These behaviors are classified in three classes.

CHAPTER 5
RESEARCH METHODOLOGY

Research methodology means the system or the way of methods followed in a particular discipline to prove our hypothesis. It is major part of my research. In this chapter, validity has to be checked or judged on some basis. The main reason of include this chapter is to know about two main question and that are how the data is collected for the thesis? And how the data is analyzed in my thesis work? Research methodology should be clear enough so that it is easy to experiment and result must be reproducible. And on the basis of that result and conclusion validated. Ultimately the research must be replicable and produce the accurate output. The research methodology tells you about your ability of replicablity.

5.1 Algorithm:-

Step 1: input image of .jpg extension.

Step 2: crop the image in three parts 1st includes head positions, 2nd includes hand positions and 3rd includes leg positions.

Step 3: save these three cropped image in different variables.

Step 4: while cropped image >0 do

Step 5: find the histogram of the entire cropped image and the image stored in database.

Step 6: find the similarity or difference between cropped image and image stored in database using Euclidean distance.

Step 7: set threshold value

Step 8: if difference is minimum && difference < threshold then

Step 9: assigns the name of gesture as folder name, in which the image having minimum difference lies.

Step 10: all recognized gestures are passed in fuzzy system which tells the behavior of the person.

Step 11: behavior classification in three forms positive, negative and neutral attitude.

Step 12: end;

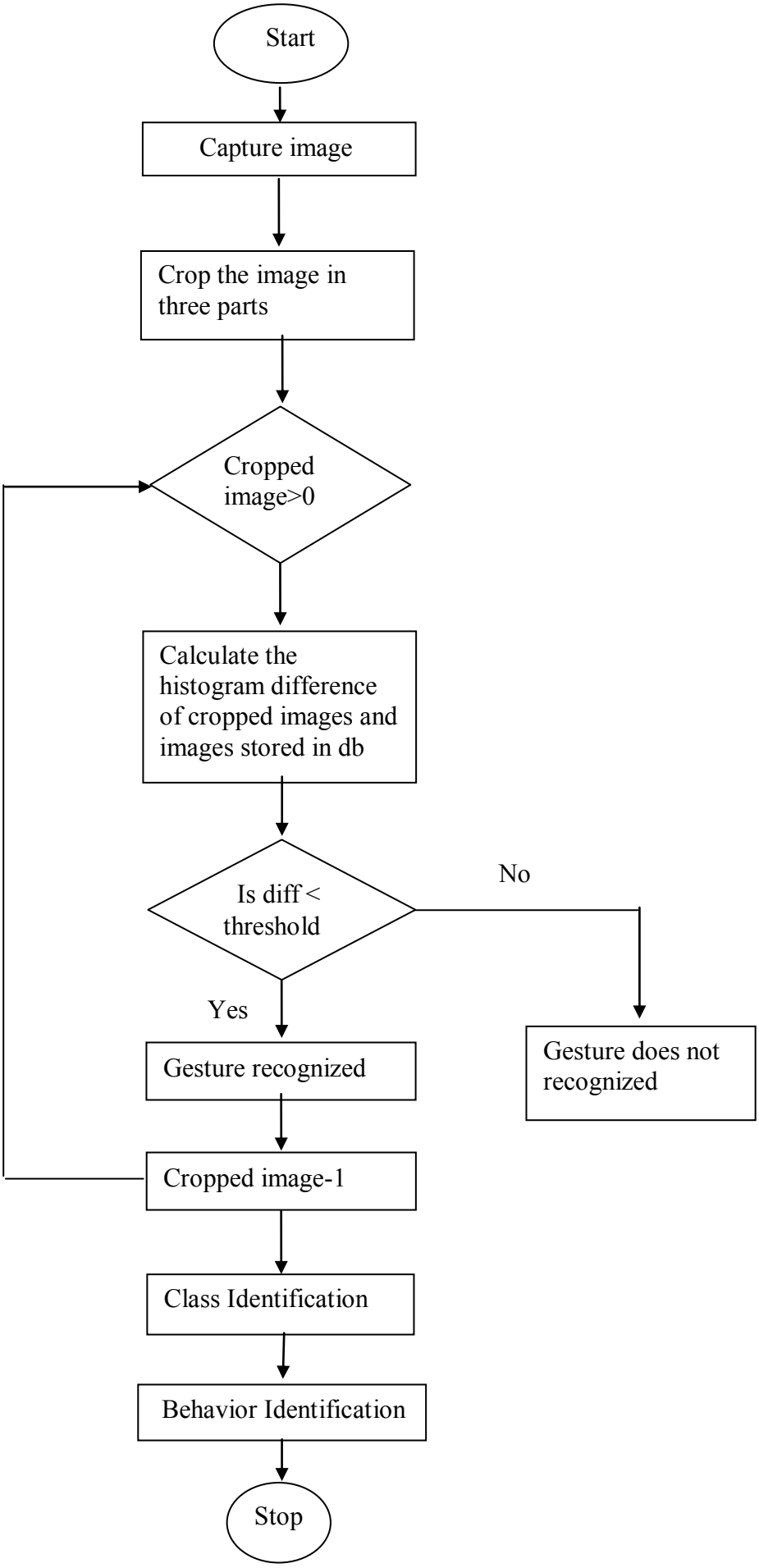


Figure 5.1 Block diagram of human behavior identification system

5.2 Design methodology

This is the simple and single platform of this system that is designed using GUI facility of MATLAB. Browse the image of the person.

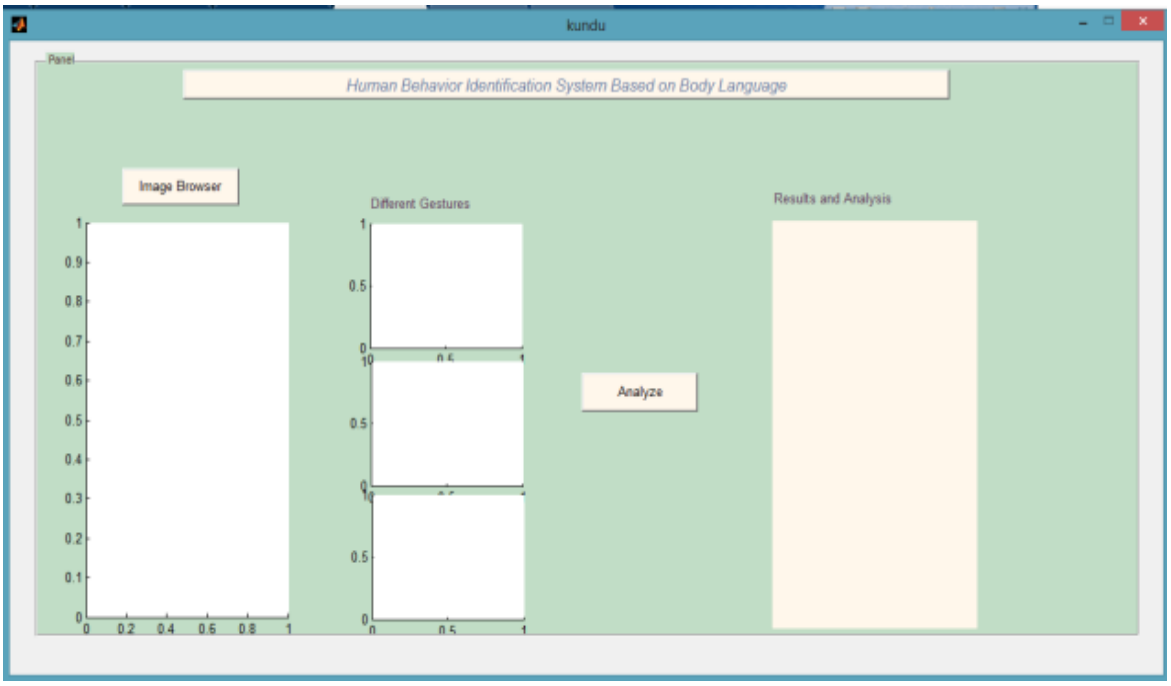


Figure5.2 Interface of the system

After that divide the images three parts 1st includes head position,2nd includes hand gestures and 3rd includes leg positions. These cropped images are compared with the images in database and select the most similar image from database.

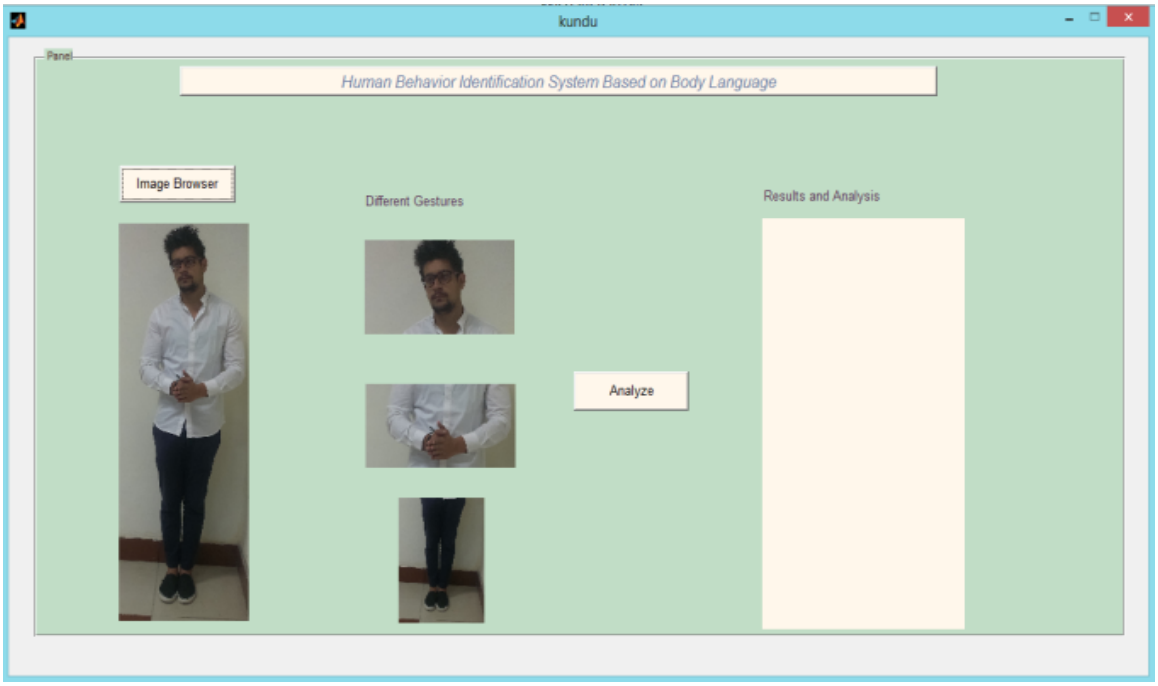


Figure5.3 Interface when image is browsed

The name of gesture is taken from the matched image. The name of gestures is given as an input to the fuzzy system. In this thesis, there are two fuzzy system are used to identify the behavior. First fuzzy system takes all the gestures as input and produces the result in the form of different behaviors like confident, submissive, dominant and brave so on. These behaviors are taken as input to the second fuzzy system which defines the classes as positive attitude, negative attitude and neutral attitude.

In first fuzzy system the inputs are body gestures like head positions, leg gestures and hand gestures. This fuzzy system accepts six inputs and produce single output in the form of different behaviors. These are:

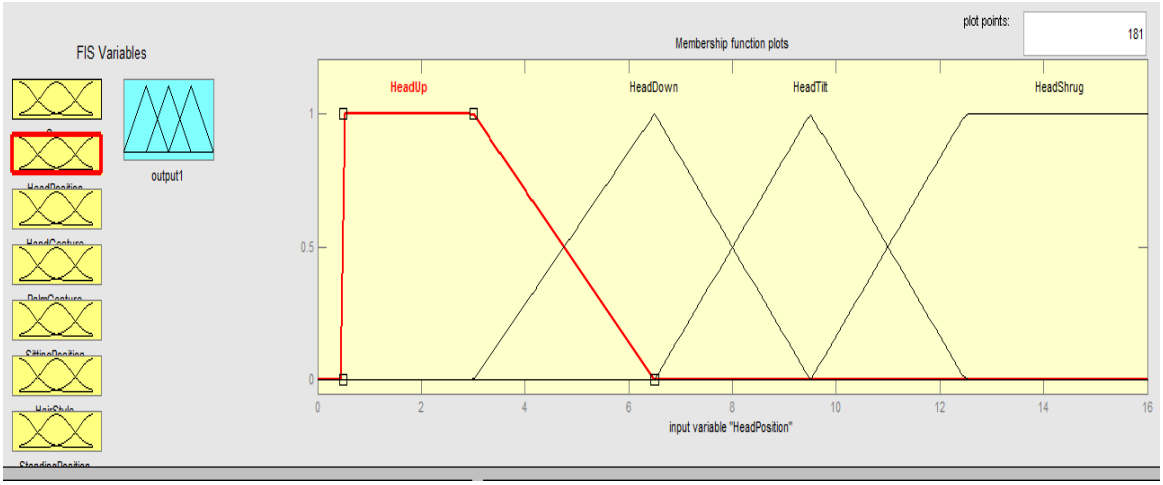


Figure 5.4 Plot of input membership function of head positions

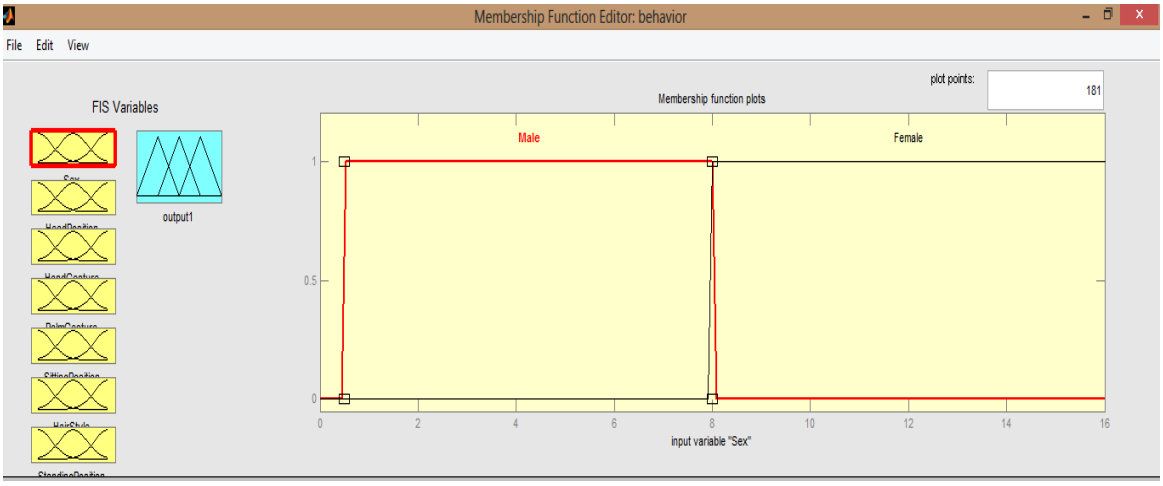


Figure 5.5 Plot of input membership function of sex.

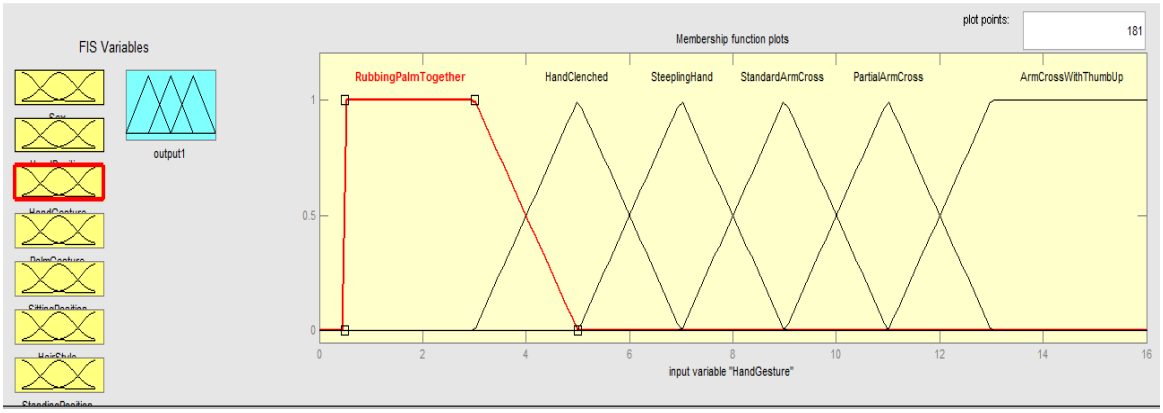


Figure 5.6 Plot of input membership function of hand gestures.

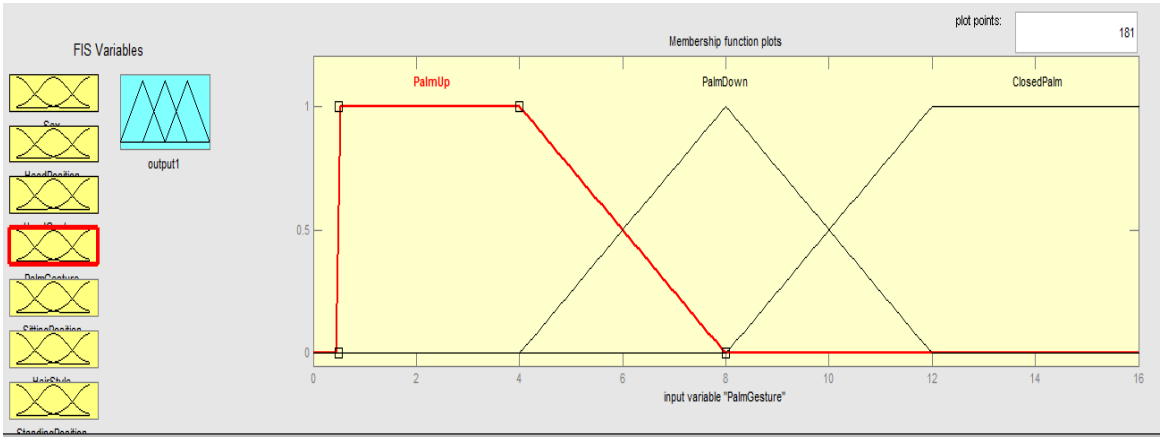


Figure 5.7 Plot of input membership function of palm gestures

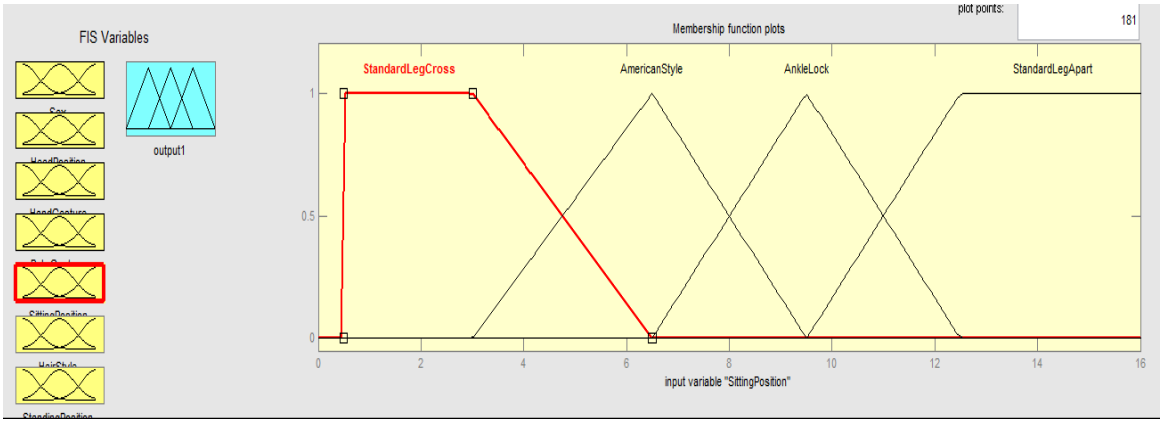


Figure 5.8 Plot of input membership function of sitting gestures

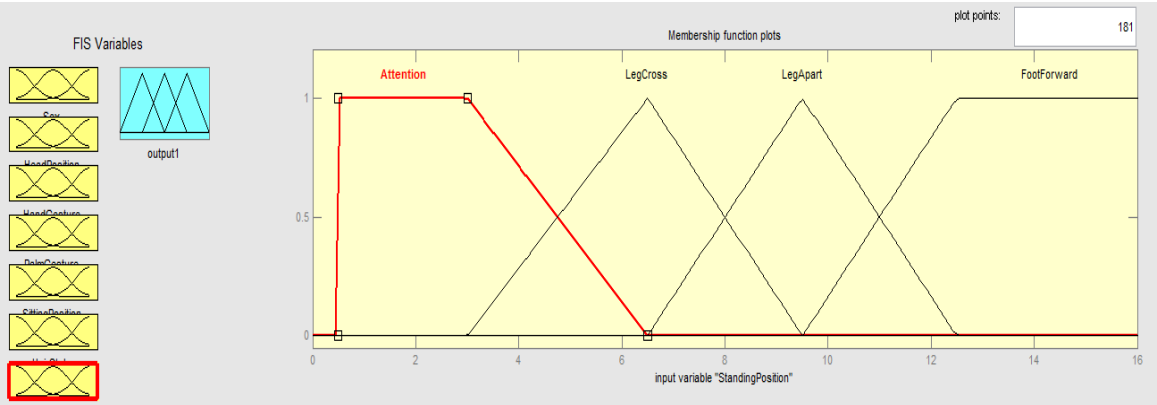


Figure 5.9 Plot of input membership function of standing gestures

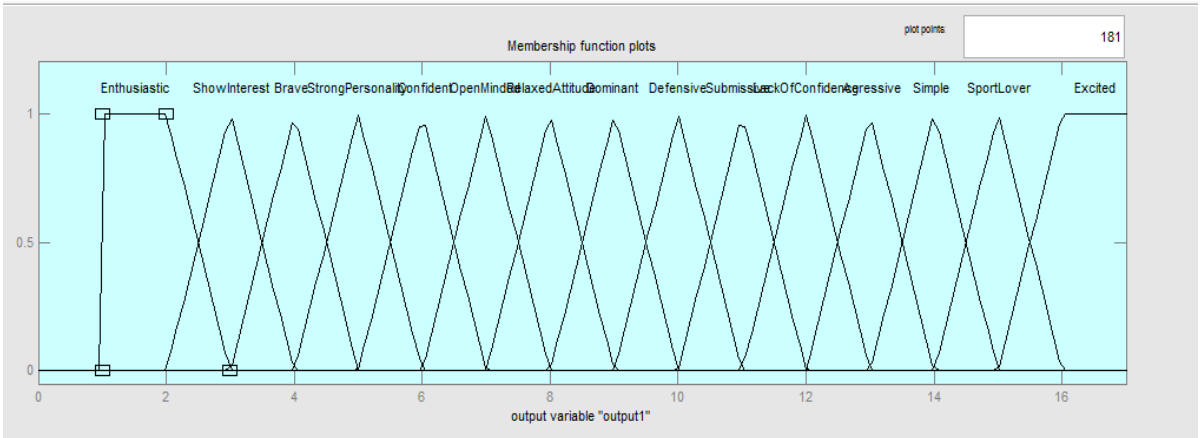


Figure 5.10 Plot of output of BehaviorNew fuzzy system.

The output of BehaviorNew fuzzy system is given to 2nd fuzzy system as an input. Class fuzzy system then tells the different classes of attitude.

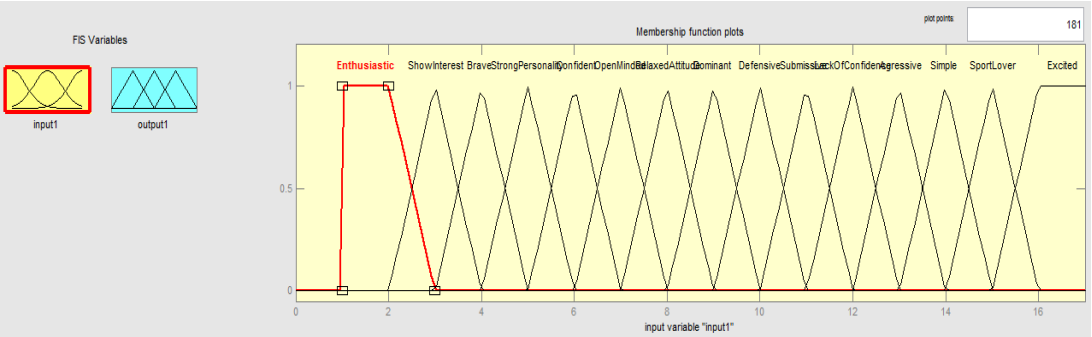


Figure 5.11 Plot of input membership function of behaviors.

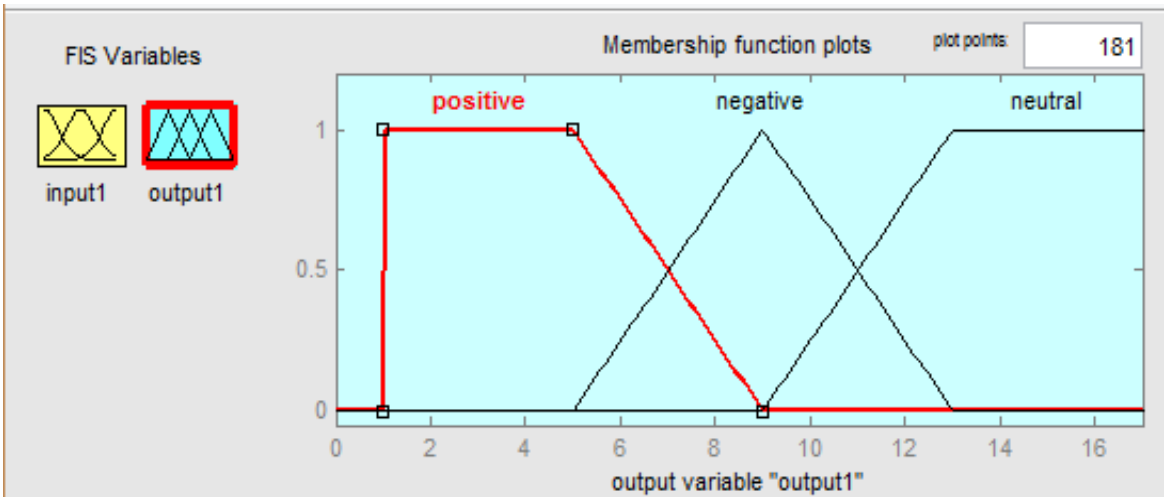


Figure 5.12 Plot of output of class fuzzy system.

Figure5.3 to figure5.12 show the plot of input and output of both the fuzzy systems that are BehaviorNew fuzzy inference system and class fuzzy inference system in MATLAB. The different If Then rules are defined in the database which is used to produce the result after mapping the actual image with the image stored in the database as per the already defined condition. Then the result is produced in the form of classes which tells the behavior and other characteristics of the person. The range of membership functions of input and output of first fuzzy system that is BehaviorNew is defined in the table1. The range of membership functions of second fuzzy system that is class is defined in the table2. Table3 contains some Sample test results of BehaviorNew fuzzy inference system**.** The output produced by BehaviorNew fuzzy inference system is given as an input to the class fuzzy interface system that produces the final result. Table4 contains some Sample test results of class fuzzy inference system**.**

If the value of final output lies between 1 to 7 then the attitude of the person is positive. And if the value of final output lies between 6 to 12 then the attitude is negative. And if the value lies between 11 to 17 then the attitude is neutral. Accordingly the system will display the images of these 3 attitudes with some suggestions. These images and classes are defined in the next chapter.

Table 5.1: Gestures and behaviors with input and output range of membership function

Input range[1 17]		*Output range[1 17]*	
GESTURES		*BEHAVIORS*	
[1 1 4 7]	*Head up*	*Enthusiastic*	*[1 1 2 3]*
[4 7 10]	*Head down*	*Show Interest*	*[2 3 4]*
[7 10 13]	*Head tilt*		
[10 13 17 17]	*Head shrug*	*Brave*	*[3 4 5]*
[1 1 4.5 9]	*Palm up*	*Strong Personality*	*[4 5 6]*
[4.5 9 13.5]	*Palm down*		
[9 13.5 17 17]	*Closed palm*	*Confident*	*[5 6 7]*
[1 1 4 6]	*Rubbing palm together*	*Open minded*	*[6 7 8]*
[4 6 8]	*Hand clenched together*		
[6 8 10]	*Steepling hands*	*Relaxed*	*[7 8 9]*
[8 10 12]	*Standard Arm Cross*	*Dominant*	*[8 9 10]*
[10 12 14]	*Partial arm cross*		
[12 14 17 17]	*Arm Cross With Thumb Up*	*Defensive*	*[9 10 11]*
[1 1 4 7]	*Standard Leg Cross*	*Submissive*	*[10 11 12]*
[4 7 10]	*American Style*		
[7 10 13]	*Ankle Lock*	*Lack of confidence*	*[11 12 13]*
[10 13 17 17]	*Standard Leg Apart*	*Aggressive*	*[12 13 14]*
[1 1 4 7]	*Attention*		
[4 7 10]	*Leg cross*	*Simple*	*[13 14 15]*
[7 10 13]	*Leg apart*	*Sports lover*	*[14 15 16]*
[10 13 17 17]	*Foot Forward*	*Excited*	*[15 16 17 17]*

Table5.2: Behavior and classes with input and output range of membership function

Input range[1 17]		***Output range[1 17]***	
BEHAVIORS(INPUT)		***CLASSES(OUTPUT)***	
[1 1 2 3]	***Enthusiastic***	***Positive attitude***	***[1 1 5 9]***
[2 3 4]	***Show Interest***		
[3 4 5]	***Brave***		
[4 5 6]	***Strong personality***		
[5 6 7]	***Confident***		
[6 7 8]	***Open minded***	***Negative attitude***	***[5 9 13]***
[7 8 9]	***Relaxed***		
[8 9 10]	***Dominant***		
[9 10 11]	***Defensive***		
[10 11 12]	***Submissive***		
[11 12 13]	***Lack of confidence***	***Neutral attitude***	***[9 13 17 17]***
[12 13 14]	***Aggressive***		
[13 14 15]	***Simple***		
[14 15 16]	***Sports lover***		
[15 16 17 17]	***Excited***		

Table 5.3 Sample test results of BehaviorNew fuzzy inference system

GESTURES(INPUT)						***(OUTPUT)***
Sex	***Head positions***	***Hand gesture***	***Palm gesture***	***Sitting positions***	***Standing positions***	***BEHAVIORS***
9	*4*	*6*	*0*	*10*	*0*	*9.512*
4	*7*	*0*	*9*	*0*	*7*	*10.499*
4	*4*	*6*	*0*	*15*	*0*	*5.999*
12	*15*	*10*	*0*	*0*	*4*	*9.374*
15	*10*	*12*	*0*	*15*	*0*	*7.707*
6	*4*	*0*	*4*	*0*	*4*	*6.999*
11	*7*	*0*	*4*	*10*	*0*	*9.499*
4	*15*	*4*	*0*	*15*	*0*	*11.512*
3	*10*	*4*	*0*	*7*	*0*	*8.117*

Table 5.4 Sample test results of Class fuzzy inference system

BEHAVIOR(INPUT)	***CLASSES(OUTPUT)***
9.512	9.000
10.499	8.999
5.999	4.078
9.374	8.999
7.707	10.838
6.999	4.078
9.499	8.988
11.512	9.000
8.117	13.331

5.3 Image database

The starting or very important point of this thesis is the creation of an image database that Images came from only one source that is photographs taken from android phone. This means that they have different sizes, but same resolution. First of all the images are converted to grayscale and the size of all the images are made equal. There are 5 to 7 images of a particular gesture in database. In the knowledge base, there are different 21 gestures and each gesture has 5 or 7 images is used for finding most similar gestures. The image database can have different formats.

First of all read the images and convert them in grayscale images.

```
Im1= rgb2gray(im1);
Im2= rgb2gray(im2);
Im3= rgb2gray(im3);
```

Now calculate normalized histogram of the images after converting to gray scale.

```
P1= imhist(im1) ./ numel(im1);
P2= imhist(im2) ./ numel(im2);
P3= imhist(im3) ./ numel(im3);
```

Suppose im1 is input image and im2 and im3 are in the knowledge base of the system.

After that calculate the Euclidean distance by using this formula:

```
m(1)=sum((P1 – P2).^2);
m(2)=sum((P1 – P3).^2);
```

im1 is compared with both the images in database.

m(i) gives value between 0 and 1. If m(i) value is very small then both images are almost similar. Suppose that m(1) is 0.2 and m(2) is 0.11 then im1 is more similar im3 as compare to im2. Then a threshold is defined that is th is 0.35. after that m(i) value is compared with the th value.

If m(i) is less then th value the image is matched else image does not matched with the images in database.

Some images that are stored in the knowledge base are:

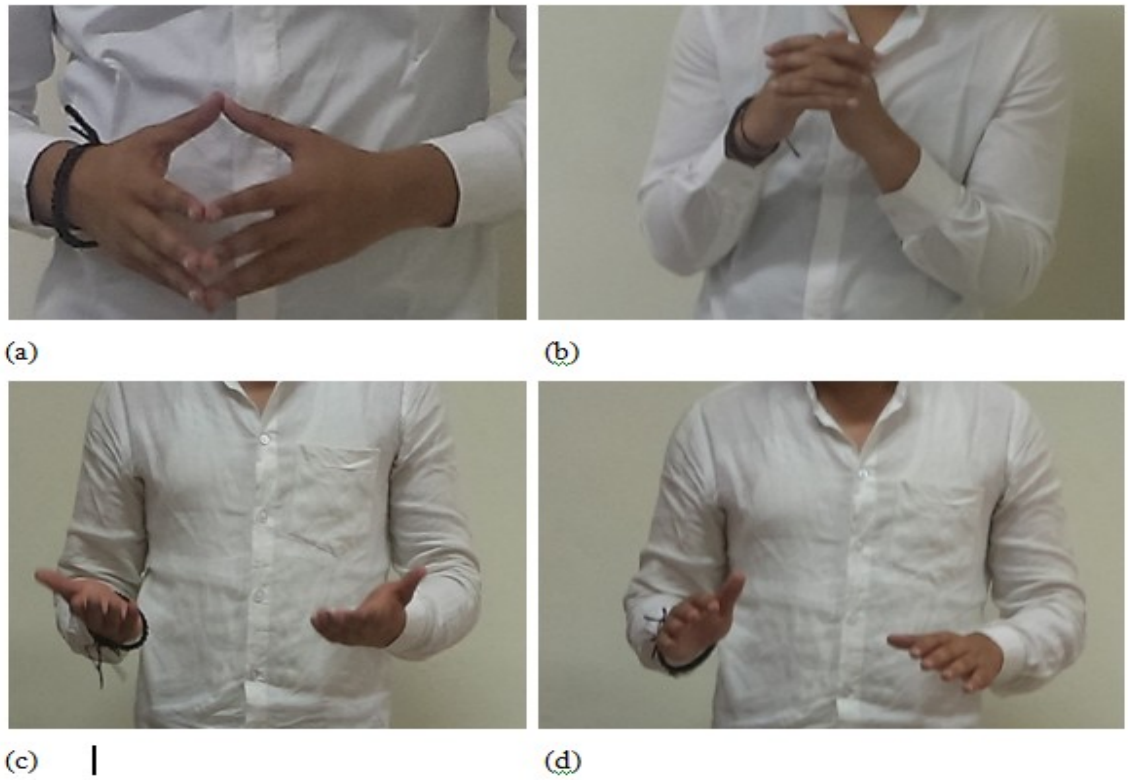


Figure 5.13 Hand gesture in knowledge base

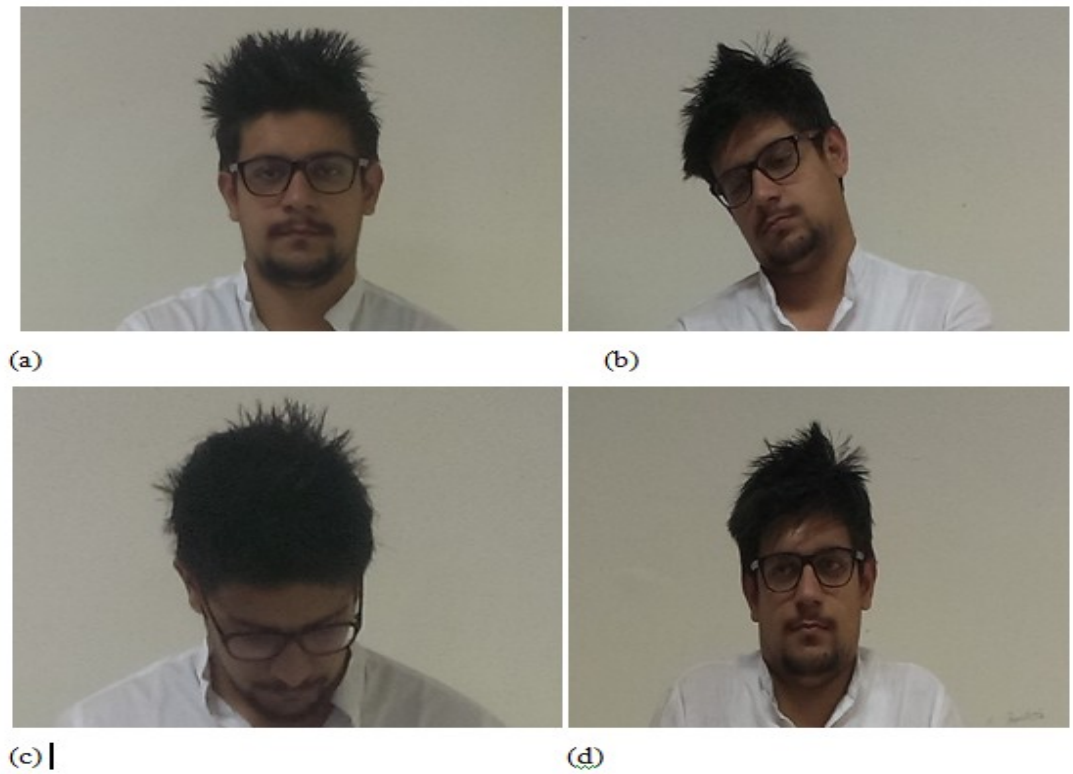


Figure 5.14 Head gesture in knowledge base

Figure 5.15 Leg gesture in knowledge base

Figure 5.13 contains some images of hand gestures that are stored in the knowledge base. There are 6 hand gestures and each of them has 5 to 7 images in the knowledge of the system. The images of hand gestures are compared with the second cropped image of input image.

Figure 5.14 contains some images of head gestures that are stored in the knowledge base. There are 4 hand gestures and each of them has 5 to 7 images in the knowledge of the system. The images of head gestures are compared with the first cropped image of input image.

Figure 5.15 contains some images of leg gestures that are stored in the knowledge base. There are 4 hand gestures and each of them has 5 to 7 images in the knowledge of the system. The images of leg gestures are compared with the third cropped image of input image.

CHAPTER 6
RESULTS AND DISCUSSIONS

This chapter actually explains that what result is produced by the system. Then the result is produced in the form of classes which tells the behavior and other characteristics of the person. The image of human is taken by the system as input. Then image is cropped so that cropped image contains only head or leg or hand. After that the difference between cropped image and the images that are in database is calculated by calculating histogram of images in MATLAB. If difference is small then assign the name of that folder in which the stored image lies, whose difference is small, to that cropped image. Then it will pick the behavior of the human according to the gesture. To recognize the behavior based on the body gesture is defined in the fuzzy system. The different If Then rules are defined in the database which is used to produce the result after mapping the actual image with the image stored in the database as per the already defined condition. Then the result is produced in the form of classes which tells the behavior and other characteristics of the person. There are 3 main classes that describe the behavior of the person that is:

I. **Positive attitude**: This class defines the positive behavior of the person like the person is confident, show interest in something, respectful, brave etc. The final output that is produced by the system if the person has positive attitude is shown in figure 6.1

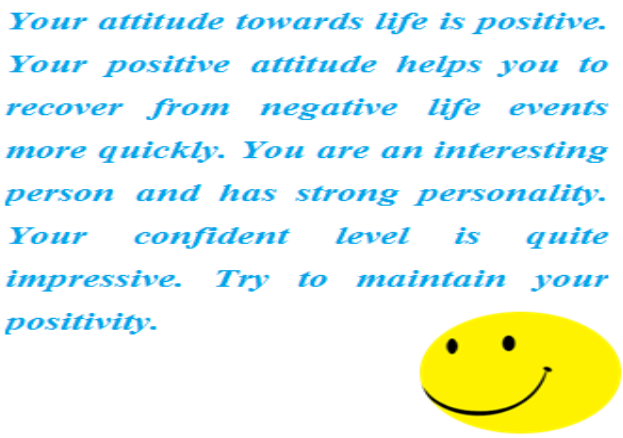


Figure 6.1 Output image of positive attitude

II. **Negative attitude**: In this class the negative behavior is described like a person is aggressive, submissive, frustrated, lack of confidence etc. The final output that is produced by the system if the person has negative attitude is shown in figure 6.2

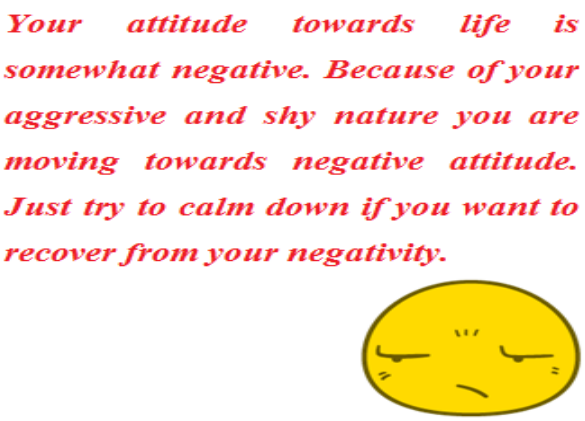


Figure 6.2 Output image of negative attitude

III. **Neutral attitude**: In this class the neutral behavior is described like a person is simple, relaxed, shy etc. The final output that is produced by the system if the person has neutral attitude is shown in figure 6.3.

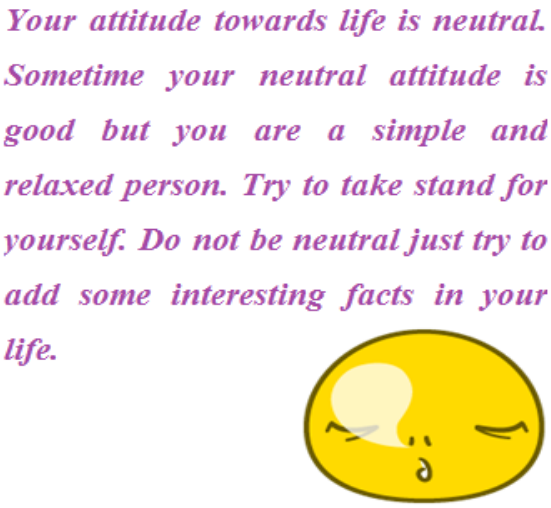


Figure 6.3 Output image of neutral attitude

Figure 6.4 is the simple and single platform of this system that is designed using GUI facility of MATLAB. Browse the image of the person. The system will ask to browse the full image of the person. Then it will crop it in three parts first cropped part includes head position, the second cropped part includes the hand positions and third cropped part includes the leg positions.

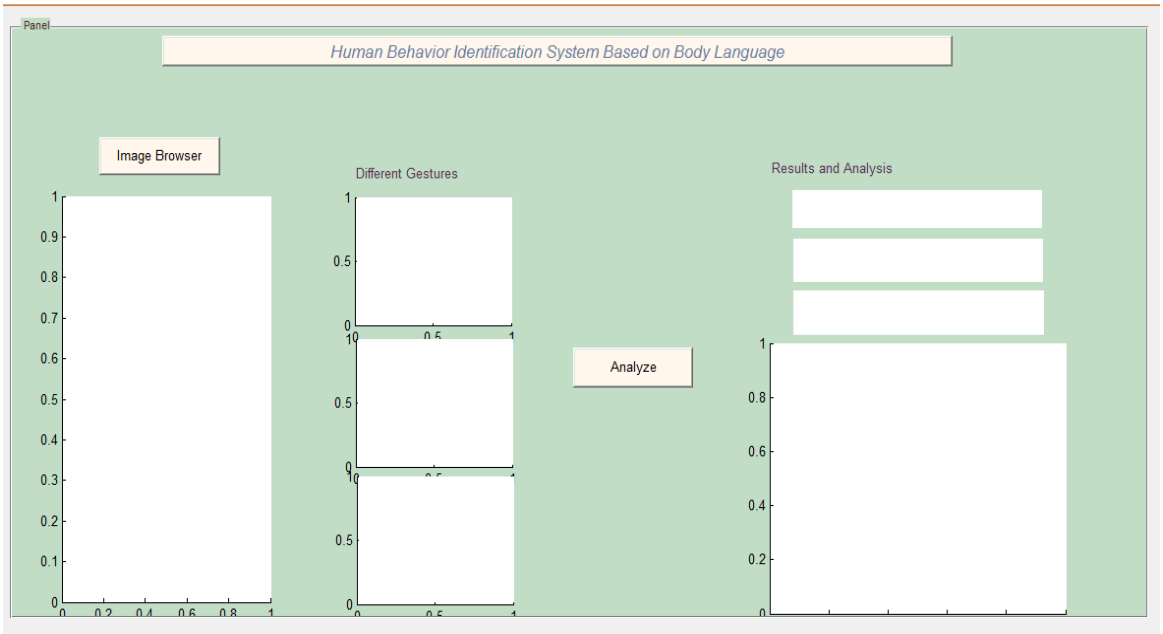


Figure 6.4 Interface of system

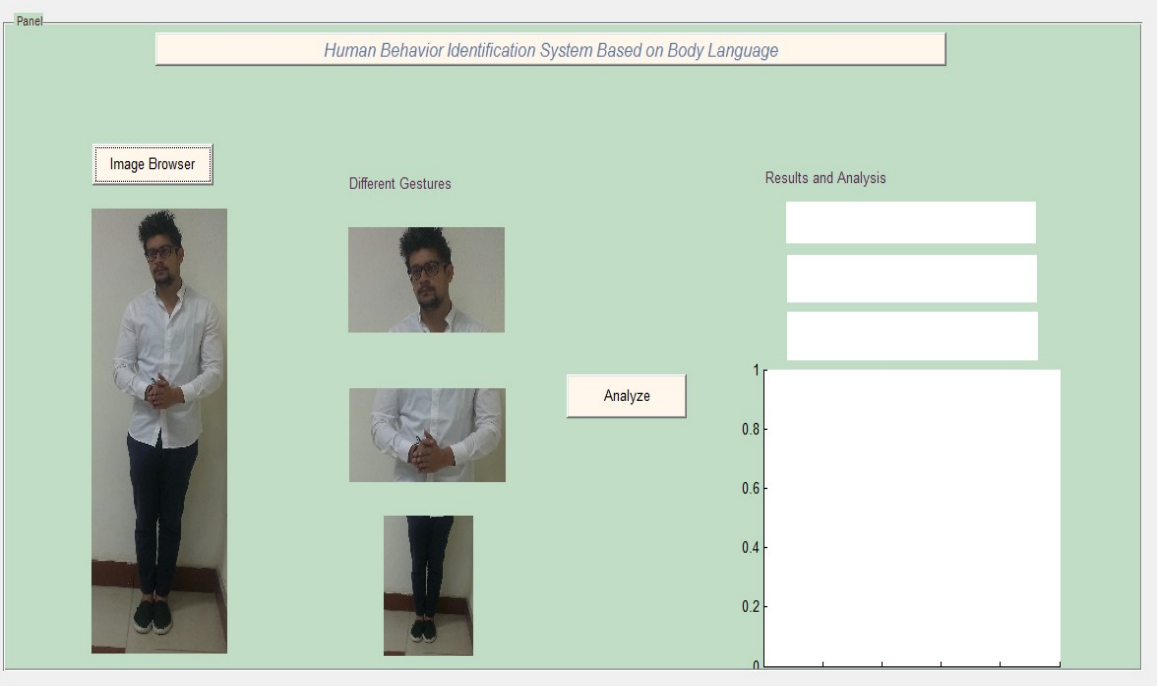


Figure 6.5 Image is browsed

The image is browsed and cropped in three parts as shown in figure 6.5. Then click on the analyze button it will tell three different gestures and produces the result.

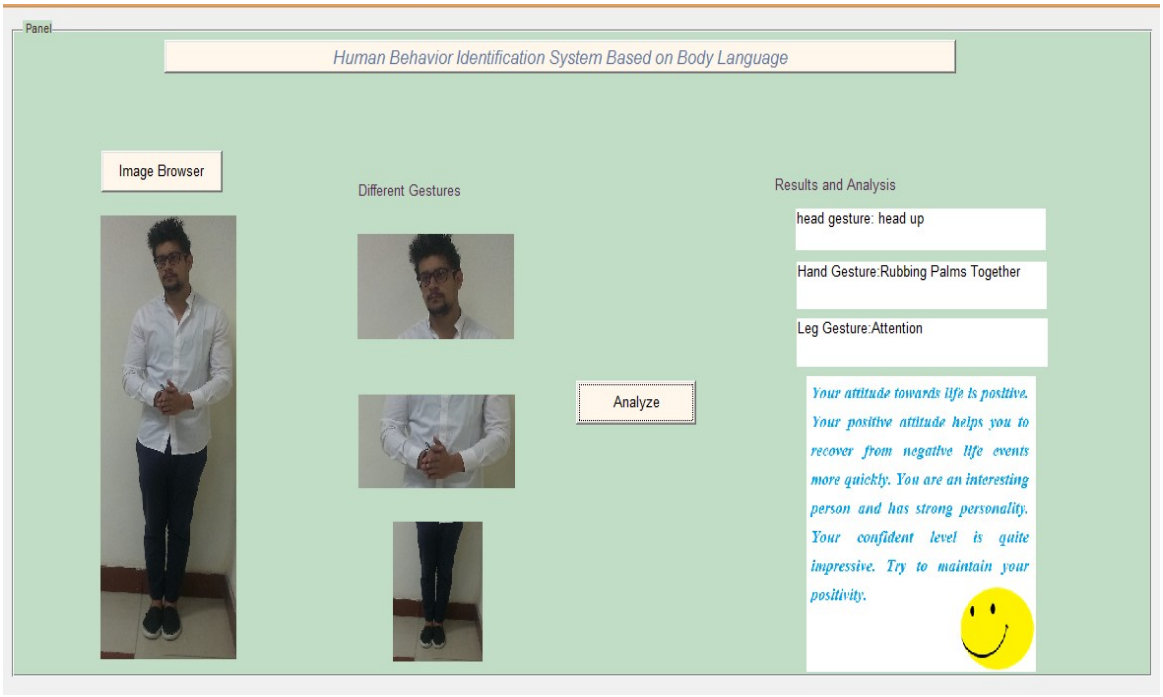


Figure 6.6 Final output

Figure 6.6 shows the final output that is produced by the system. For the particular person the head gesture is head up, hand gesture is rubbing palm together and leg position is attention. The attitude of this person is positive attitude.

Some more results that produce different gestures for another person are:

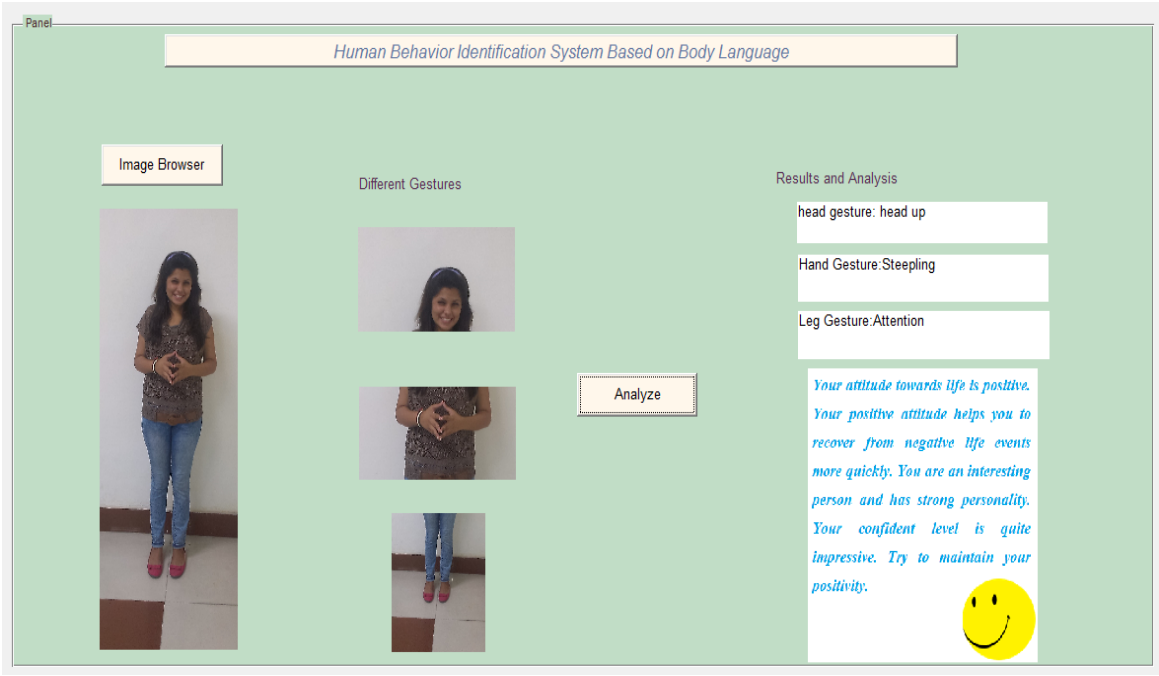


Figure 6.7 Second result

Figure 6.7 shows the final output that is produced by the system. For the particular person the head gesture is head up, hand gesture is steepling and leg position is attention. The

attitude of this person is positive attitude.

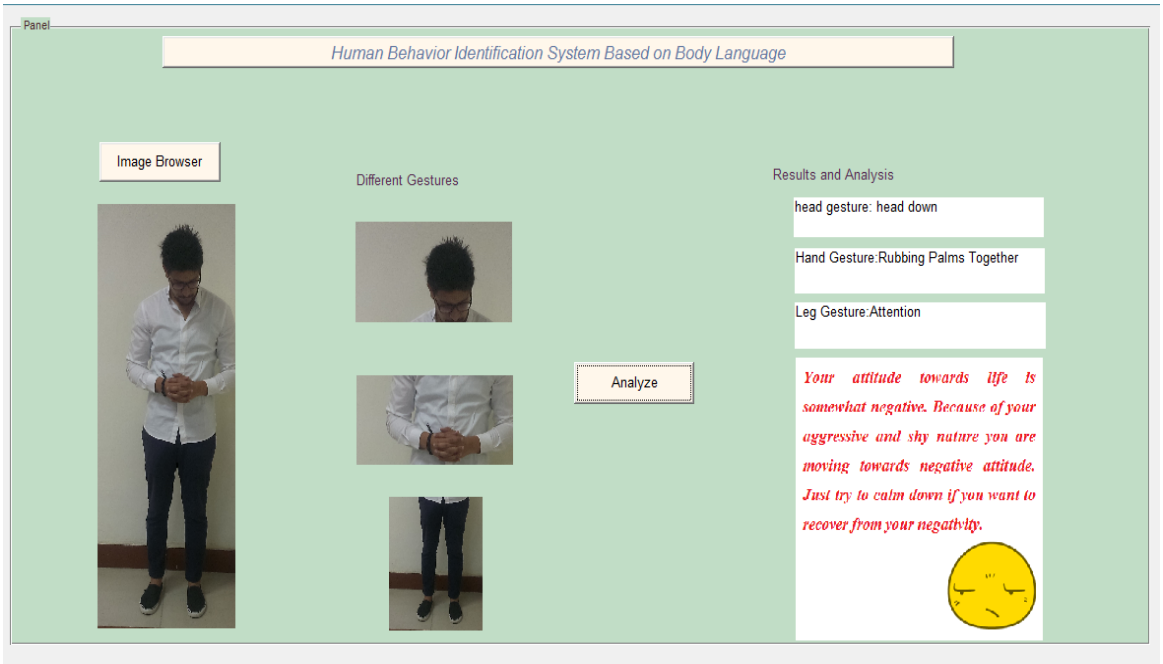


Figure 6.8 Third result

Figure 6.8 shows the final output that is produced by the system. For the particular person the head gesture is head down, hand gesture is rubbing palm together and leg position is attention. The attitude of this person is negative attitude.

CHAPTER 7
SUMMARY AND CONCLUSION

7.1 Summary:

The behavior and character of human can be judged from their body gesture. . One can read others thoughts and mind by their body gestures. An intelligent system (IS) can be designed that can tell the behavior of human being by seeing or by capturing the human gesture like hand gesture, leg gesture etc. The system will recognize the human behavior and produce the result in the form of classes which tells the behavior and other characteristics of the person. According to many experts, body language is thought to account for between 50 to 70 percent of all inter communication. It is very essential to understand body language but it is important to remember to note other cues and to check other signals as a group rather than focusing on a particular gesture. One can get benefit if he or she has the knowledge about body language.

7.2 Conclusion:

From my hypothesis, I concluded that my proposed system will analysis the human behavior by capturing the body language or by capturing the hand gesture, leg gesture, head position etc. The behavior and character of human can be judged from their body gesture. The image of human is taken by the system as input. Then image is cropped so that cropped image contains only head or leg or hand. After that the difference between cropped image and the images that are in database is calculated by calculating histogram of images in MATLAB. If difference is small then assign the name of that folder in which the stored image lies, whose difference is small, to that cropped image. then it will pick the behavior of the human according to the gesture. To recognize the behavior based on the body gesture is defined in the fuzzy system. The different If Then rules are defined in the database which is used to produce the result after mapping the actual image with the image stored in the database as per the already defined condition. Then the result is produced in the form of classes which tells the behavior and other characteristics of the person.

This system is used to identify the behavior of a person by body language. It can also be used to analysis psychological behavior of the person and helps in different medical treatments. This system can be used to identify the behavior of a person. So it can be used to identify any criminals and terrorists. If 2 or 3 people are sitting in a building or banks and they seem like the terrorists then with the help of the system we can capture the images of these people and can find out their behavior and nature. If we get negative attitude of these people then with the help of system we can say that they all are criminals.

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Appendix

Program how to match images:

```
a1 = imread('ak.jpg');
a = imcrop(a1,[10 50 800 2400]);
imshow(a);
Im1 = imcrop(a,[20 40 800 450]);
imshow(Im1);
image=imcrop(a,[20 650 800 400]);
imshow(image);
ima=imcrop(a,[10 1200 800 1500]);
imshow(ima);
Im1 = rgb2gray(Im1);
hn = imhist(Im1)./numel(Im1);
ima=rgb2gray(ima);
h=imhist(ima)./numel(ima);
image=rgb2gray(image);
hh=imhist(image)./numel(image);

% matching of head gestures

p1='C:\Users\Naveen\Documents\MATLAB\gesture\Head Up\a';
for i=1:4
z1=strcat(p1,num2str(i));
z1=strcat(z1,'.jpg');
Im2 = imread(z1);
Im2 = rgb2gray(Im2);
hn1 = imhist(Im2)./numel(Im2);
ar1(i)=sum((hn - hn1).^2);
end
p2='C:\Users\Naveen\Documents\MATLAB\gesture\Head Down\a';
for i=1:4
z2=strcat(p2,num2str(i));
z2=strcat(z2,'.jpg');
Im2 = imread(z2);
Im2 = rgb2gray(Im2);
hn2 = imhist(Im2)./numel(Im2);
ar2(i)=sum((hn - hn2).^2);
end
p3='C:\Users\Naveen\Documents\MATLAB\gesture\Head Tilt\a';
for i=1:4
z3=strcat(p3,num2str(i));
z3=strcat(z3,'.jpg');
Im2 = imread(z3);
Im2 = rgb2gray(Im2);
hn3 = imhist(Im2)./numel(Im2);
ar3(i)=sum((hn - hn3).^2);
end
p4='C:\Users\Naveen\Documents\MATLAB\gesture\Head Shrug\a';
```

```
for i=1:4
z4=strcat(path,num2str(i));
z4=strcat(z4,'.jpg');
Im2 = imread(z4);
Im2 = rgb2gray(Im2);
hn4 = imhist(Im2)./numel(Im2);
ar4(i)=sum((hn - hn4).^2);
end
temp1=ar1(1);
 for i=2:16
    if(i<=4)
     if(ar1(i)<temp1)
       temp1=ar1(i);
       n1=i;
     end;
    elseif(i>4 && i<=8)
        if(ar2(i)<temp1)
        temp1=ar2(i);
        n1=i;
        end;
    elseif(i>8 && i<12)
         if(ar3(i)<temp1)
               temp1=ar3(i);
               n1=i;
          else
              if(ar4(i)<temp1)
                 temp1=ar4(i);
                 n1=i;
             end;
       end;
 end;
   if(temp1<0.3)
    if(n1<=4)
     t1=strcat(p1,num2str(n1));
     t1=strcat(t1,'.jpg');
     elseif(n1>4 && n1<=8)
       t1=strcat(p2,num2str(n1));
    t1=strcat(t1,'.jpg');
      elseif(n1>8 && n1<=12)
       t1=strcat(p3,num2str(n1));
    t1=strcat(t1,'.jpg');
   else
       t1=strcat(p4,num2str(n1));
    t1=strcat(t1,'.jpg');
   end;
   else
       disp('dnt match');

   end;
```

```
% matching of hand gestures

path='C:\Users\Naveen\Documents\MATLAB\gesture\Clenched Together\im';
for i=1:4
x1=strcat(path,num2str(i));
x1=strcat(x1,'.jpg');
image1 = imread(x1);
image1 = rgb2gray(image1);
h1 = imhist(image1)./numel(image1);
m1(i)=sum((h - h1).^2);
end
path1='C:\Users\Naveen\Documents\MATLAB\gesture\Rubbing Palms Together\im';
for i=5:8
x2=strcat(path1,num2str(i));
x2=strcat(x2,'.jpg');
image2 = imread(x2);
image2 = rgb2gray(image2);
h2 = imhist(image2)./numel(image2);
m2(i)=sum((h - h2).^2);
end
path2='C:\Users\Naveen\Documents\MATLAB\gesture\Steepling\im';
for i=9:12
x3=strcat(path2,num2str(i));
x3=strcat(x3,'.jpg');
image3 = imread(x3);
image3  = rgb2gray(image3);
h3 = imhist(image3)./numel(image3);
m3(i)=sum((h - h3).^2);
end
path3='C:\Users\Naveen\Documents\MATLAB\gesture\Standard Arm Cross\im';
for i=13:16
x4=strcat(path3,num2str(i));
x4=strcat(x4,'.jpg');
image4 = imread(x4);
image4 = rgb2gray(image4);
h4 = imhist(image4)./numel(image4);
m4(i)=sum((h - h4).^2);
end
path4='C:\Users\Naveen\Documents\MATLAB\gesture\Arm Cross With ThumbUp\im';
for i=17:20
x5=strcat(path4,num2str(i));
x5=strcat(x5,'.jpg');
image5 = imread(x5);
image5 = rgb2gray(image5);
h5 = imhist(image5)./numel(image5);
m5(i)=sum((h - h5).^2);
end
path5='C:\Users\Naveen\Documents\MATLAB\gesture\Partial Arm Cross\im';
for i=21:24
x6=strcat(path5,num2str(i));
```

```
x6=strcat(x6,'.jpg');
image6 = imread(x6);
image6 = rgb2gray(image6);
h6 = imhist(image6)./numel(image6);
m6(i)=sum((h - h6).^2);
end
temp2=m1(1);
 for i=2:24
    if(i<=4)
     if(m1(i)<temp2)
       temp2=m1(i);
       n2=i;
     end;
    elseif(i>4 && i<=8)
        if(m2(i)<temp2)
        temp2=m2(i);
        n2=i;
        end;
          elseif(i>8 && i<=12)
        if(m3(i)<temp2)
        temp2=m3(i);
        n2=i;
        end;
          elseif(i>12 && i<=16)
        if(m4(i)<temp2)
        temp2=m4(i);
        n2=i;
        end;
          elseif(i>16 && i<=20)
        if(m5(i)<temp2)
        temp2=m5(i);
        n2=i;
        end;
        else
            if(m6(i)<temp2)
               temp2=m6(i);
               n2=i;
            end;
       end;
 end;
   disp(temp2);
   if(temp2<0.3)

   if(n2<=4)
   t2=strcat(path,num2str(n2));
    t2=strcat(t2,'.jpg');
   elseif(n2>5 && n2<=8)
      t2=strcat(path1,num2str(n2));
    t2=strcat(t2,'.jpg');
     elseif(n2>9 && n2<=12)
```

```
      t2=strcat(path2,num2str(n2));
    t2=strcat(t2,'.jpg');
     elseif(n2>13 && n2<=16)
      t2=strcat(path3,num2str(n2));
    t2=strcat(t2,'.jpg');
     elseif(n2>17 && n2<=20)
      t2=strcat(path4,num2str(n2));
    t2=strcat(t2,'.jpg');
   else
      t2=strcat(path5,num2str(n2));
    t2=strcat(t2,'.jpg');
   end;
   else
      disp('dnt match');

   end;

% matching of leg gestures

pa1='C:\Users\Naveen\Documents\MATLAB\gesture\Attention\ima';
for i=1:4
y1=strcat(pa1,num2str(i));
y1=strcat(y1,'.jpg');
im1 = imread(y1);
im1= rgb2gray(im1);
hh1 = imhist(im1)./numel(im1);
arr1(i)=sum((hh - hh1).^2);
end
pa2='C:\Users\Naveen\Documents\MATLAB\gesture\Leg Cross\ima';
for i=5:8
y2=strcat(pa2,num2str(i));
y2=strcat(y2,'.jpg');
im2 = imread(y2);
im2= rgb2gray(im2);
hh2 = imhist(im2)./numel(im2);
arr2(i)=sum((hh - hh2).^2);
end
pa3='C:\Users\Naveen\Documents\MATLAB\gesture\Leg Apart\ima';
for i=9:12
y3=strcat(pa3,num2str(i));
y3=strcat(y3,'.jpg');
im3 = imread(y3);
im3= rgb2gray(im3);
hh3 = imhist(im3)./numel(im3);
arr3(i)=sum((hh - hh3).^2);
end
pa4='C:\Users\Naveen\Documents\MATLAB\gesture\Foot Forward\ima';
for i=13:16
y4=strcat(pa4,num2str(i));
y4=strcat(y4,'.jpg');
```

```
im4 = imread(y4);
im4= rgb2gray(im4);
hh4 = imhist(im4)./numel(im4);
arr4(i)=sum((hh - hh4).^2);
end
temp2=arr1(1);
 for i=2:16
    if(i<=4)
     if(arr1(i)<temp3)
       temp3=arr1(i);
       n3=i;
     end;
    elseif(i>4 && i<=8)
        if(arr2(i)<temp3)
        temp3=arr2(i);
        n3=i;
        end;
    elseif(i>8 && i<12)
         if(arr3(i)<temp3)
               temp3=arr3(i);
               n3=i;
          else
              if(arr4(i)<temp3)
                 temp3=arr4(i);
                 n3=i;
             end;
       end;
 end;
   if(temp3<0.3)
    if(n3<=4)
     t3=strcat(pa1,num2str(n3));
     t3=strcat(t3,'.jpg');
     elseif(n3>4 && n3<=8)
       t3=strcat(pa2,num2str(n3));
    t3=strcat(t3,'.jpg');
      elseif(n3>8 && n3<=12)
       t3=strcat(pa3,num2str(n3));
    t3=strcat(t3,'.jpg');
   else
       t3=strcat(pa4,num2str(n3));
    t3=strcat(t3,'.jpg');
   end;
   else
       disp('dnt match');

   end;
```