RAMA UNIVERSITY

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FACULTY OF EGINEERING AND TECHNOLOGY

Soft Computing

LECTURE -36

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OUTLINE

- Fuzzy Control
- Architecture of Fuzzy Control
- Mat lab
- Components of an Information Retrieval System
- Clustering of Document and Terms
- Steps of TSP using GA
- Multiple Choice Question
- References

FUZZY CONTROL

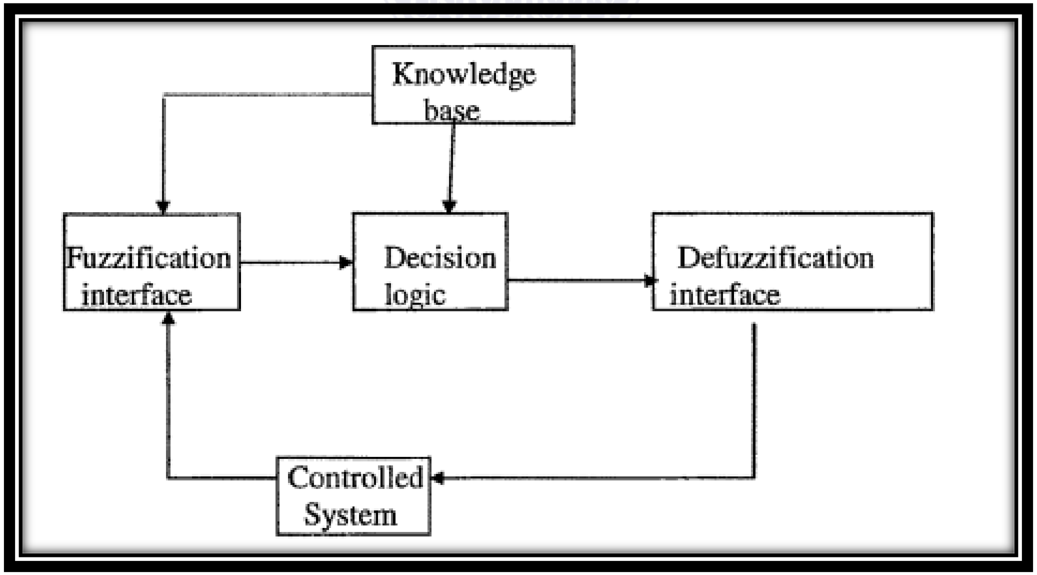
Fuzzy Control

A control system is an arrangement of physical components designed to alter another physical system so that this system exhibits certain desired characteristics. Following are some reasons of using Fuzzy Logic in Control Systems −

❑While applying traditional control, one needs to know about the model and the objective function formulated in precise terms. This makes it very difficult to apply in many cases.

❑By applying fuzzy logic for control we can utilize the human expertise and experience for designing a controller.

❑The fuzzy control rules, basically the IF-THEN rules, can be best utilized in designing a controller.



GENETIC ALGORITHM BASED INTERNET SEARCH TECHNIQUES

Important process in web information retrieval framework

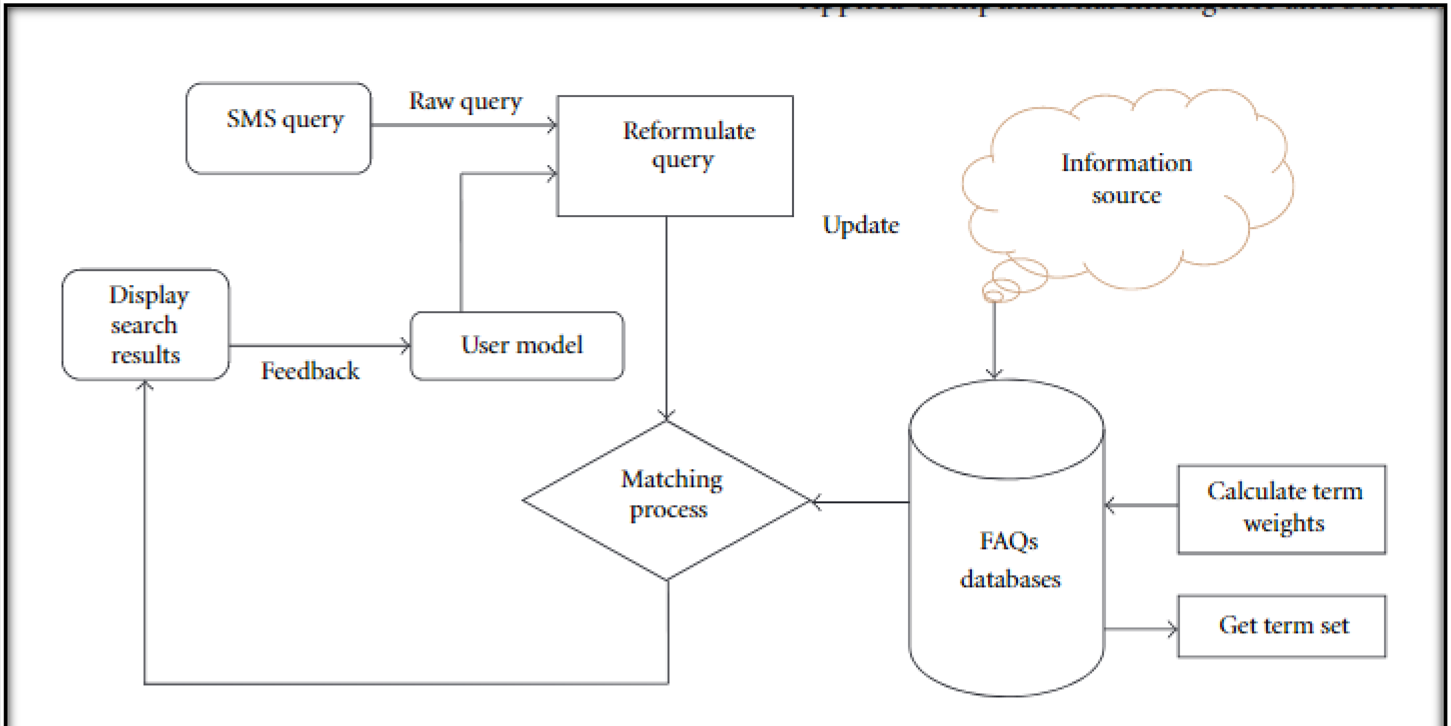


FIGURE 1: Important Processes in Web Information Retrieval-framework.

INTRODUCTION TO MATLAB ENVIRONMENT FOR SOFT COMPUTING TECHNIQUES

Introduction to MATLAB Environment for Soft computing Techniques

The developments tools such as MATLAB, SIMULINK, and tools boxes are described in the section. Their use is illustrated by applications.

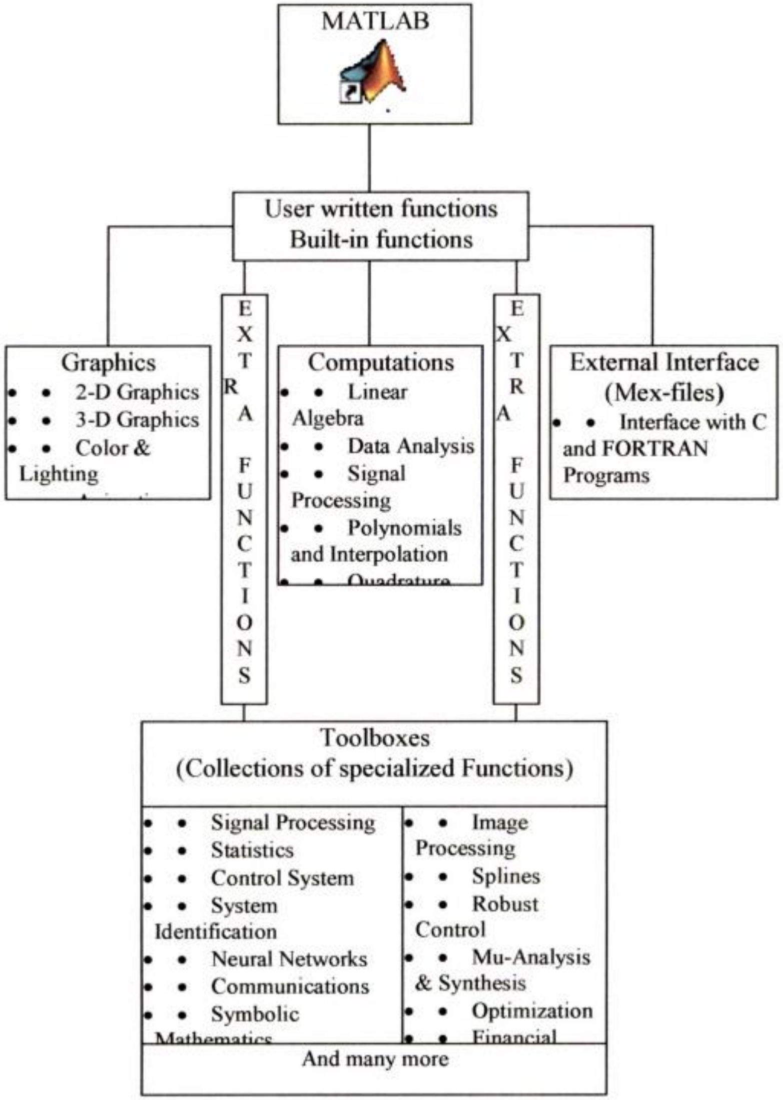
MATLAB [5] is a high-performance language for technical computing. The name MATLAB stands for matrix laboratory. A numerical analyst called Cleve Moler wrote the first version of MATLAB in the 1970s. It has since evolved into a successful commercial software package. The MATLAB system consists offive main parts:

MATLAB

The MATLAB Mathematical Function Library: -

This is a vast collection of computational algorithms ranging from elementary functions, like sum, sine, cosine, and complex arithmetic.

The MATLAB Language: - This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features.



MATLAB

User written functions
Built-in functions

Graphics
- 2-D Graphics
- 3-D Graphics
- Color & Lighting

EXTRA FUNCTIONS

Computations
- Linear Algebra
- Data Analysis
- Signal Processing
- Polynomials and Interpolation
- Quadrature

EXTRA FUNCTIONS

External Interface (Mex-files)
- Interface with C and FORTRAN Programs

Toolboxes
(Collections of specialized Functions)

- Signal Processing
- Statistics
- Control System
- System Identification
- Neural Networks
- Communications
- Symbolic Mathematics

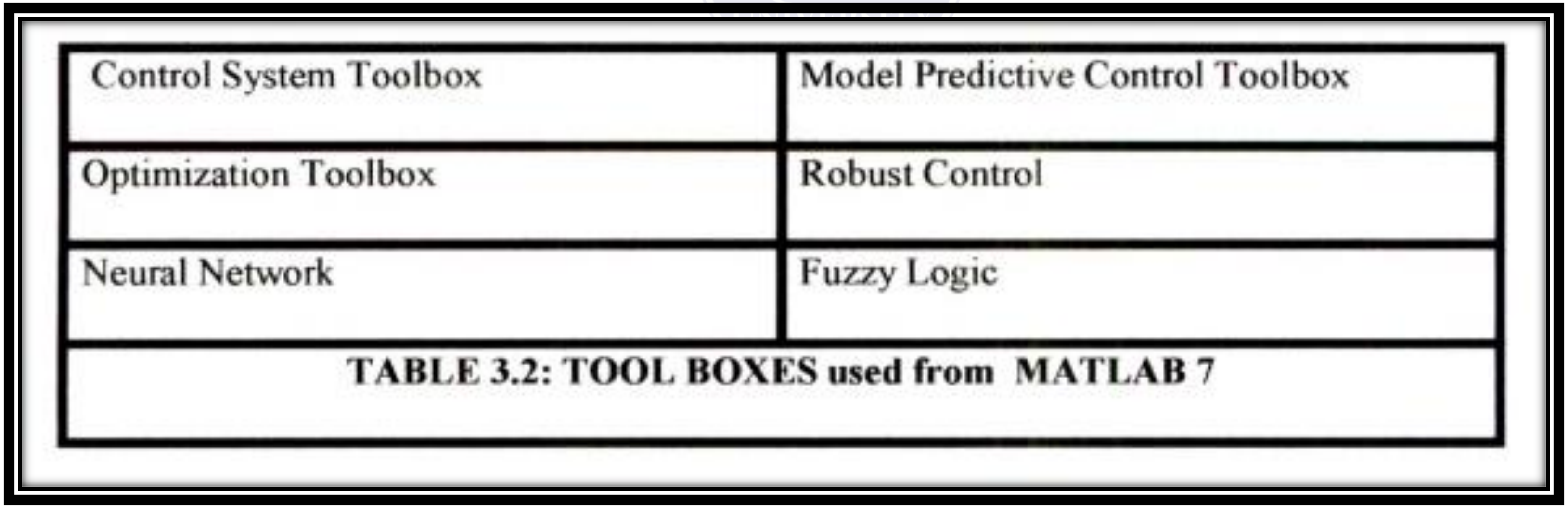
- Image Processing
- Splines
- Robust Control
- Mu-Analysis & Synthesis
- Optimization
- Financial

And many more

MATLAB

The MATLAB Application Program Interface (API): -

This is a library that allows you to write C and Fortran programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files. Toolboxes available in MATLAB 7.0 and used in the thesis are listed in table

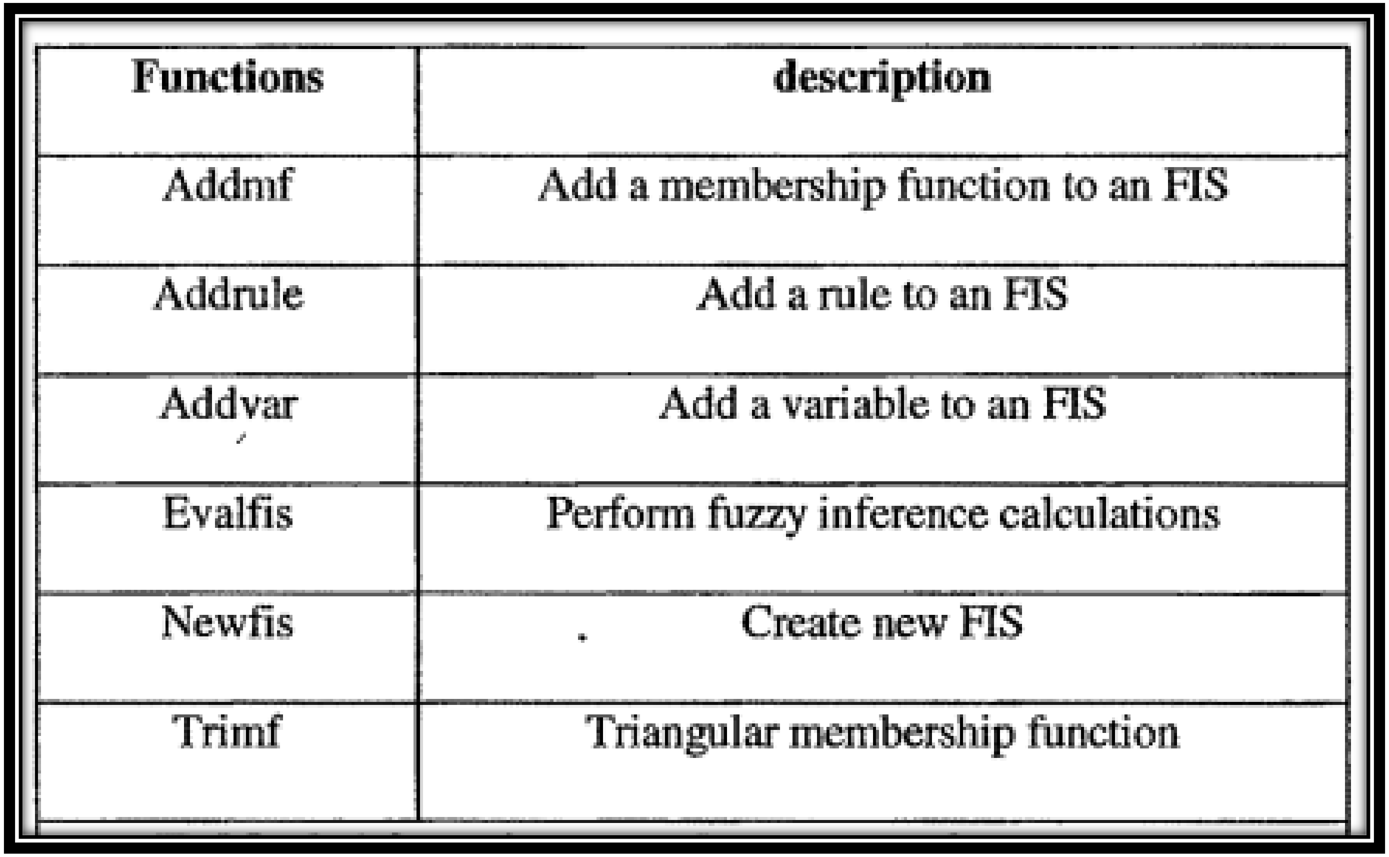


Control System Toolbox	Model Predictive Control Toolbox
Optimization Toolbox	Robust Control
Neural Network	Fuzzy Logic

TABLE 3.2: TOOL BOXES used from MATLAB 7

MATLAB Function

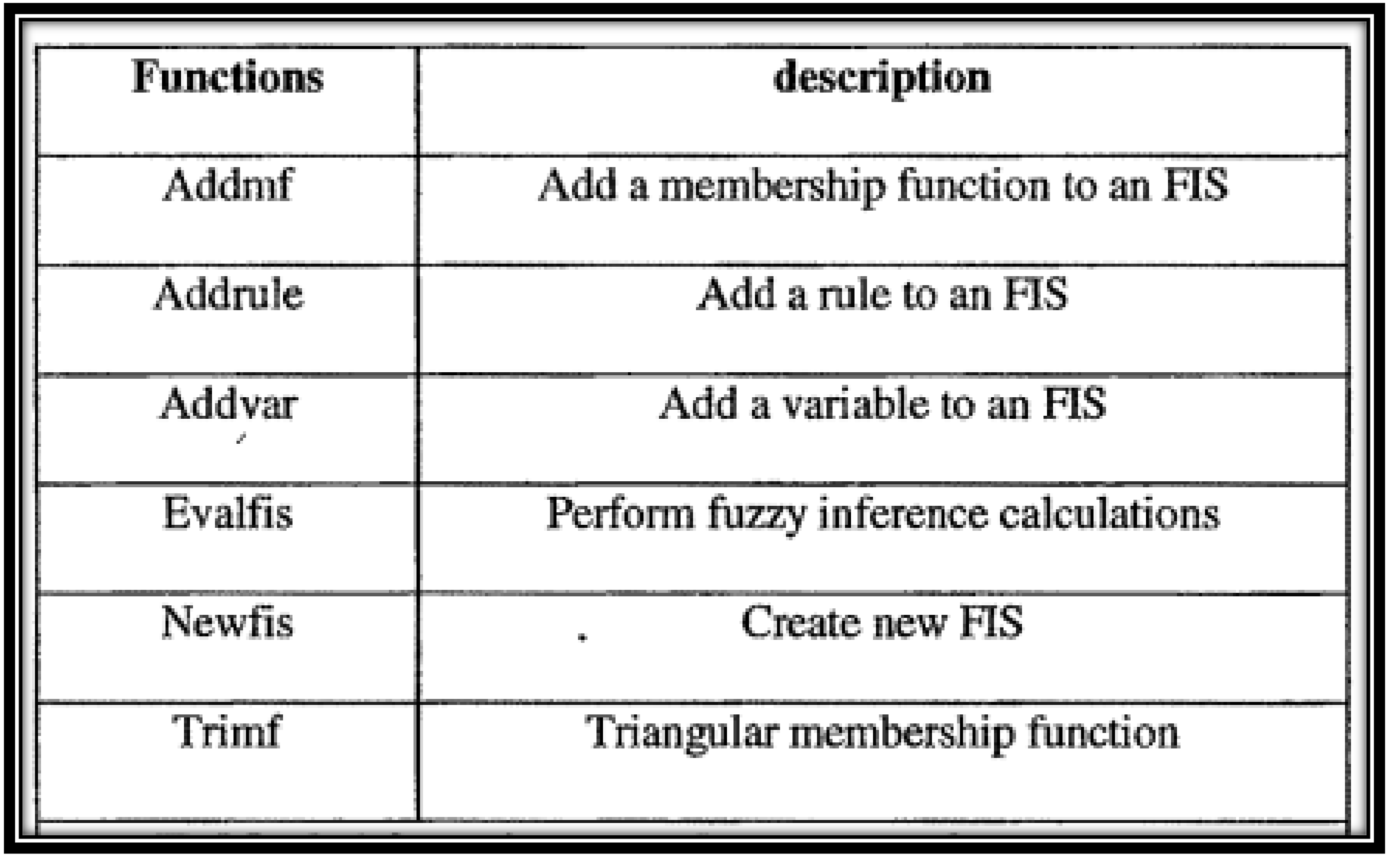
There are various function some of them are listed in table.



Functions	description
Addmf	Add a membership function to an FIS
Addrule	Add a rule to an FIS
Addvar	Add a variable to an FIS
Evalfis	Perform fuzzy inference calculations
Newfis	Create new FIS
Trimf	Triangular membership function

Neural Network Toolbox

There are various neural network toolbox listed below in table.



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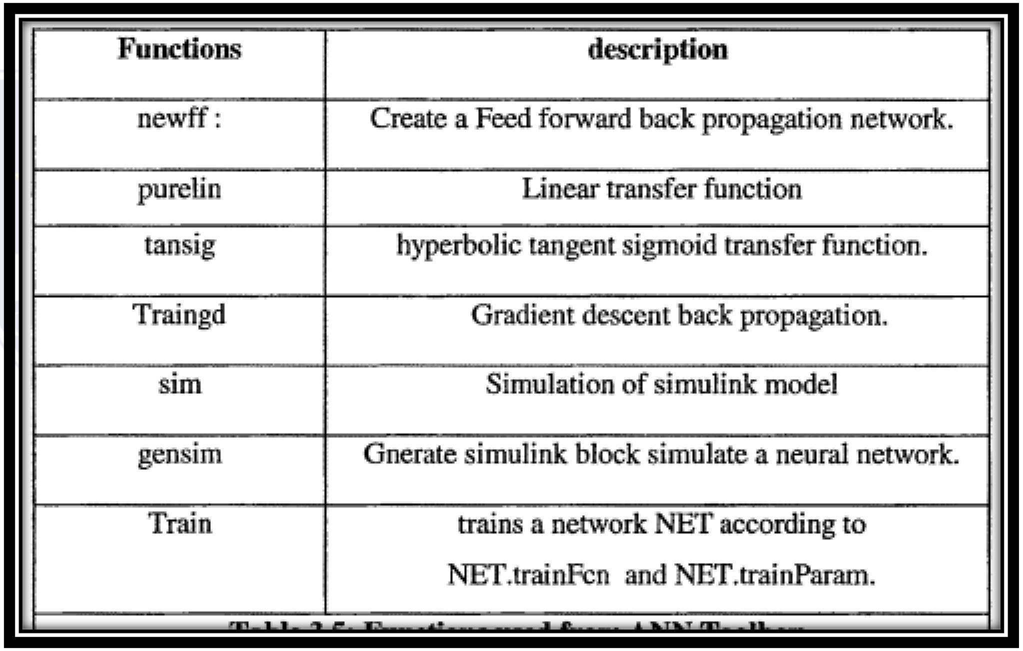
Neural Network Toolbox

There are various neural network toolbox listed below in table.

The MATLAB neural network toolbox provides a complete set of functions and a graphical user interface for the design, implementation, visualization, and simulation of neural networks. It supports the most commonly used supervised and unsupervised network architectures and a comprehensive set of training and learning functions. The neural network toolbox extends the MATLAB computing environment to provide tools for the design, implementation, visualization, and simulation of neural network. Table 3.5 lists MATLAB functions used for training and learning of the ANN controller.



Functions	description
newff :	Create a Feed forward back propagation network.
purelin	Linear transfer function
tansig	hyperbolic tangent sigmoid transfer function.
Traingd	Gradient descent back propagation.
sim	Simulation of simulink model
gensim	Gnerate simulink block simulate a neural network.
Train	trains a network NET according to NET.trainFcn and NET.trainParam.

Table 3.5: Functions used from ANN Toolbox

Fuzzy Logic Algorithm

Initialization:

- Define Linguistic variables and terms
- Construct Membership Functions
- Construct Rule Base

Fuzzification:

Convert crisp input data to fuzzy values using the membership functions

Inference:

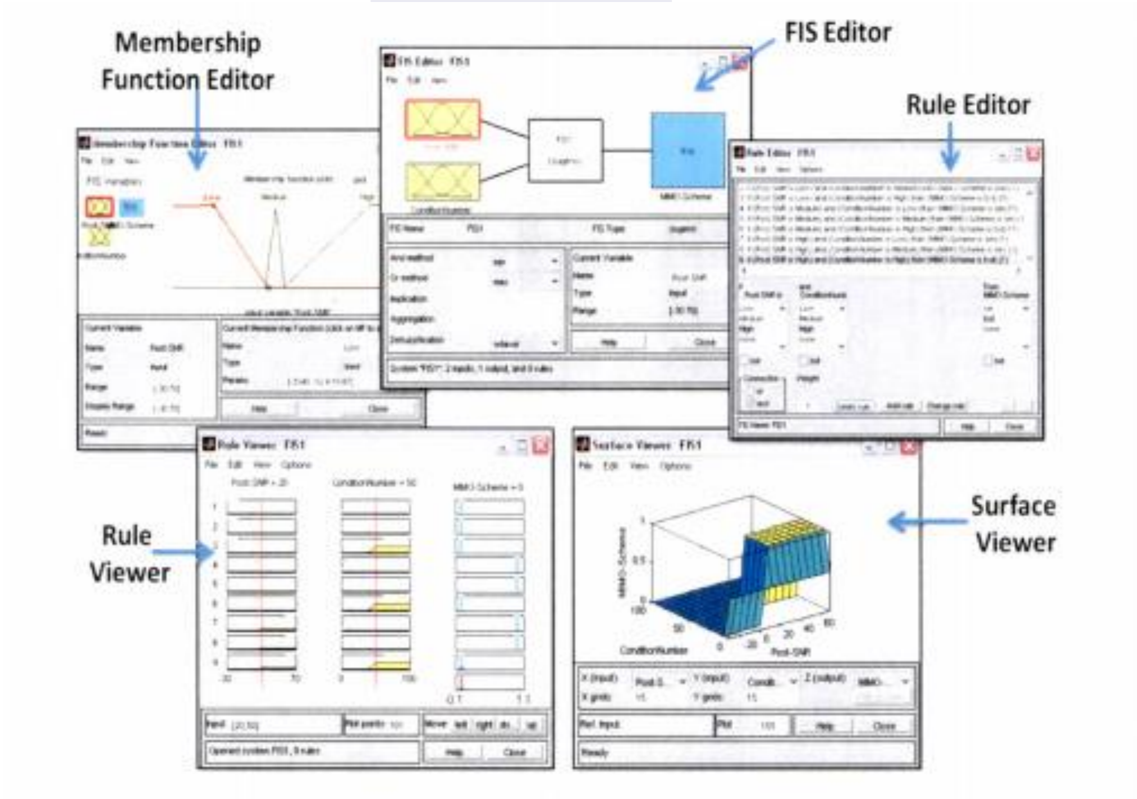
Evaluate the rules in the rule base and combine the results in rule base

Defuzzification:

Convert output data to non-fuzzy values

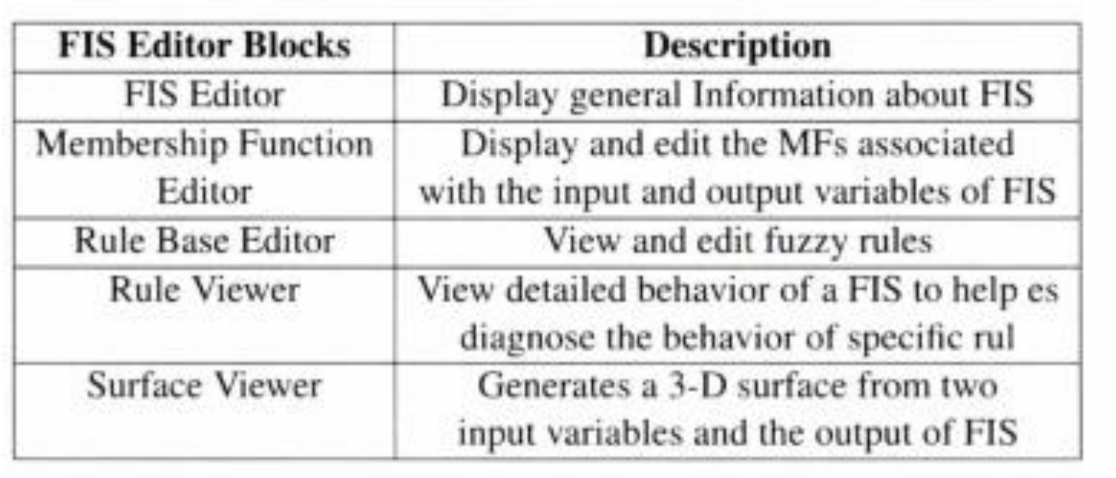
MATLAB Simulation-Fuzzy Logic Toolbox

MATLAB Simulation-Fuzzy Logic Toolbox The Fuzzy Logic Systems can be designed and simulated using MATLAB Fuzzy Logic Toolbox. The Fuzzy Logic Toolbox, provides functions and GUI based editors for building Fuzzy Inference System (FIS).



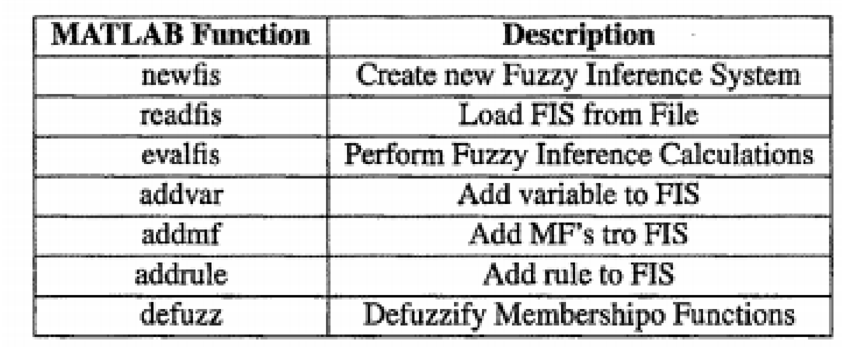
Fuzzy Inference System Editors and Viewers

List of FIS Editor Blocks and description



FIS Editor Blocks	Description
FIS Editor	Display general Information about FIS
Membership Function Editor	Display and edit the MFs associated with the input and output variables of FIS
Rule Base Editor	View and edit fuzzy rules
Rule Viewer	View detailed behavior of a FIS to help es diagnose the behavior of specific rul
Surface Viewer	Generates a 3-D surface from two input variables and the output of FIS

List of MATLAB Functions for Designing FIS

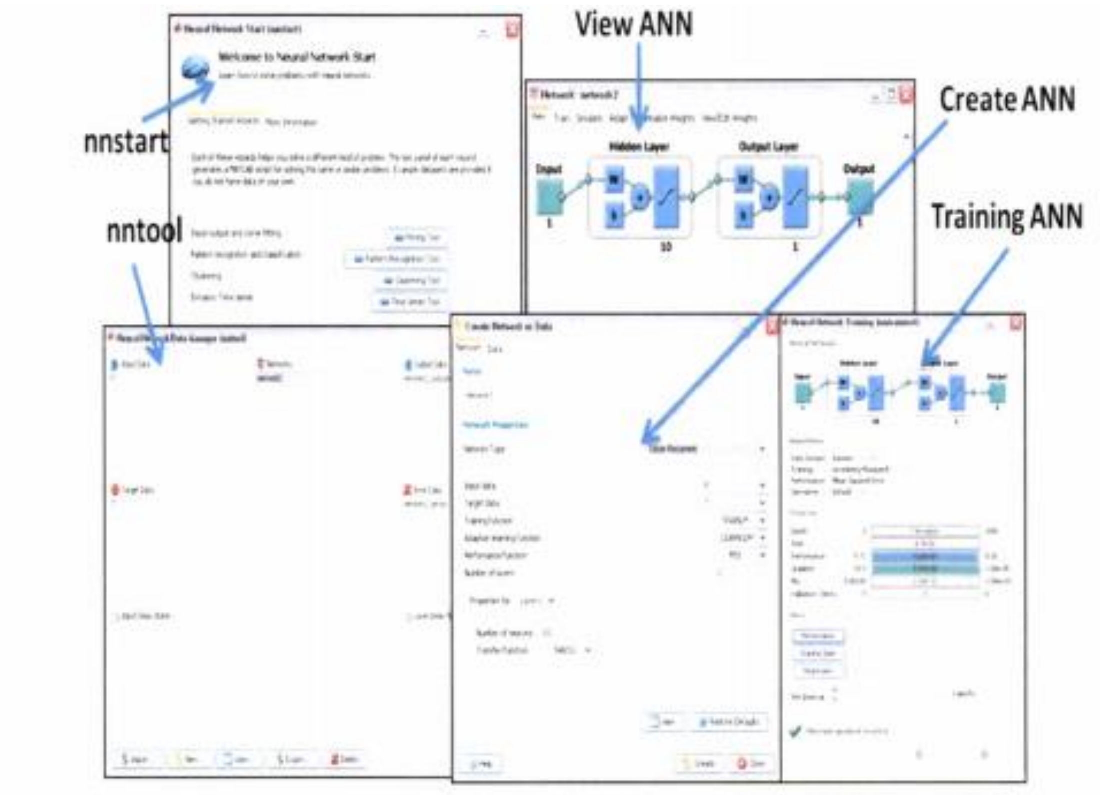


MATLAB Function	Description
newfis	Create new Fuzzy Inference System
readfis	Load FIS from File
evalfis	Perform Fuzzy Inference Calculations
addvar	Add variable to FIS
addmf	Add MF's tro FIS
addrule	Add rule to FIS
defuzz	Defuzzify Membershipo Functions

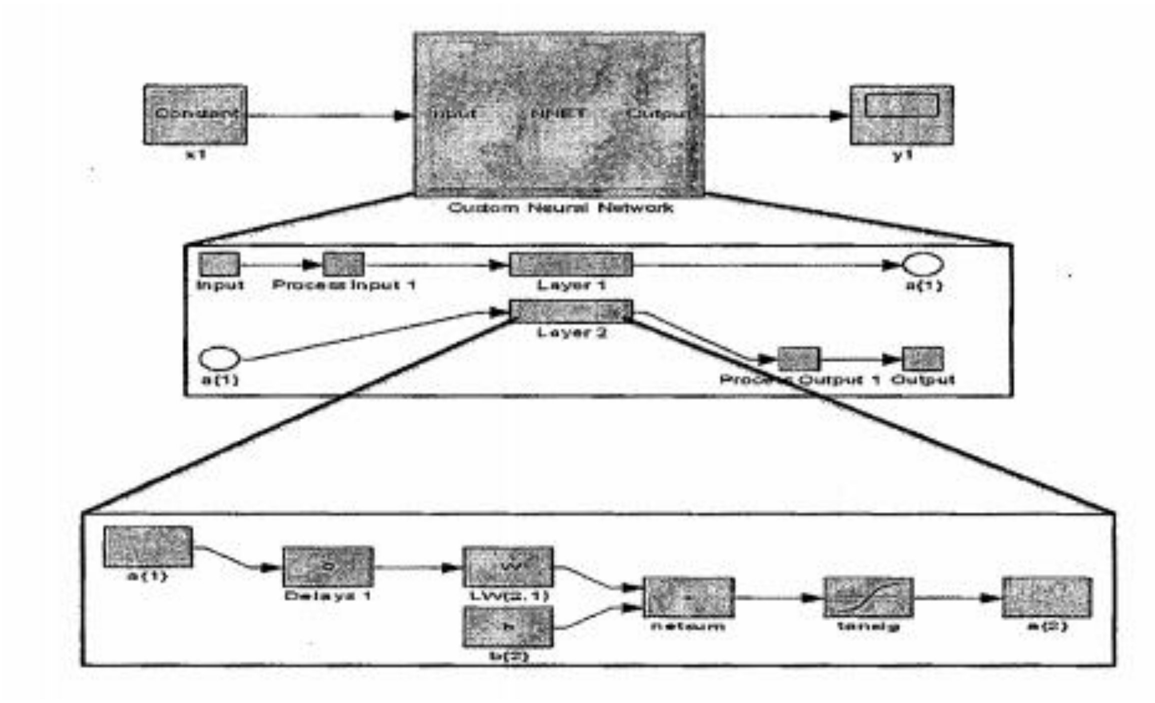
Designing Neural Network

1. Collection of data
2. Designing the network
3. Training the network
4. Testing the network

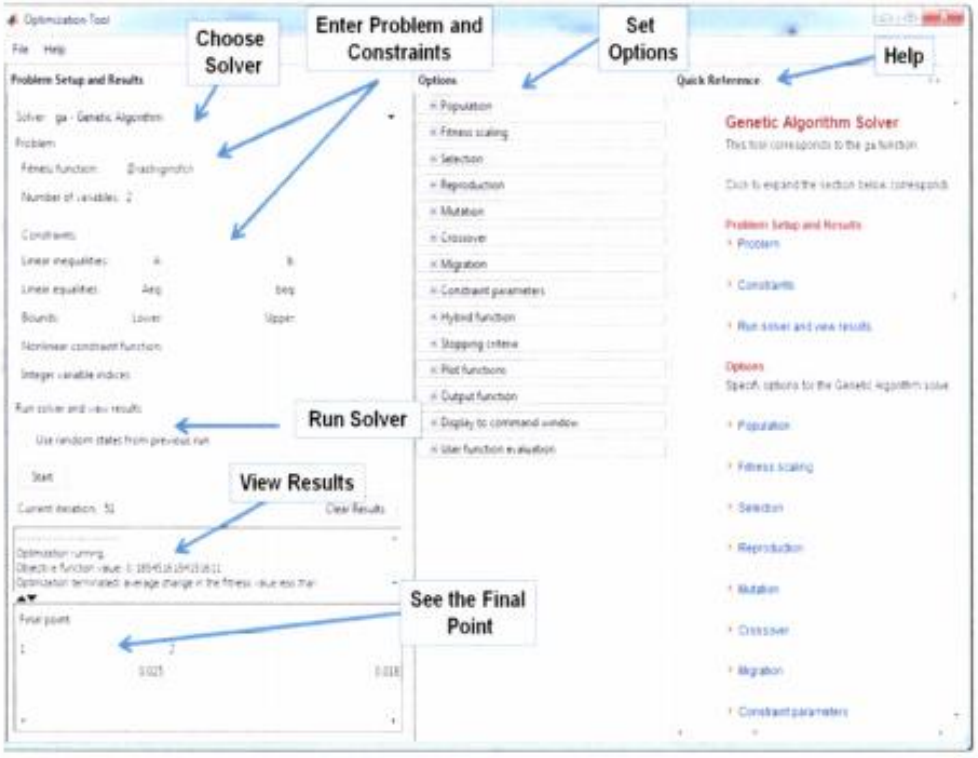
MATLAB Simulation: Neural Network Toolbox



Neural Network Simulink model



MATLAB Simulation: Global Optimization Toolbox



Choose Solver

Enter Problem and Constraints

Set Options

Help

Run Solver

View Results

See the Final Point

Solver: ga - Genetic Algorithm

Fitness function: @rastriginsfcn

Number of variables: 2

Current iteration: 51

Optimization running.
Objective function value: 0.18545181854151611
Optimization terminated: average change in the fitness value less than

Final point:

1	2
0.025	0.018

Genetic Algorithm Solver

This tool corresponds to the ga function.

Click to expand the section below corresponds

Specify options for the Genetic Algorithm solve

MULTIPLE CHOICE QUESTION

1. What is the output of the following code?

A=[0 0 0; 0 9 0; 1 2 3]; nnz[A]

a) 4

b) 5

c) 3

d) Error

2. What is the output of the following code?

A=[1 2 3; 32 23 26; 0 0 0]; spones(A)

a) Returns a sparse matrix with the non-zeros replaced by normally distributed random numbers

b) Returns a sparse matrix with the zeros replaced by ones

c) Returns a sparse matrix with the non-zeros replaced by fractions

d) Returns a sparse matrix with the non-zeros replaced by random numbers

3. The space located for the matrix generated from the spones command is _______

a) Same as a sparse matrix

b) Same as the original matrix

c) Same as an identity matrix

d) Double that of the sparse matrix

4. What is the output of the following code?

A=[1 2 3; 4 5 6; 7 8 9];if(nzmax(A)==nzmax(spones(A)) disp(‘Yeah !’)

a) No output

b) Error

c) Yeah !

d) Output suppressed

5. What is the output of the following code?

nnz(spconvert([1 2 3; 4 5 6; 7 8 9])

a) 3

b) 2

c) 1

d) 6

MULTIPLE CHOICE QUESTION

6. What is the output of the following code?

nzmax(spconvert([1 2 3; 4 5 6; 7 8 9])

a) 2

b) 3

c) 1

d) Error

View Answer

7. A memory for sparse matrix is dedicated by the _______ command.

a) spalloc

b) sparsealloc

c) allocspar

d) no such command

8. What is the output of the following command?

spalloc(2,3, 7)

a) A 2*3 sparse matrix

b) Memory is allocated for a 2*3 sparse matrix

c) A 3*2 sparse matrix

d) Error

9. The default number of non-zero elements which can be put into the memory allocated by the spalloc command is > 1.

a) True

b) False

10. The pattern generated by the spy command is a measure of the number of zeros in the input matrix.

a) True

b) False

MULTIPLE CHOICE QUESTION

1. How can we smoothen the following graph of sin (t) and cos (t) into a circle?

a) reduce the gap between linearly spaced elements of the dependent variable t

b) reduce the gap between elements of the dependent variable t

c) increase the gap between linearly spaced elements of the dependent variable t

d) increase the gap between elements of the dependent variable t

2. Which command gives a title to the graph plotted by MATLAB?

a) plot() generates the title itself

b) title()

c) hlabel()

d) heading()

3. Which command enables a title for the x-axis?

a) xlabel()

b) horilabel()

c) xlabel[]

d) no command

4. Which command enables a title for the y-axis?

a) vertlabel()

b) ylabel()

c) ylabel[]

d) no command

5. How can several graphs for the same function be plotted on the same window?

a) Contour plots

b) Bode plots

c) 3-D plots

d) n-D plots

MULTIPLE CHOICE QUESTION

6. What is the output of the following command?

meshgrid [x,y]

a) two x*y matrices

b) one x*y matrix

c) one y*x matrix

d) error

7. What is the output of the following code?

t=0:0.001*pi:pi/2; plot(t,sin(t),*);

a) An inverted sine curve

b) A sine curve

c) A point

d) Error

8. What is the slope of the sawtooth waveform generated by the sawtooth command?

a) 1/pi

b) pi

c) 1/(2*pi)

d) 2*pi

9. What is the period of the sawtooth() waveform which is generated by the sawtooth() command?

a) 2*pi

b) pi*2

c) pi

d) 3*pi/2

10. The command used to generate an array of arrows is ________

a) quiver[]

b) arrows()

c) quiver()

d) arrows[]

MULTIPLE CHOICE QUESTION

11. What is the output of the following code?

t=0:.001*pi:2*pi; plot(cos(t),sin(t))

a) A circle

b) A straight line

c) A unit circle

d) A sinusoid

12. The period of sinusoidal curves can be changed in MATLAB.

a) True

b) False

13. The command to draw the nature of a function over a default fundamental period is _________

a) ezplot()

b) plot()

c) stem()

d) plot3()

14. In the following code, what is the fundamental frequency of the sawtooth command?

f=1/50; sawtooth(2*pi*1/f*t)

a) 50

b) .02

c) 100

d) Error

15. The limits of the axes drawn are only specified in the command used to plot the graph itself.

a) True

b) False

MULTIPLE CHOICE QUESTION

1. Which command is suitable to change the axes of the graph plotted?

a) axes

b) axis

c) yxaxes

d) no command

2. What is the output of the following code?

ezplot(x^2)

a) No such command

b) A parabola

c) A part of a parabola

d) Error

3. Which command can be used to generate multiple graphs in the same window?

a) hold on

b) wait

c) not possible without contour command

d) not possible

4. Inline functions can be plotted by the __________ command.

a) ezplot()

b) plot3()

c) plot()

d) cannot be done

5. Which toolbox provides the plot command?

a) Symbolic Maths Toolbox

b) Signal Processing Toolbox

c) Engineering Toolbox

d) Functions

REFERENCES

❑https://www.javatpoint.com/artificial-neural-network-hopfield-network

❑https://www.geeksforgeeks.org/traveling-salesman-problem-using-genetic-algorithm/