Fuzzy Logic Toolbox

Analysis and Design

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Matlab Fuzzy Toolbox

- Matlab Fuzzy Toolbox consist of two useful tools:
  - FIS Editor:

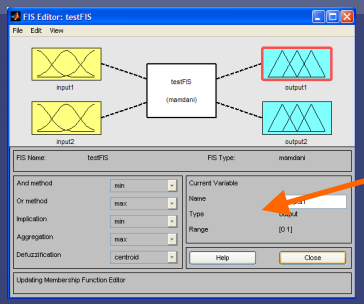
    This Editor in combination with 4 other editors provides a powerful environment to define and modify Fuzzy Inference System (FIS) variable

  - Fuzzy Controller:

    This is a block in fuzzy Toolbox Library in Simulink environment. This block admits FIS variable produced by FIS Editor and implements the desirable rules

Fuzzy Inference System

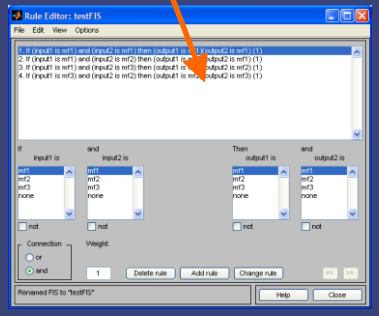
FIS Editor



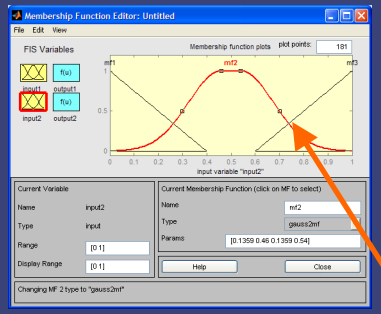
IF-THEN rules
Define/Modify

Change and Modify
Inference Settings

Rule Editor



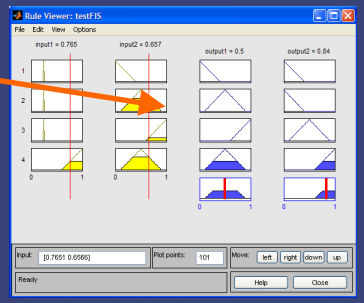
Membership Function Editor



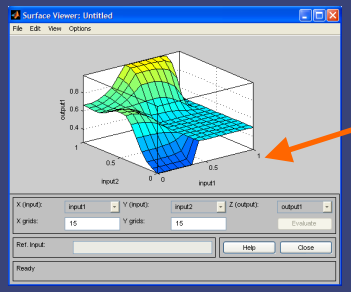
Fuzzy Inference System

Modifying Input/Output
Membership functions

Easy test for
Input/Output
Relationship



Rule Viewer



Surface Viewer

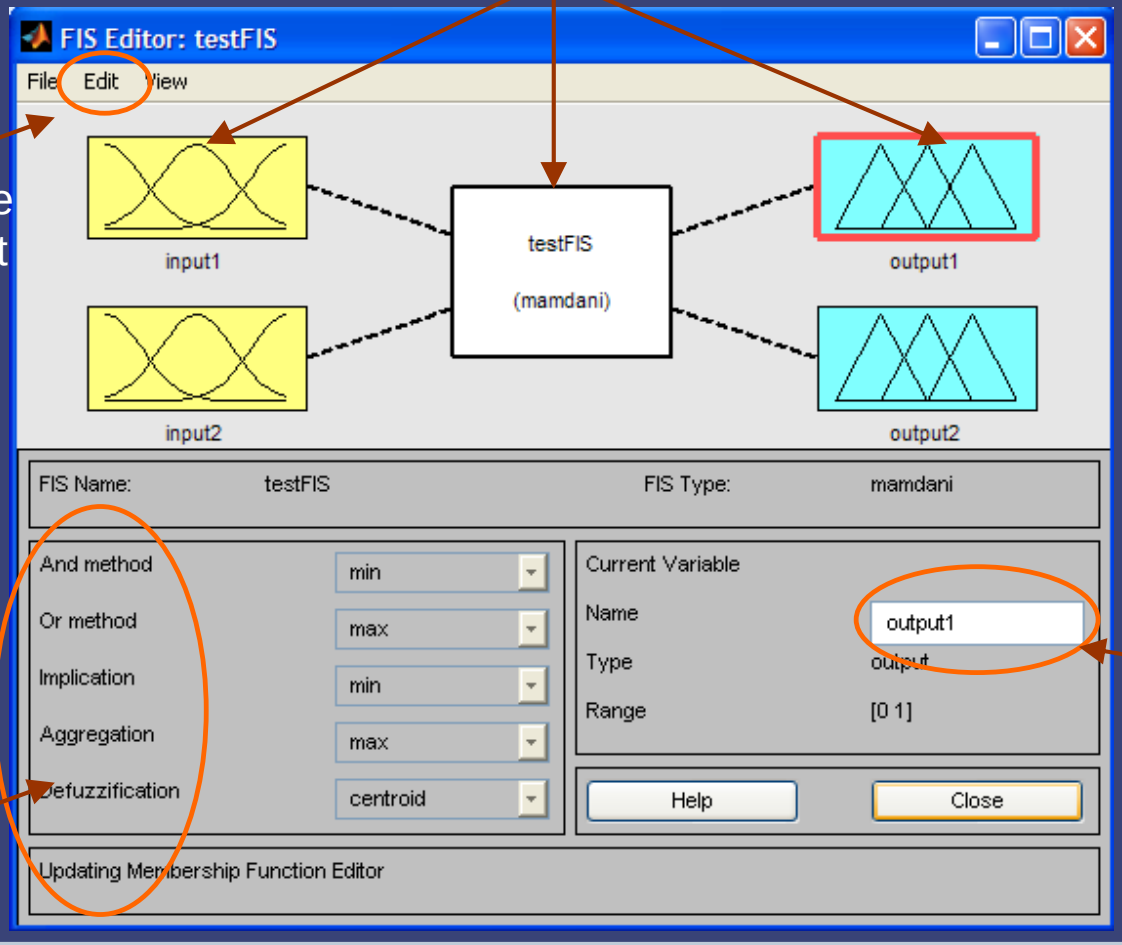
Visualization of
Membership Func.
in 2 input system

FIS Diagram

- To implement a Fuzzy inference system, five steps must be followed:

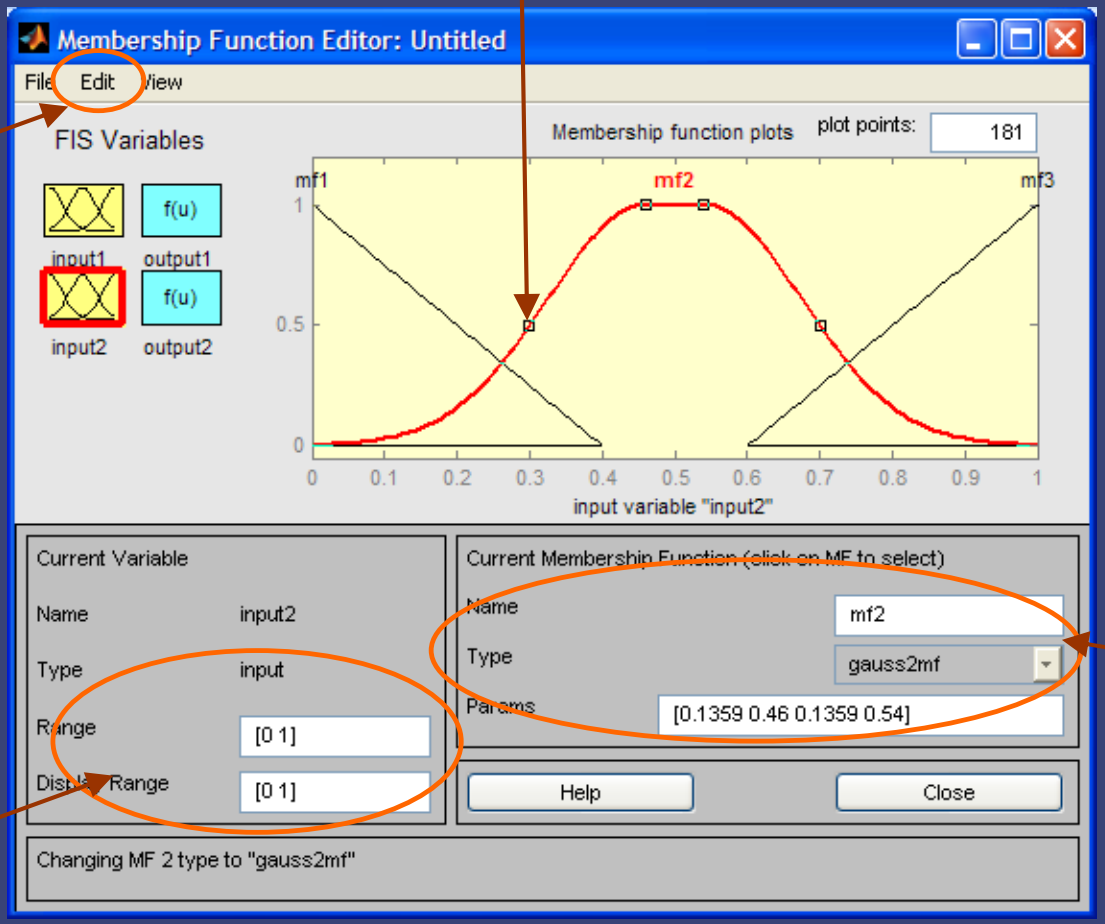
1. Fuzzyfication using input membership functions
2. Apply Fuzzy Operand
3. Apply Implication method on each rule
4. Aggregate all Outputs
5. Defuzzification of output set

FIS Editor


Double click to load other Editors
Add or Remove Input or Output
Set or Modify Inference settings
Change name of Input or Output
FIS Editor: testFIS
File
Edit
View
input1
input2
testFIS
(mamdani)
output1
output2
FIS Name:
testFIS
FIS Type:
mamdani
And method
min
Or method
max
Implication
min
Aggregation
max
Defuzzification
centroid
Current Variable
Name
output1
Type
output
Range
[0 1]
Help
Close
Updating Membership Function Editor

Membership Function Editor

Change parameter by dragging and scrolling

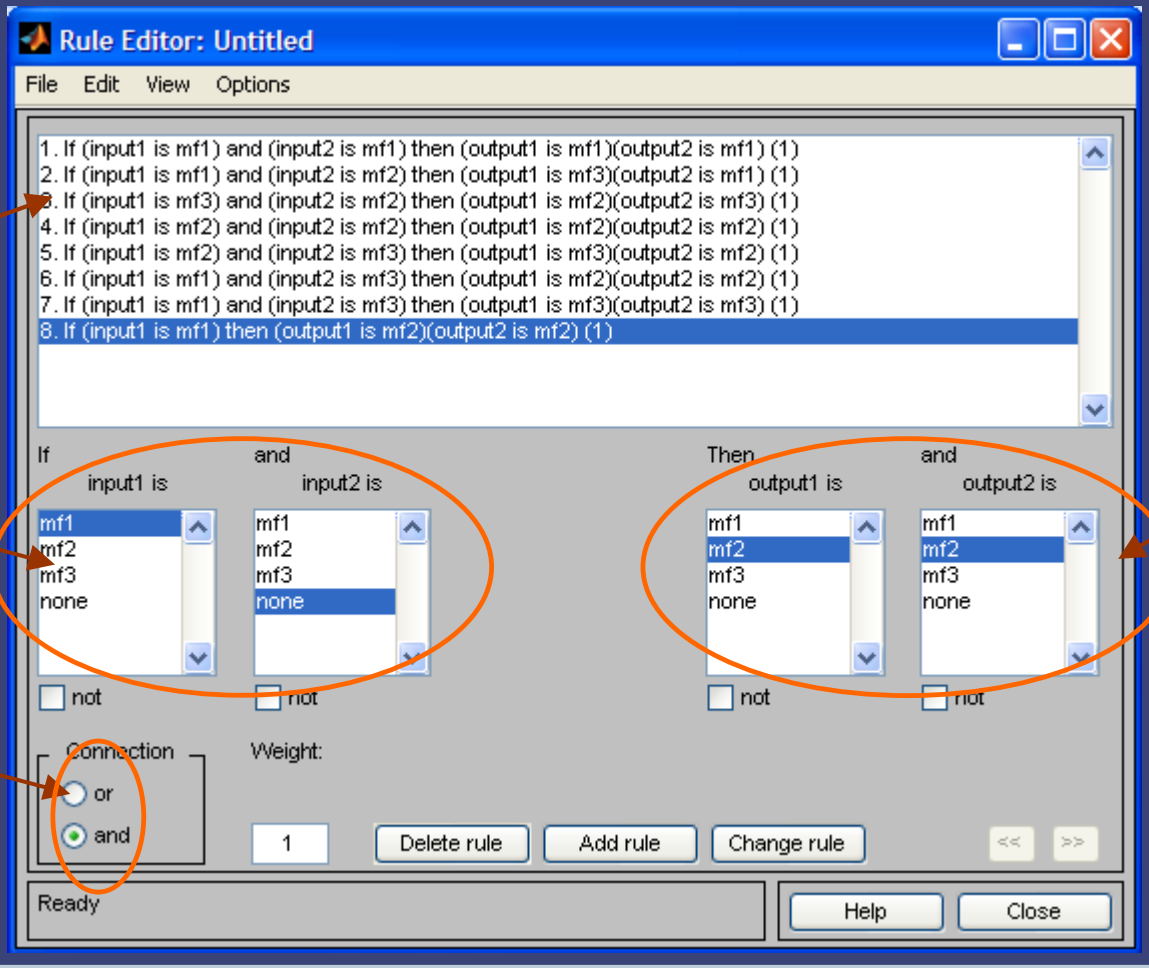


Add or Remove Membership Functions to or from any Input ou Output

Change Input or Output range

Set Membership Function parameters manually

Rule Editor



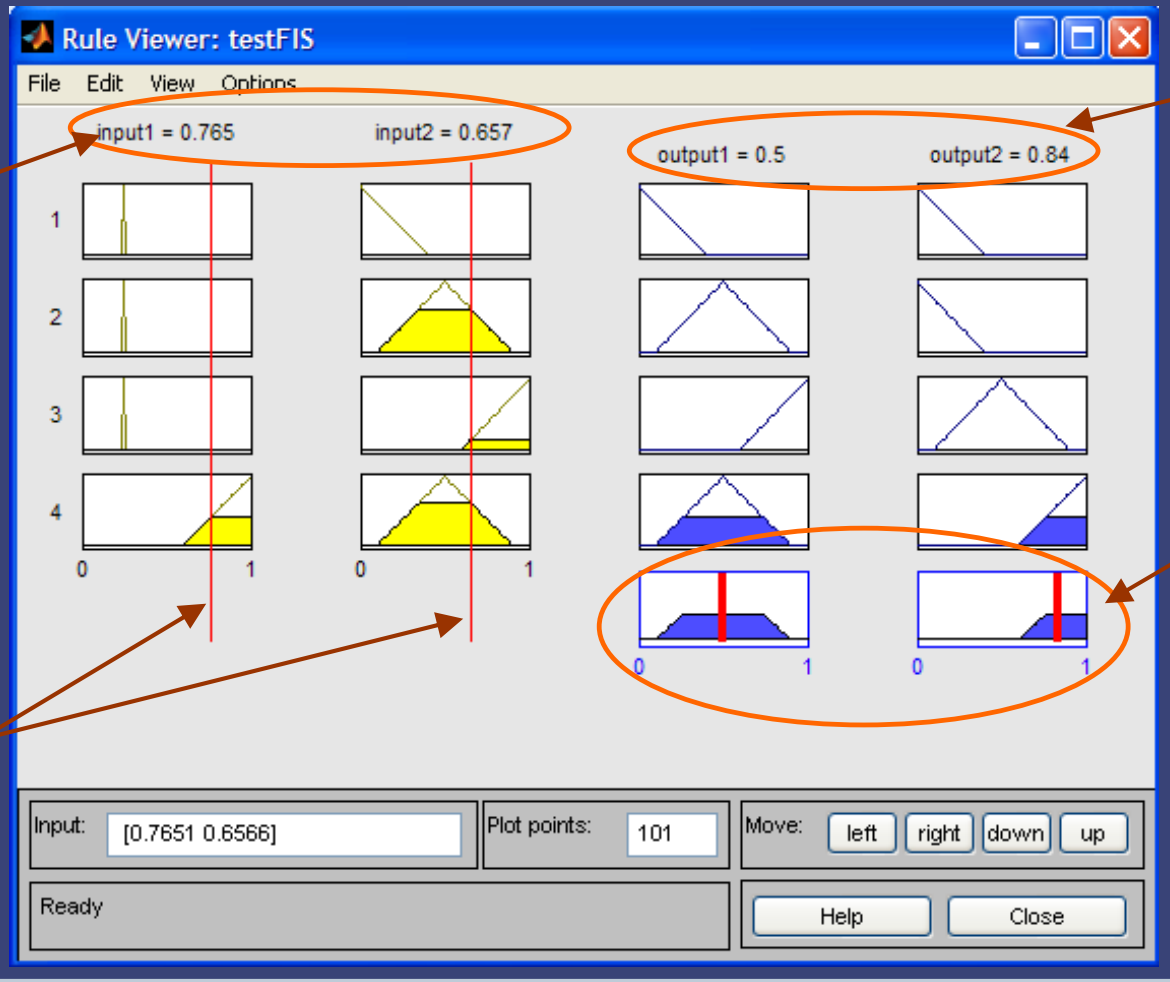
Rule List

Intputs Membership Functions

Connectors

Outputs Membership Functions

Rule Viewer



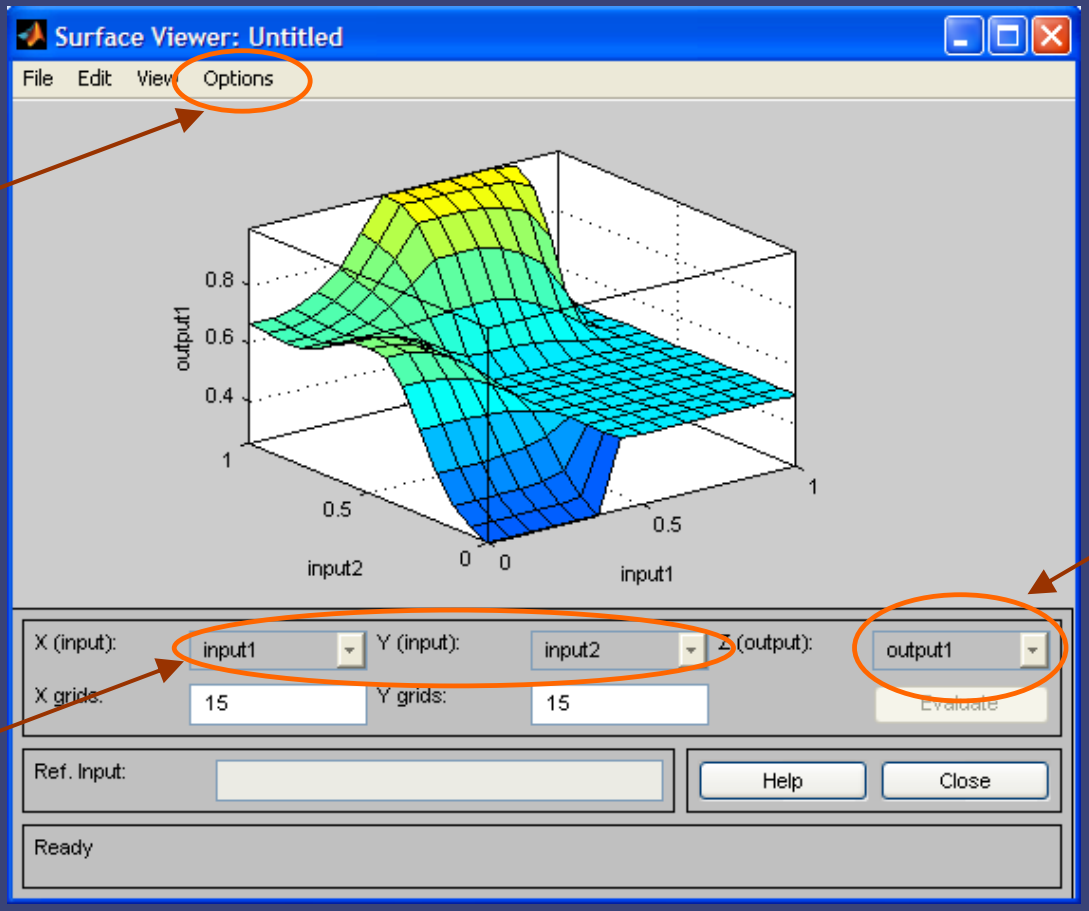
Input Values

Output Values

Output Sets

Scroll to Change Input Values

Surface Viewer



Change surface view settings

Input selector

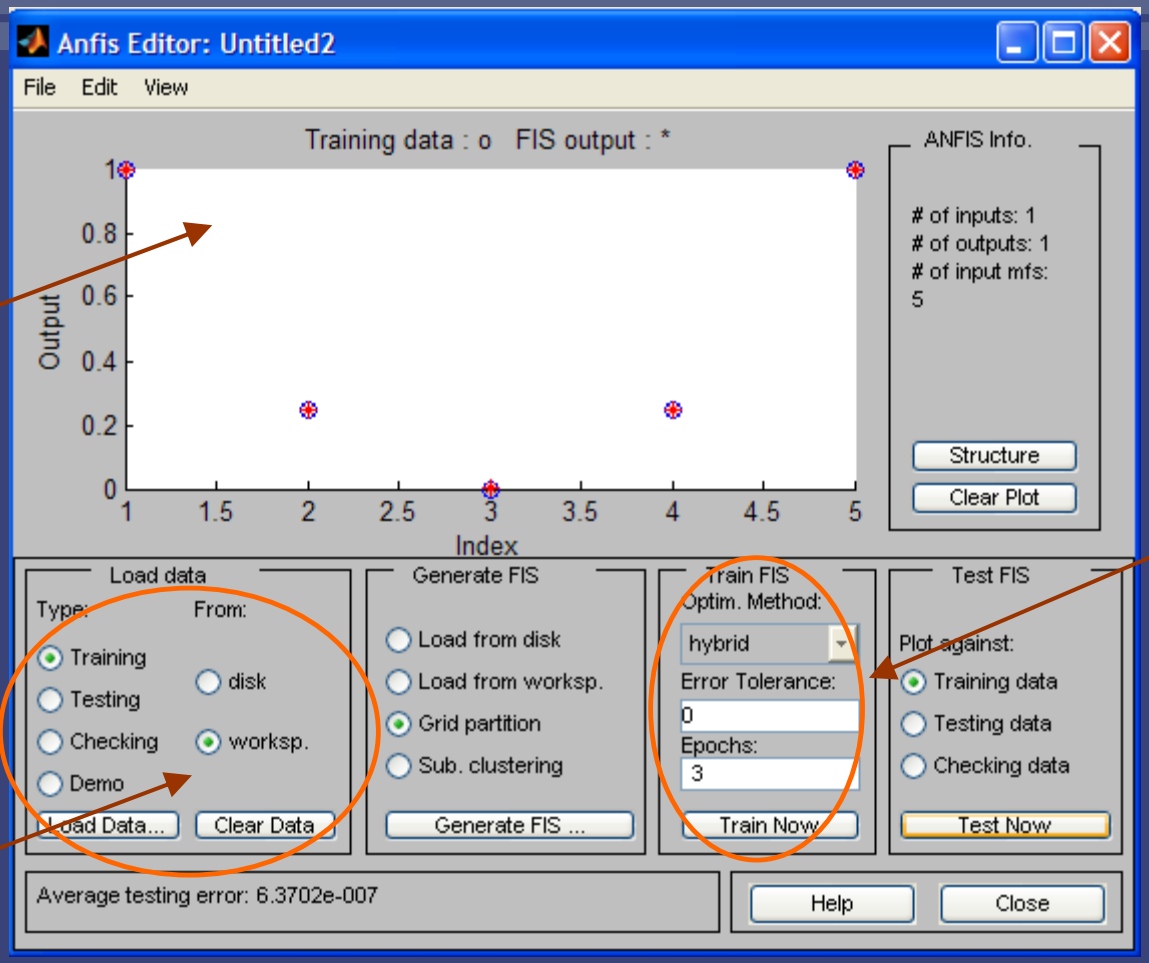
Output Selector

FIS Editor Benefits

- Easily Define and modify a Fuzzy system
  - Simply Add or Remove Inputs and/or Outputs
  - Set or modify Inference methods
  - Simply Add or Remove Membership functions and easy management of function's parameters
  - Easy Rule definition and modification
  - Great Visualization area for FIS Diagram
  - 2-D visualization of Inference for any Input pairs to any Output
- Offers two Inference Engines
  - Mandani
  - Sugeno in which rule syntaxes became:

$$R^k : \textbf{If } \mathbf{x} \text{ is } A^k \textbf{ then } y = c^k, \quad k = 1, 2, \ldots, K$$

ANFIS Editor



Input Data and Trained results

Training Parameters

Data to be loaded