Expert System Labwork

Fuzzy Logic Toolbox in MATLAB

Chapter #10

Example

▸ We want to buid FIS Mamdani, with this rules :

▸ 1. If the service is poor or the food is rancid, then tip is cheap.

▸ 2. If the service is good, then tip is average.

▸ 3. If the service is excellent or the food is delicious, then tip is generous.

How to run it?

▸ Run Matlab

▸ Type **fuzzy** in command window, then push **enter** in your keyboard
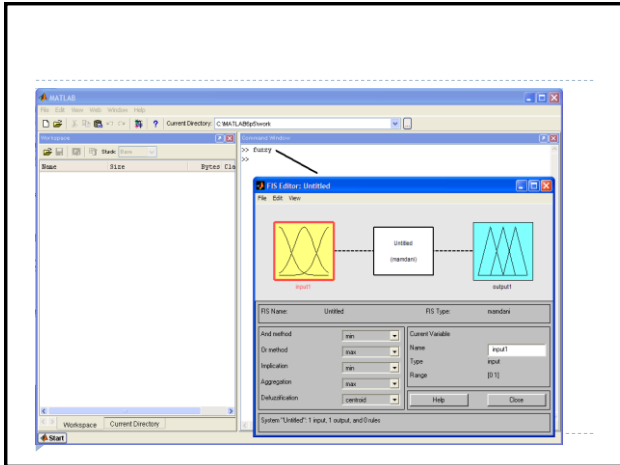
How to build new FIS Mamdani?

▸ Select **New Fis** > **Mamdani** in the **File** menu
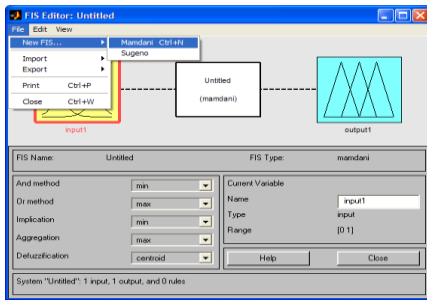
Add input variable

▸ Select **Add variable… -> Input** from the **Edit** menu
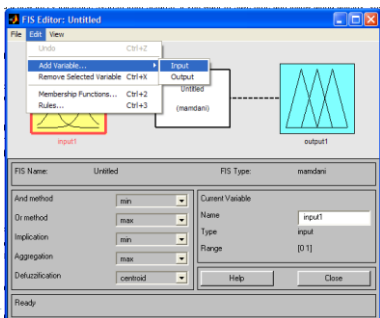
Result of Input with 2
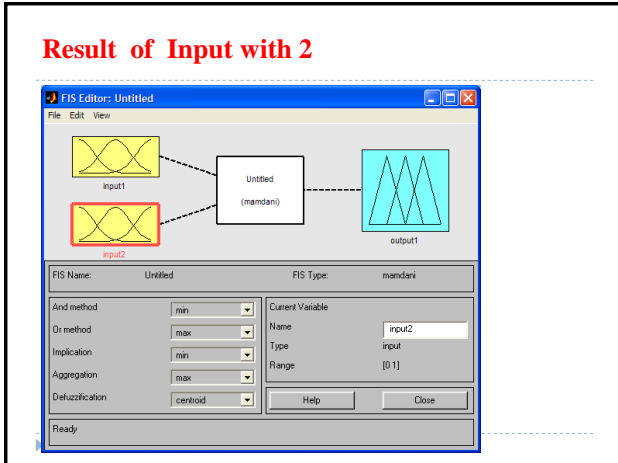
Change input and output name

- Click once on the box (yellow) on the left marked **input1** (the box will be highlighted in red).
- In the white edit field on the right, change **input1** to **service** and press **Enter**.
- Click once on the box (yellow) marked **input2** (the box will be highlighted in red).
- In the white edit field on the right, change **input2** to food and press **Enter**.
- Click once on the box (blue) on the right marked **output1**.
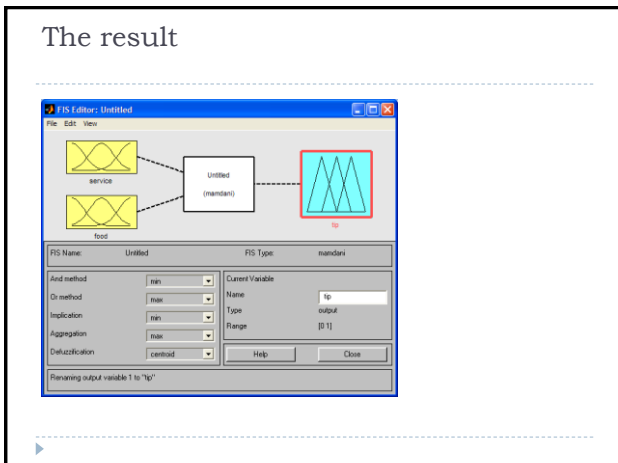- In the white edit field on the right, change **output1** to **tip** and press **Enter**.

The result

Export to Matlab workspace

▸ From the File menu, select Export and then To Workspace…
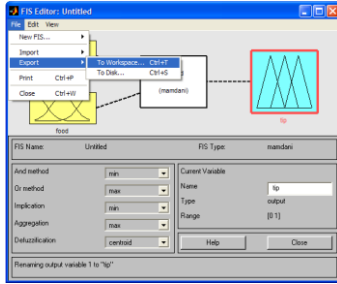
▸ Put the FIS name in the box

▸ Then push **OK**
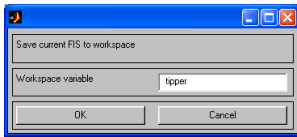
Define the membership function

▸ Open the Membership Function Editor by Select **Membership function..** From the **Edit** menu

▸ Or push **Ctrl+2** in your keyboard

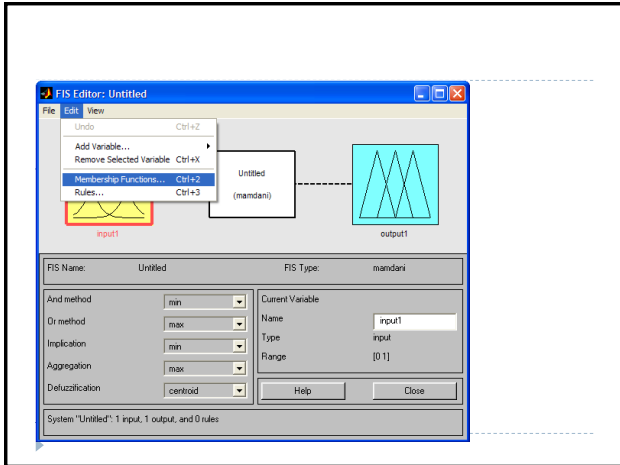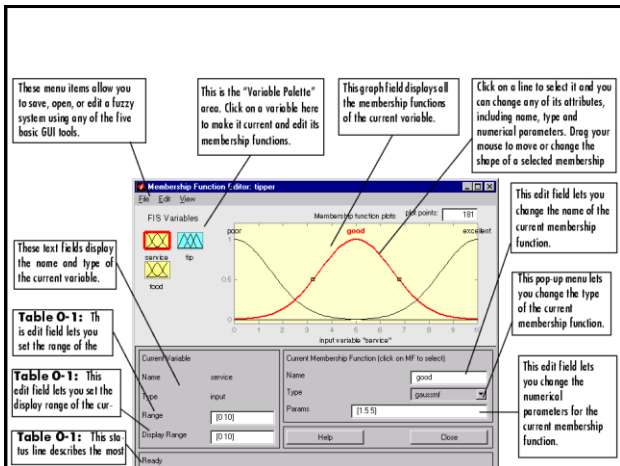- Select the input variable, **service**, by double-clicking on it.

- Set both the **Range** and the **Display Range** to the vector [0 10].

- Select **Add MFs...** from the **Edit** menu. The window below pops open

▶ Use the pull-down tab to choose gaussmf for MF Type and 3 for Number of MFs. This adds three Gaussian curves to the input variable service.
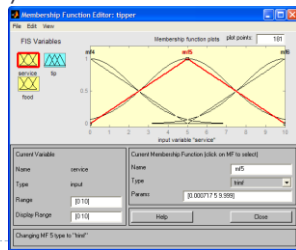
▶

▶ Delete another MF, that will not be used (the trimf), by

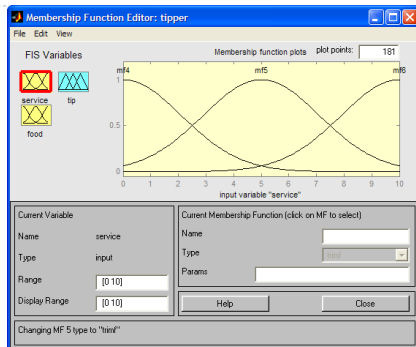 ▶ Select it

  ▶ Push **Delete** in your keyboard

▶

Result

▶

Customize Membership Function

- Click once on the curve with the leftmost hump. Change the name of the curve to **poor**.
- To adjust the shape of the membership function, type in a desired parameter change, and then click on the membership function. The default parameter listing for this curve is [1.5 0].
- Name the curve with the middle hump, **good**, and the curve with the rightmost hump, **excellent**. Reset the associated parameters if desired.

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Customize Membership Function

- Select the input variable, **food**, by clicking on it. Set both the Range and the Display Range to the vector [0 10].
- Select **Add MFs...** from the **Edit** menu and add two **trapmf** curves to the input variable **food**.
- Delete another MF, that will not be used (the trimf)
- Click once directly on the curve with the leftmost trapezoid. Change the name of the curve to **rancid**.
- To adjust the shape of the membership function, type in a desired parameter change, and then click on the membership function. The default parameter listing for this curve is [0 0 1 3].
- Name the curve with the rightmost trapezoid, **delicious**, and reset the associated parameters if desired.

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Create the membership functions for the output variable (tip)

- To create the output variable membership functions, use the Variable Palette on the left, selecting the output variable, **tip**.
- The inputs ranged from 0 to 10, but the output scale is going to be a tip between **5 and 25** percent.
- Use triangular membership function types (trimf) for the output.
- First, set the **Range (and the Display Range) to [0 30]**, to cover the output range.
- Initially, the **cheap** membership function will have the parameters [0 5 10], the **average** membership function will be [10 15 20], and the **generous** membership function will be [20 25 30].

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Adding rule

Insert all rules

▸ Example ,To insert the first rule in the Rule Editor, select the following:

▸ **poor** under the variable **service**

▸ **rancid** under the variable **food**

▸ The **or** radio button, in the Connection block

▸ And select **cheap**, under the output variable, **tip**.

▸ Click **Close** to finish

Testing or view the rule
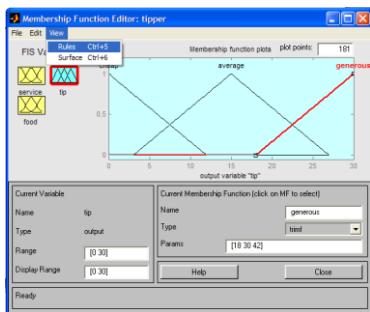
Surface view