

Fuzzy Expert Systems Lab

Job recommender

Matlab Fuzzy Toolkit

Exercise

We will continue with the construction of an expert system for evaluating jobs.

- Two input variables:
 - **Distance** (0 to 100 km): “very near”(about 10km), “near” (about 20km), “far”(about 50km), “very far”(about 80km)
 - **Salary** (700 to 4000 €): “minimum”(about 800€), “normal” (about 1300€), “good”(about 2500€), “awesome” (about 3500€)
- One output variable to measure our “interest” in a job. The output will be given in an scale from 0 to 10.

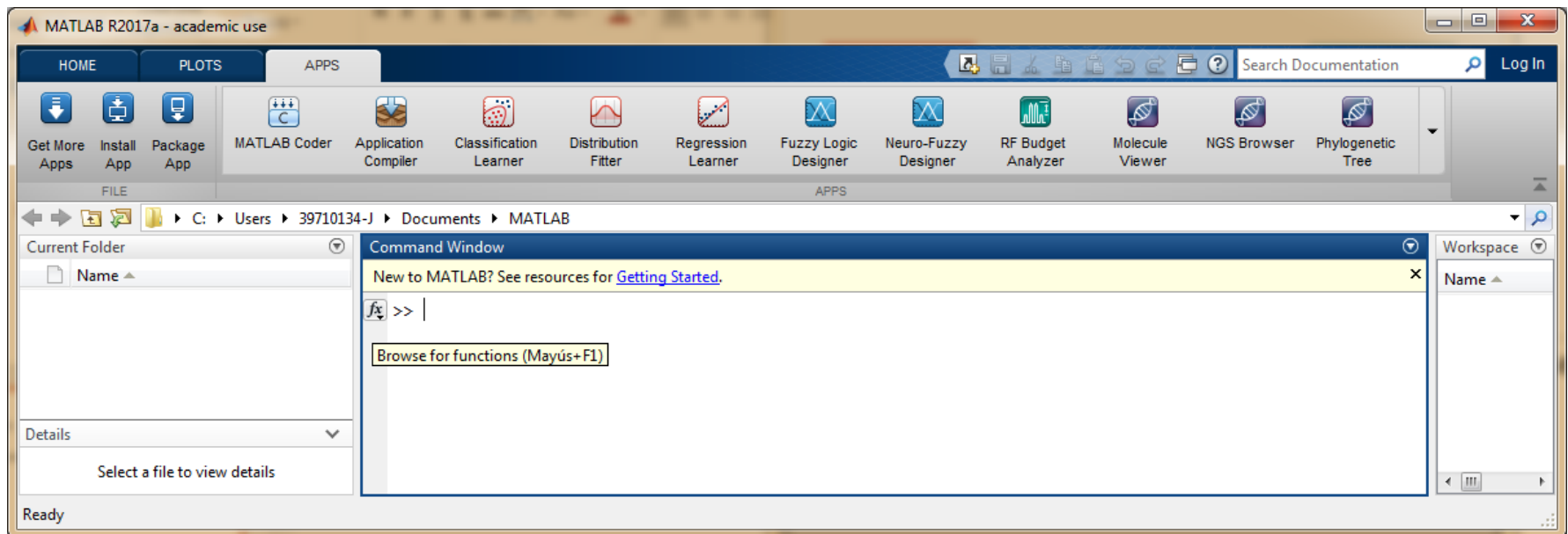
Import the file jobsExample.fis that you will find in URV virtual campus.

Exercises

1. Complete the set of rules so that all possible input linguistic values are covered.
2. Use rules with 1 or 2 premises and different weights
3. Check the new surface to verify there is no abrupt transition
4. Test the system with different cases
5. Change the defuzzification to “lom” and compare the new results with previous ones. You can also try “som”.

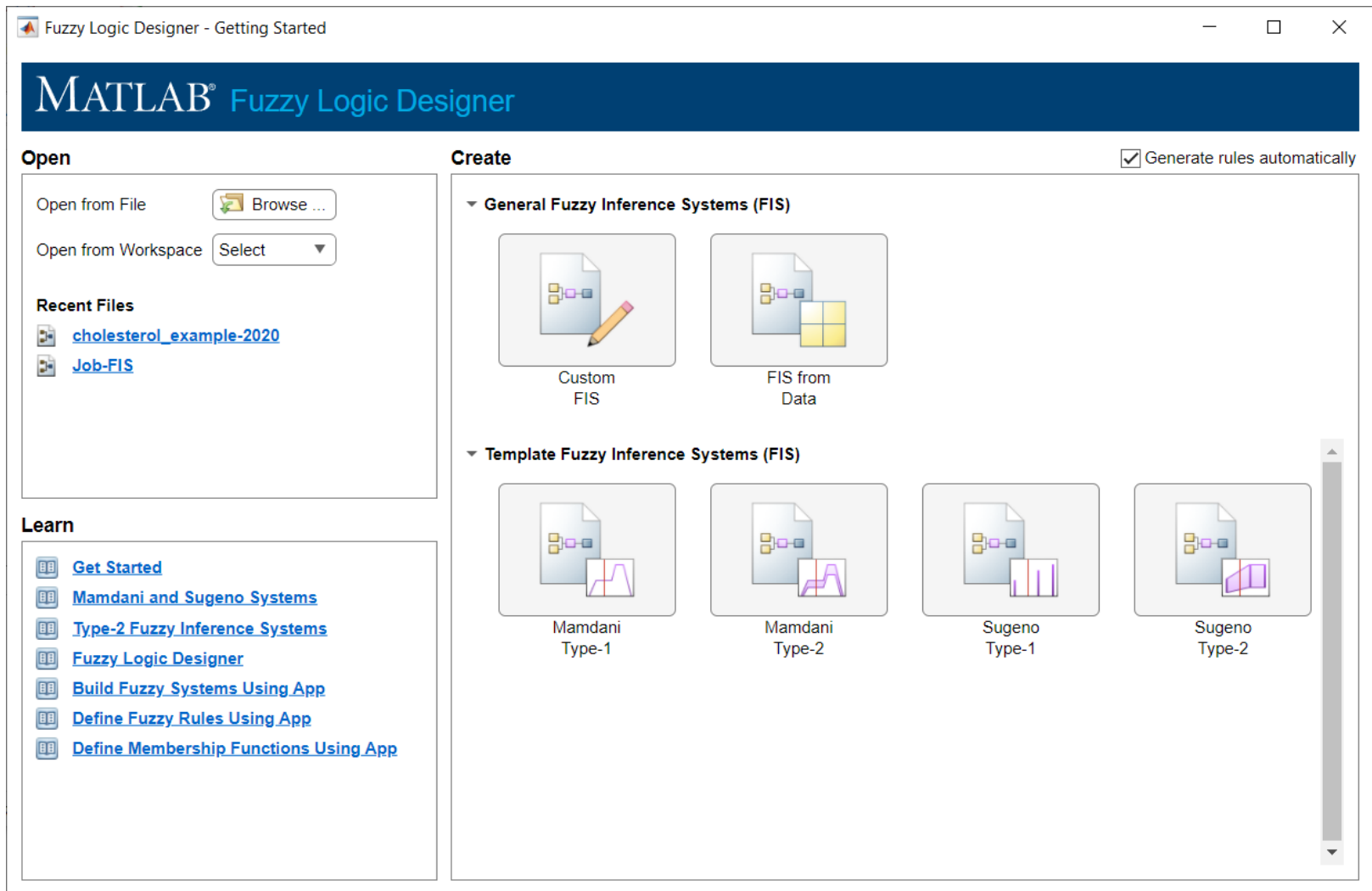
Software: Matlab version R2022b

- We will use Matlab. Apps => Fuzzy Logic Designer



Software: Matlab version R2022b

- Import from the option in the left: “open from file”



JobExample configuration: Mamdani inference

Click on the yellow or blue figures to see the configuration at right panel
Use the tabs to see the membership functions and the rules

Fuzzy Logic Designer: JobExample

DESIGN

New Save Import

Input Output Rule Add All Rules

Mamdani to Sugeno Type-1 to Type-2

Number of Samples: 101

Rule Inference Control Surface

Store Current Design Export

DESIGNS EXPORT

DESIGN BROWSER

Set Active Design

Active	Design	Type
✓	JobExample	Mamdani Type-1

SYSTEM BROWSER

JobExample

- Inputs
- Outputs
- Rules

Fuzzy Inference System (FIS) Plot

Membership Function (MF) Editor

Rule Editor

System: JobExample

distance (4 MFs)

salary (4 MFs)

Mamdani Type 1

interest (4 MFs)

System JobExample: 2 input, 1 output, 4 rules

PROPERTY EDITOR: FIS

Type: Mamdani Type-1

Name: JobExample

And method: min

Or method: max

Implication method: min

Aggregation method: max

Defuzzification method: centroid

Inputs: 2

Outputs: 1

Rules: 4

Rules

- You have 4 rules in the fuzzy expert system at the moment
- Notice that some cases are not covered by these rules (f.i. salary=low ...)
- We have rules with one premise and others with two.
- Rules have different weights.
- Add new rules with “+” button, and configure them in the right-hand panel

The screenshot displays the Fuzzy Logic Designer JobExample interface. The top menu bar includes options like New, Save, Import, Input, Output, MF, Rule, Mamdani to Sugeno, Type-1 to Type-2, Rule Inference, Control Surface, Store Current Design, and Export. The main workspace is divided into several panels:

- DESIGN BROWSER:** Shows the active design as JobExample, which is a Mamdani Type-1 system.
- SYSTEM BROWSER:** Lists the components of the system: Inputs (distance, salary), Outputs (interest), and Rules.
- Rule Editor:** A table listing the current rules. Rule 4 is selected.
- PROPERTY EDITOR: RULE:** A panel for configuring the selected rule (rule4).

The Rule Editor table is as follows:

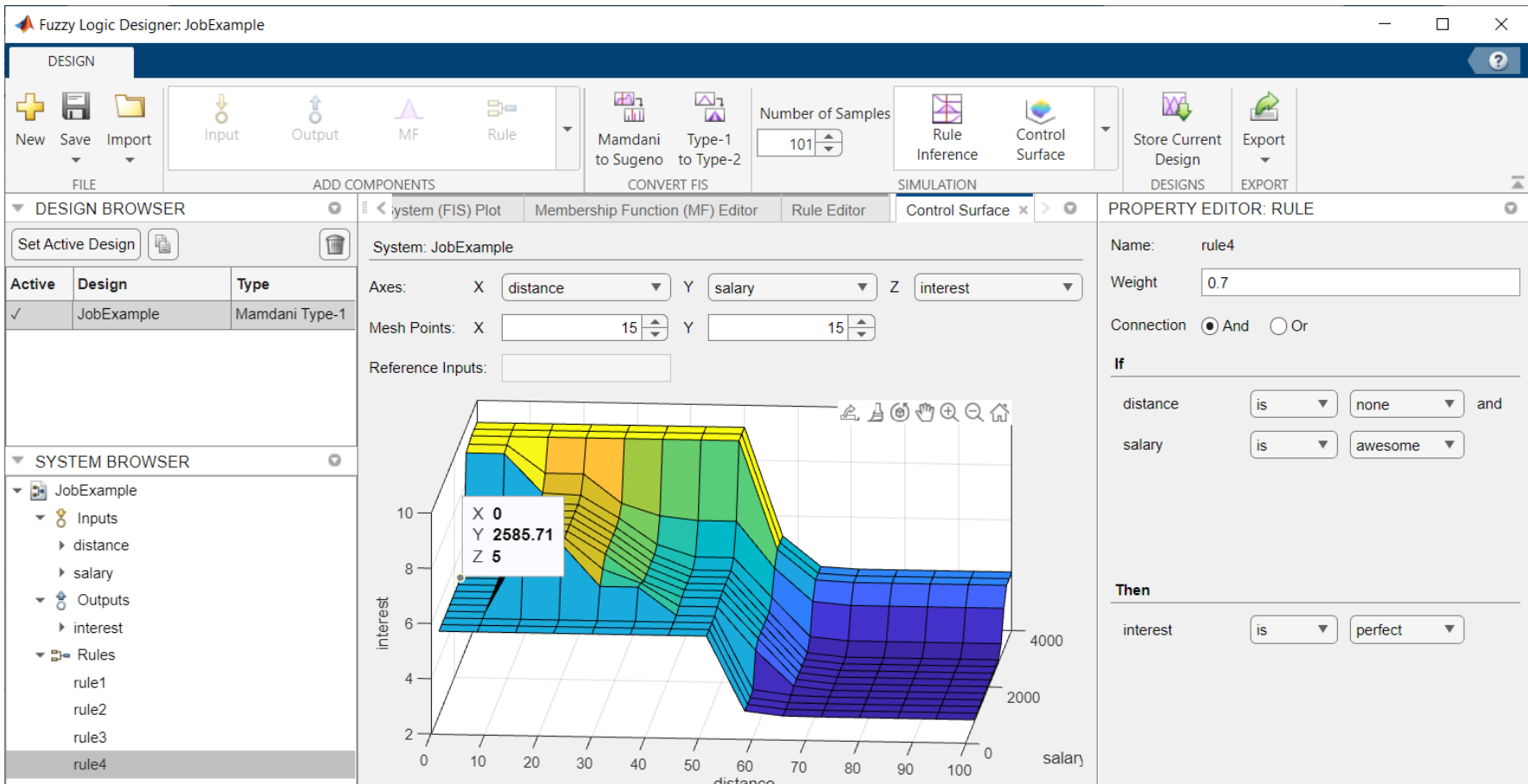
Rule	Weight	Name
1	1	rule1
2	1	rule2
3	0.7	rule3
4	0.7	rule4

The Property Editor for Rule 4 shows the following configuration:

- Name:** rule4
- Weight:** 0.7
- Connection:** And (selected)
- If:**
 - distance is none
 - salary is awesome
- Then:** interest is perfect

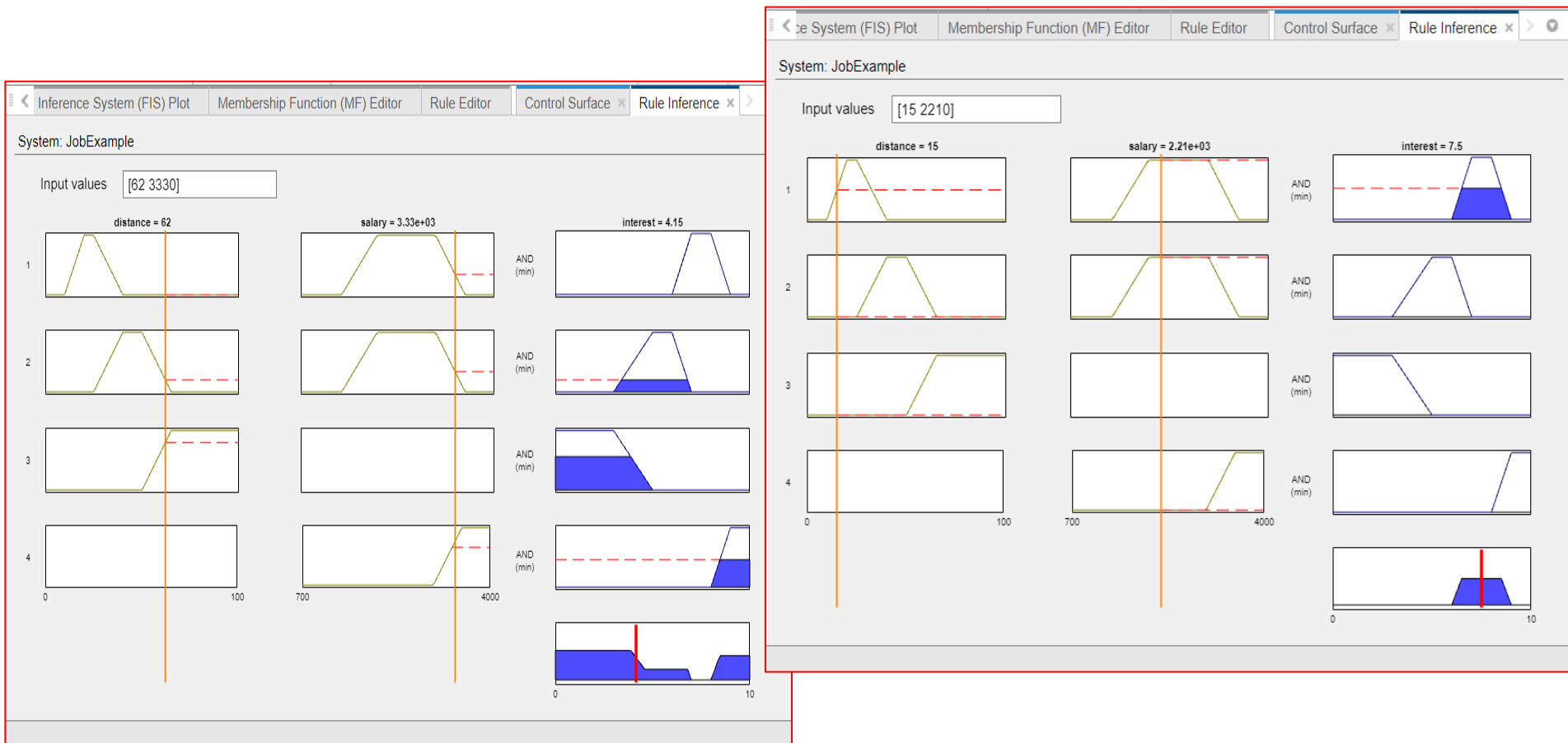
Surface display of the rules

- Use the button Control Surface for a display in 3D. If some values do not have a rule, they are mapped to near value by interpolation. See for example the distances 0 (low) at left, with a too low value and crisp change.
- You can use the mouse to rotate the surface graphic to another view direction



FES execution

- Use button Rule Inference
- You can type the numerical input values at the top or move the red bar



3 rules are activated. Last one with 0.7 of weight

Only first rule is activated