

BEST STUDENT PERFORMANCE

Implement FIS (Fuzzy Inference System) using MATLAB fuzzy logic toolbox and evaluate the performance of a student. The goal is to find the overall performance of the student. The evaluation criteria are based on the following three input parameters. The output of the system is the performance score of a given student in range [0, 10].

Inputs:

- Academics: Performance in academics are measured by CGPA (scale 0-10)
- Sports: Total number of games won or participated (scale 0-10)
- Co-curricular activities: the number of certificates (participation and winning certificate in the range of 0 to 10).

Outputs:

- Performance: score of a given student in range [0, 10] inferred based on a set of rules.

INPUT VARIABLES

1. Academics: Performance in academics are measured by CGPA (scale 0-10)

Range[0, 10]

Linguistic Variables:

POOR – Membership function : Pi-shaped [0, 2.2, 3.5, 4.4]

AVG - Membership function : Pi-shaped [4.3, 5, 6.3, 6.9] GOOD - Membership function : Pi-shaped [6.1, 6.7, 7.7, 8.9]

EXCELLENT - Membership function : Pi-shaped [8.3, 9.5, 10, 10]

2. Sports: Total number of games won or participated

Range[0, 10]

Linguistic Variables:

POOR - Membership function : Generalised Bell-shaped [2.1, 2.5, -1.38e-16]

AVG - Membership function : Pi-shaped [1.25, 4.6, 5.4, 8.75]

GOOD - Membership function : S-shaped [6.25, 9.583]

3. CCA (Co-curricular activities): number of certificates (participation and winning certificate)

Range [0, 10]

Linguistic Variables:

POOR - Membership function : Gaussian [1.769, 1.2]

AVG - Membership function : Gaussian [1.769, 5]

GOOD - Membership function : Pi-shaped [6.25 9.6 10.45 10.75]

OUTPUT VARIABLES

1. Performance:

Range [0,10]

Linguistic Variables:

POOR - Membership function : Triangular shaped [0, 2.4, 4]

AVG - Membership function : Pi-shaped [3.8, 4, 6, 7]

GOOD - Membership function : Pi-shaped [6.6, 7.2, 7.5, 8.4]

EXCELLENT - Membership function : Pi-shaped [7.5, 8.2, 10, 10]

FIS CODE:

```
[System]
Name='best_student'
Type='mamdani'
Version=2.0
NumInputs=3
NumOutputs=1
NumRules=15
AndMethod='min'
OrMethod='max'
ImpMethod='min'
AggMethod='max'
DefuzzMethod='centroid'

[Input1]
Name='Academic'
Range=[0 10]
NumMFs=4
MF1='Average': 'pimf', [4.333 5 6.333 6.889]
MF2='Good': 'pimf', [6.111 6.667 7.667 8.889]
MF3='Excellent': 'pimf', [8.333 10 10 10]
MF4='Poor': 'pimf', [0 2 3.5 4.444]

[Input2]
Name='Sports'
Range=[0 10]
NumMFs=3
MF1='Poor': 'gbellmf', [2.083 2.5 -1.388e-16]
MF2='Average': 'pimf', [1.25 4.583 5.417 8.75]
MF3='Good': 'smf', [6.25 9.583]

[Input3]
Name='CCA'
Range=[0 10]
NumMFs=3
MF1='Poor': 'gaussmf', [1.769 1.2]
MF2='Average': 'gaussmf', [1.769 5]
MF3='Good': 'pimf', [6.25 9.583 10.42 13.75]

[Output1]
Name='Performance'
```

```

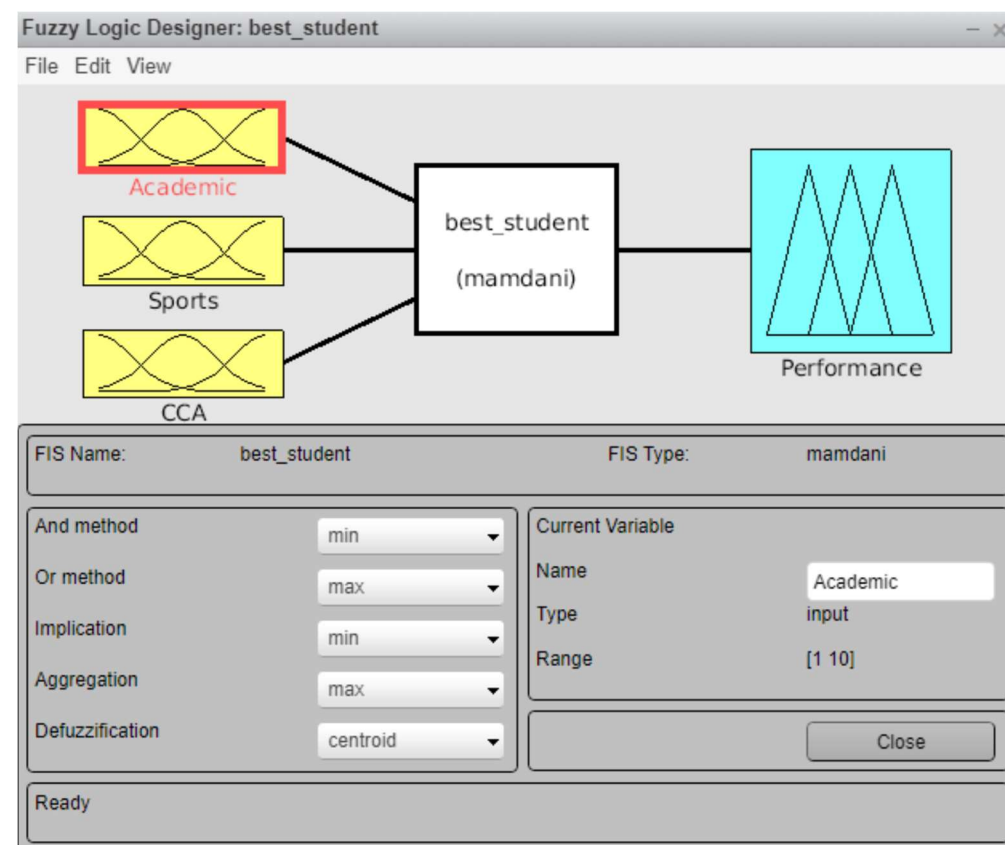
Range=[0 10]
NumMFs=4
MF1='Poor': 'trimf',[0 2.389 4]
MF2='Average': 'pimf',[3.8 4 6 7]
MF3='Good': 'pimf',[6.594 7.128 7.544 8.344]
MF4='Excellent': 'pimf',[7.5 8.2 10 10]

```

```

[Rules]
4 0 0, 1 (1) : 1
3 -1 -1, 4 (1) : 1
1 -1 -1, 2 (1) : 1
2 -1 -1, 3 (1) : 1
-4 3 3, 3 (1) : 1
-3 1 1, 1 (1) : 1
2 -3 -3, 2 (1) : 1
2 3 3, 4 (1) : 1
4 3 3, 2 (1) : 1
-2 1 3, 2 (1) : 1
-2 3 1, 2 (1) : 1
-2 2 2, 2 (1) : 1
-4 3 1, 2 (1) : 1
-1 2 1, 1 (1) : 1
2 1 3, 3 (1) : 1

```



Rule Editor: best_student

File Edit View Options

2. If (Academic is Excellent) and (Sports is not Poor) and (CCA is not Poor) then (Performance is Excellent) (1)

3. If (Academic is Average) and (Sports is not Poor) and (CCA is not Poor) then (Performance is Average) (1)

4. If (Academic is Good) and (Sports is not Poor) and (CCA is not Poor) then (Performance is Good) (1)

5. If (Academic is not Poor) and (Sports is Good) and (CCA is Good) then (Performance is Good) (1)

6. If (Academic is not Excellent) and (Sports is Poor) and (CCA is Poor) then (Performance is Poor) (1)

7. If (Academic is Good) and (Sports is not Good) and (CCA is not Good) then (Performance is Average) (1)

8. If (Academic is Good) and (Sports is Good) and (CCA is Good) then (Performance is Excellent) (1)

9. If (Academic is Poor) and (Sports is Good) and (CCA is Good) then (Performance is Average) (1)

10. If (Academic is not Good) and (Sports is Poor) and (CCA is Good) then (Performance is Average) (1)

11. If (Academic is not Good) and (Sports is Good) and (CCA is Poor) then (Performance is Average) (1)

12. If (Academic is not Good) and (Sports is Average) and (CCA is Average) then (Performance is Average) (1)

13. If (Academic is not Poor) and (Sports is Good) and (CCA is Poor) then (Performance is Average) (1)

14. If (Academic is not Average) and (Sports is Average) and (CCA is Poor) then (Performance is Poor) (1)

If

Academic is

Average

Good

Excellent

Poor

none

☐ not

and

Sports is

Poor

Average

Good

none

☐ not

and

CCA is

Poor

Average

Good

none

☐ not

Then

Performance is

Poor

Average

Good

Excellent

none

☐ not

Connection

☐ or

☒ and

Weight:

1

Delete rule

Add rule

Change rule

<<

>>

Translating to verbose format

Close

