

## # fuzzy combine & plot

```
import numpy as np
import matplotlib.pyplot as plt

#define fuzzy set A & B(randomly)
np.random.seed(42)
num_eles=10 #no. of eles in each fuzzy set
param_A=np.random.uniform(low=0,high=10,size=(num_eles,3)) #10 rows & 3 cols in each fuzzy set
param_B=np.random.uniform(low=0,high=10,size=(num_eles,3)) #10 rows & 3 cols in each fuzzy set

#define triangular MF
def tri(x,a,b,c):
    return np.where(x <= a, 0,
        np.where(x < b, (x - a) / (b - a),
            np.where(x < c, (c - x) / (c - b), 0)))

#define x(an array of 100 evenly spaced random no.s started from 0 & ended at 10)
x=np.linspace(0,10,100)

#initialize list that wil contain membership vals
mv_A_list=[]
mv_B_list=[]
mv_union_list=[]

#cal. memebership vals
for (a1,b1,c1),(a2,b2,c2) in zip(param_A,param_B): #zip() function pairs the first tuple from
param_A with the first tuple from param_B, the second tuple from each, and so on.
    mv_A=tri(x,a1,b1,c1)
    mv_B=tri(x,a2,b2,c2)
    mv_union=np.maximum(mv_A,mv_B)
```

```
mv_A_list.append(mv_A)
mv_B_list.append(mv_B)
mv_union_list.append(mv_union)
```

#plotting (MV of each eles of a set)

#plot fuzzy set A

```
plt.figure(figsize=(12,8))
```

for i,mv\_A in enumerate(mv\_A\_list): #numerate() is used to loop over mv\_A\_list while simultaneously providing the index i and the value mv\_A in each iteration.

```
    plt.plot(x,mv_A,label=f'fuzzy set A{i+1}')
```

```
plt.title("fuzzy set A")
```

```
plt.xlabel("x")
```

```
plt.ylabel("membership grade(vals)")
```

```
plt.legend()
```

```
plt.grid(True)
```

```
plt.show()
```

#plot fuzzy set B

```
plt.figure(figsize=(12,8))
```

for i,mv\_B in enumerate(mv\_B\_list):

```
    plt.plot(x,mv_B,label=f'fuzzy set B{i+1}')
```

```
plt.title("fuzzy set B")
```

```
plt.xlabel("x")
```

```
plt.ylabel("membership grade(vals)")
```

```
plt.legend()
```

```
plt.grid(True)
```

```
plt.show()
```

The figure consists of two vertically stacked line graphs, labeled 'fuzzy set A' (top) and 'fuzzy set B' (bottom). Both graphs plot the membership grade (y-axis, ranging from 0.0 to 1.0) against the variable x (x-axis, ranging from 0 to 10). Each graph displays 10 different fuzzy sets, represented by colored lines.

**Fuzzy Set A Graph:**

- fuzzy set A1 (blue):** A trapezoidal shape starting at (4, 0), increasing linearly to (10, 1), and then dropping to 0 at x=10.
- fuzzy set A2 (orange):** A very narrow peak at x=9.5, reaching a membership grade of 1.0.
- fuzzy set A3 (green):** A trapezoidal shape starting at (0, 0), increasing linearly to (8, 1), and then dropping to 0 at x=9.
- fuzzy set A4 (red):** A small triangular peak at x=7.5, reaching a membership grade of approximately 0.25.
- fuzzy set A5 (purple):** A trapezoidal shape starting at (0, 0), increasing linearly to (9, 1), and then dropping to 0 at x=10.
- fuzzy set A6 (brown):** A triangular peak at x=3, reaching a membership grade of 1.0.
- fuzzy set A7 (pink):** A triangular peak at x=4.5, reaching a membership grade of approximately 0.55.
- fuzzy set A8 (grey):** A triangular peak at x=3, reaching a membership grade of 1.0.
- fuzzy set A9 (yellow):** A trapezoidal shape starting at (4.5, 0), increasing linearly to (8, 1), and then dropping to 0 at x=8.
- fuzzy set A10 (cyan):** A very narrow peak at x=5.5, reaching a membership grade of 1.0.

**Fuzzy Set B Graph:**

- fuzzy set B1 (blue):** A trapezoidal shape starting at (0, 0), increasing linearly to (10, 1), and then dropping to 0 at x=10.
- fuzzy set B2 (orange):** A very narrow peak at x=9.5, reaching a membership grade of approximately 0.65.
- fuzzy set B3 (green):** A trapezoidal shape starting at (0, 0), increasing linearly to (3, 0.65), and then decreasing linearly to (7, 0).
- fuzzy set B4 (red):** A small triangular peak at x=4.5, reaching a membership grade of approximately 0.15.
- fuzzy set B5 (purple):** A trapezoidal shape starting at (0, 0), increasing linearly to (9, 1), and then dropping to 0 at x=10.
- fuzzy set B6 (brown):** A trapezoidal shape starting at (0, 0), increasing linearly to (9, 1), and then dropping to 0 at x=10.
- fuzzy set B7 (pink):** A triangular peak at x=5.5, reaching a membership grade of approximately 0.55.
- fuzzy set B8 (grey):** A trapezoidal shape starting at (7.5, 0), increasing linearly to (9.5, 1), and then dropping to 0 at x=10.
- fuzzy set B9 (yellow):** A trapezoidal shape starting at (6, 0), increasing linearly to (9.5, 1), and then dropping to 0 at x=10.
- fuzzy set B10 (cyan):** A triangular peak at x=2.5, reaching a membership grade of approximately 0.45.

