Παράδειγμα κατασκευής ενός FLS

Εργαστηριακό μάθημα

Πηγή: https://towardsdatascience.com/a-very-brief-introduction-to-fuzzy-logic-and-fuzzy-systems-d68d14b3a3b8

Έχουμε 3 ασαφής μεταβλητές:

- Θερμοκρασία – Temperature
- Υγρασία – Humidity
- Ταχύτητα ανεμιστήρα – Fan Speed

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Temperature: Cold, Medium, Hot
Humidity: Dry, Normal, Wet
Fan Speed: Slow, Moderate, Fast
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TEMPRATURE

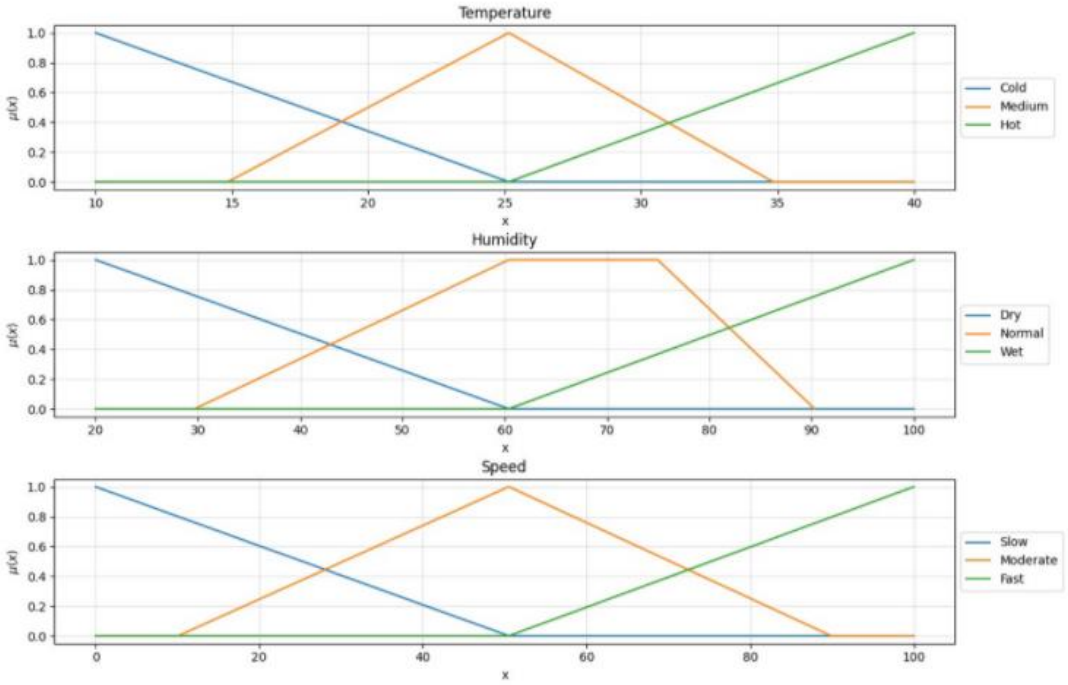
$$\mu_{COLD(x)}\begin{cases}0,\ x\geq 25\\ \frac{25-x}{15}, 10\leq x\leq 25\end{cases}\qquad \mu_{MEDIUM(x)}\begin{cases}0, x\leq 15\ or\ x\geq 35\\ \frac{x-15}{10}, 15\leq x\leq 25\\ \frac{35-x}{10}, 25\leq x\leq 35\end{cases}\qquad \mu_{HOT(x)}\begin{cases}0,\ x\leq 25\\ \frac{x-25}{15}, 25\leq x\leq 40\end{cases}$$

HUMIDITY

$$\mu_{DRY(x)}\begin{cases}0,\ x\geq 60\\ \frac{60-x}{40}, 20\leq x\leq 60\end{cases}\qquad \mu_{NORMAL(x)}\begin{cases}0, x\leq 30\ or\ x\geq 90\\ \frac{x-30}{30}, 30\leq x\leq 60\\ 1, 60\leq x\leq 75\\ \frac{90-x}{15}, 75\leq x\leq 90\end{cases}\qquad \mu_{WET(x)}\begin{cases}0,\ x\leq 60\\ \frac{100-x}{40}, 60\leq x\leq 100\end{cases}$$

SPEED

$$\mu_{SLOW(x)}\begin{cases}0,\ x\geq 50\\ \frac{50-x}{50}, x\leq 50\end{cases}\qquad \mu_{MODERATE(x)}\begin{cases}0, x\leq 10\ or\ x\geq 90\\ \frac{x-10}{40}, 10\leq x\leq 50\\ \frac{90-x}{40}, 50\leq x\leq 90\end{cases}\qquad \mu_{FAST(x)}\begin{cases}0,\ x\leq 50\\ \frac{x-50}{50}, 50\leq x\leq 100\end{cases}$$

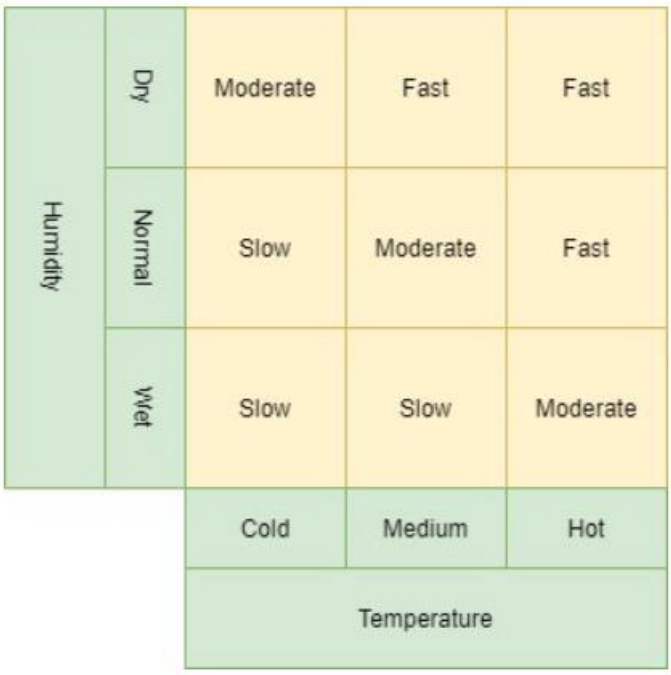


➢ Fuzzy Rules

1) If Temperature is Cold and Humidity is Dry Then Fan Speed is Slow
2) If Temperature is Medium and Humidity is Dry Then Fan Speed is Slow
3) If Temperature is Cold and Humidity is Normal Then Fan Speed is Slow

4) If Temperature is Hot and Humidity is Dry Then Fan Speed is Moderate
5) If Temperature is Medium and Humidity is Normal Then Fan Speed is Moderate
6) If Temperature is Cold and Humidity is Wet Then Fan Speed is Moderate

7) If Temperature is Hot and Humidity is Normal Then Fan Speed is Fast
8) If Temperature is Hot and Humidity is Wet Then Fan Speed is Fast
9) If Temperature is Medium and Humidity is Wet Then Fan Speed is Fast



Παράδειγμα:

- Θερμοκρασία – Temperature =18^{o} C
- Υγρασία – Humidity = 60%
- Ταχύτητα ανεμιστήρα – Fan Speed = ???

<u>Θερμοκρασία</u>

```
0.48 Cold
0.29 Medium
0.00 Hot
```

($\mu_{cold}(x)$, $\mu_{medium}(x)$, $\mu_{hot}(x)$)
(0.48, 0.29, 0)

<u>Υγρασία</u>

```
0.0 Wet
1.0 Normal
0.0 Dry
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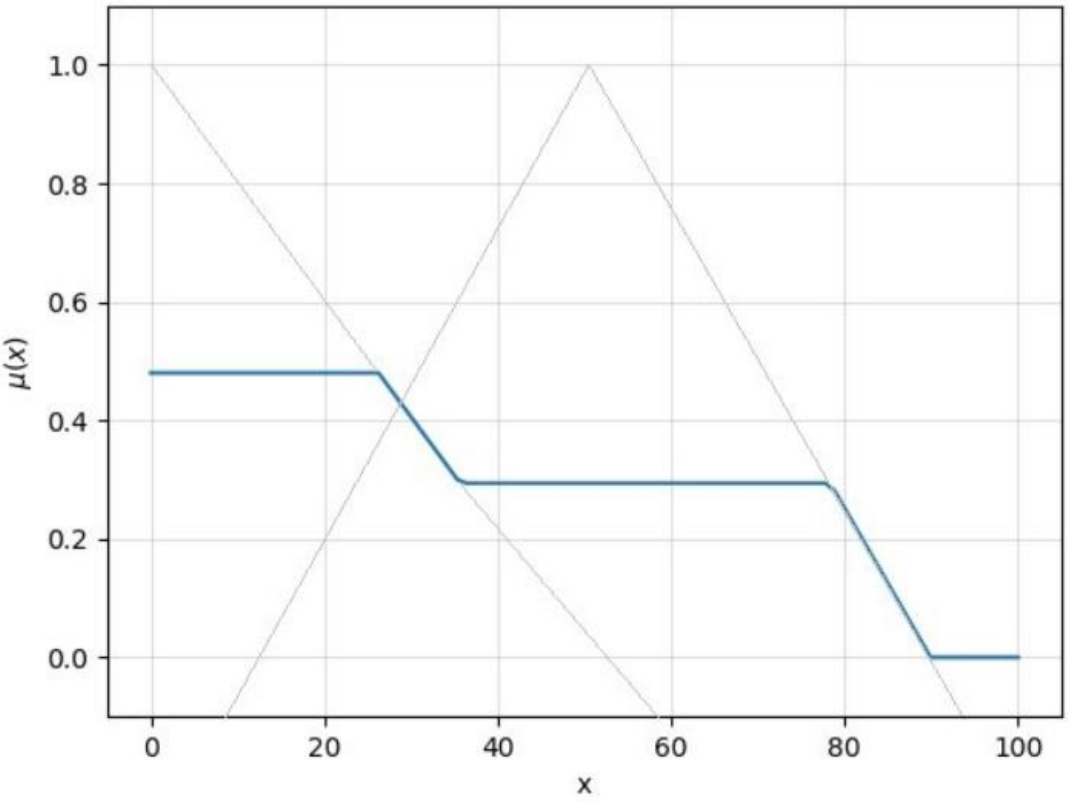
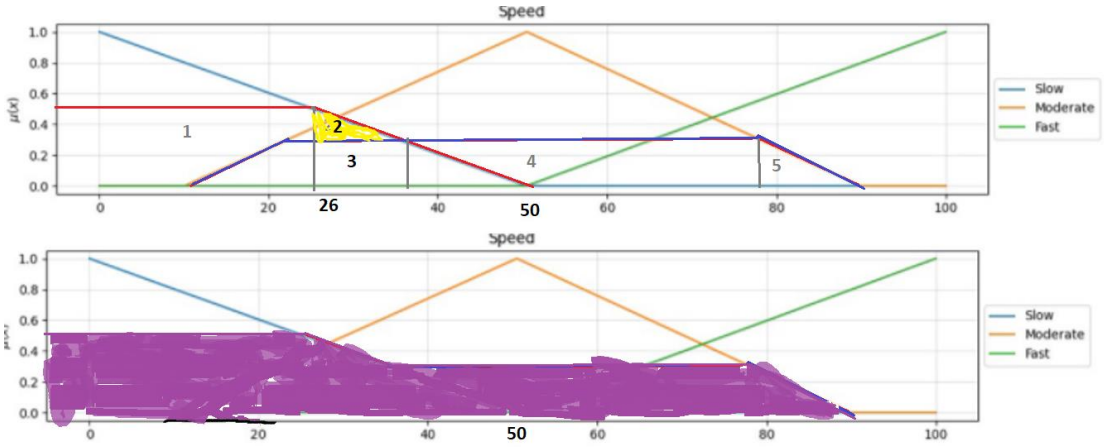
($\mu_{wet}(x)$, $\mu_{normal}(x)$, $\mu_{dry}(x)$)
(0, 1, 0)

<u>Αποτέλεσμα</u>

Humidity	Temperature		
	Cold (0.48)	Medium(0.29)	Hot(0.0)
Dry(0.0)	Moderate	Fast	Fast
Normal(1.0)	Slow	Moderate	Fast
Wet(0.0)	Slow	Slow	Moderate



Επιλέγουμε μέθοδο αποσαφοποίησης


Speed
μ(x)
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
26
50
1
2
3
4
5
Slow
Moderate
Fast

Speed
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
50
Slow
Moderate
Fast