

Exercise 4

TDT4137

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a

Fuzzification

- Distance:
 $\mu_{(x=VerySmall)} = 0.0$
 $\mu_{(x=Small)} = 0.6$
 $\mu_{(x=Perfect)} = 0.1$
 $\mu_{(x=Big)} = 0.0$
 $\mu_{(x=VeryBig)} = 0.0$
- Delta:
 $\mu_{(y=ShrinkingFast)} = 0.0$
 $\mu_{(y=Shrinking)} = 0.0$
 $\mu_{(y=Stable)} = 0.3$ $\mu_{(y=Growing)} = 0.4$
 $\mu_{(y=GrowingFast)} = 0.0$

Rule evaluation

- If distance is Small (0.6) AND delta is Growing (0.4) THEN action is None ($\min(0.6, 0.4) = 0.4$)
- If distance is Small (0.6) AND delta is Stable (0.3) THEN action is Slow-Down ($\min(0.6, 0.3) = 0.3$)
- If distance is Perfect (0.1) AND delta is Growing (0.4) THEN action is SpeedUp ($\min(0.1, 0.4) = 0.1$)
- If distance is VeryBig (0.0) AND (delta is NOT Growing ($1.0 - 0.4 = 0.6$) OR delta is NOT GrowingFast ($1.0 - 0.0 = 1.0$)) ($\max(0.6, 1.0) = 1.0$) THEN action is FloorIt ($\min(0.0, 1.0) = 0.0$)
- If distance is VerySmall (0.0) THEN action is BrakeHard (0.0)

Aggregation and defuzzification

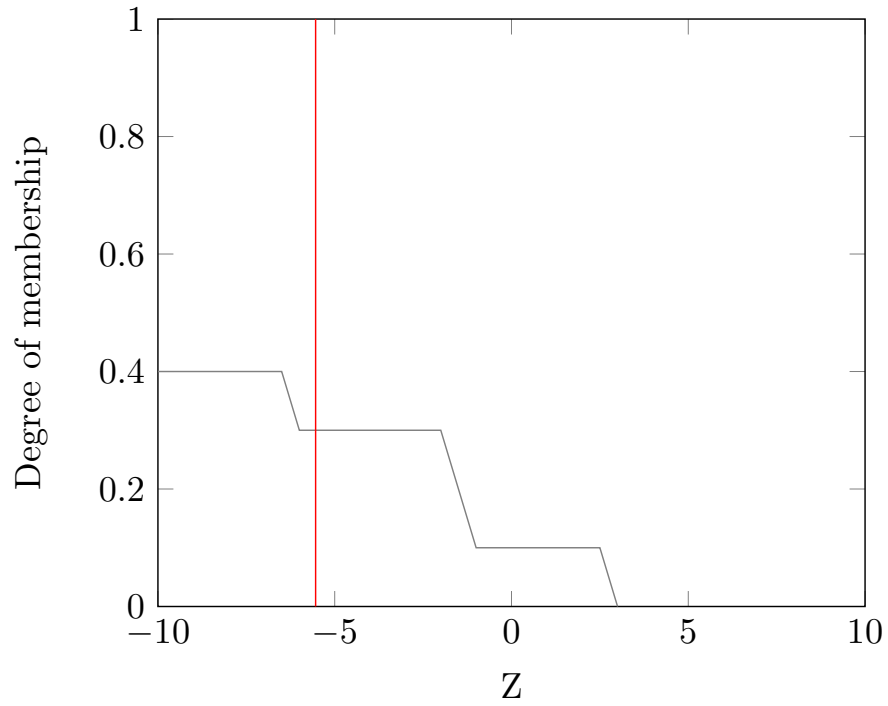


Figure 1: The red line marks the center of gravity

$$COG \approx \frac{(-10-9.0-8.0-7.0)*0.4+(-6.0-5.0-4.0-3.0-2.0)*0.3+(-1.0+1.0+2.0)*0.1}{4.0*0.4+5.0*0.3+4.0*0.1} = -5.54$$

The robot will do the SlowDown action.

b

The reasoner is implemented in `src/MamdaniFuzzyReasoner.java`