



Word Problem Involving Fuzzy Difference

Problem:

A health monitoring system assesses two factors for evaluating the overall health risk of in **Diet Quality** and **Exercise Regularity**. The fuzzy set for Diet Quality is given by $D = \{(high, 0.8), (moderate, 0.6), (low, 0.2)\}$, and the fuzzy set for Exercise Regularity is given by $E = \{(high, 0.7), (moderate, 0.5), (low, 0.3)\}$.

Question:

Calculate the fuzzy difference $D \setminus E$ and interpret what it signifies about the relationship Diet Quality and Exercise Regularity in terms of health risk. What does the result suggest about individuals who maintain a good diet but have varying levels of exercise regularity?

Would you like the solution to this problem as well?



Solution to the Fuzzy Difference Problem

Problem Recap:

You are given the fuzzy sets for Diet Quality D and Exercise Regularity E :

- **Diet Quality:** $D = \{(high, 0.8), (moderate, 0.6), (low, 0.2)\}$
- **Exercise Regularity:** $E = \{(high, 0.7), (moderate, 0.5), (low, 0.3)\}$

Step 1: Fuzzy Difference Calculation

The fuzzy difference $D \setminus E$ is computed using the formula:

$$D \setminus E = \{(x, \max(0, \mu_D(x) - \mu_E(x))) \mid x \in X\}$$

Where $\mu_D(x)$ and $\mu_E(x)$ are the membership functions of the elements in sets D and E .

1. For the element "high":

$$\mu_D(\text{high}) = 0.8, \quad \mu_E(\text{high}) = 0.7$$

$$\text{Fuzzy Difference: } \mu_{D \setminus E}(\text{high}) = \max(0, 0.8 - 0.7) = 0.1$$

2. For the element "moderate":

$$\mu_D(\text{moderate}) = 0.6, \quad \mu_E(\text{moderate}) = 0.5$$

$$\text{Fuzzy Difference: } \mu_{D \setminus E}(\text{moderate}) = \max(0, 0.6 - 0.5) = 0.1$$

3. For the element "low":

$$\mu_D(\text{low}) = 0.2, \quad \mu_E(\text{low}) = 0.3$$

$$\text{Fuzzy Difference: } \mu_{D \setminus E}(\text{low}) = \max(0, 0.2 - 0.3) = 0$$

Step 2: Resulting Fuzzy Set

The fuzzy difference set $D \setminus E$ is:

$$D \setminus E = \{(\text{high}, 0.1), (\text{moderate}, 0.1), (\text{low}, 0)\}$$

Step 3: Interpretation

- The positive difference for "high" and "moderate" suggests that individuals with moderate diet quality have a slightly better health condition than their exercise might suggest. In other words, their good diet somewhat compensates for their lack of exercise.
- The zero difference for "low" indicates that when both diet quality and exercise are low, diet does not compensate for poor exercise habits, leaving the health risk high.

Conclusion:

The fuzzy difference $D \setminus E$ highlights how much diet quality contributes to health beyond what is accounted for by exercise regularity. The results suggest that maintaining a good diet can somewhat mitigate the health risks associated with less frequent exercise, but this effect is only present when both factors are low.

