Extension principle

using min operation (Zadehs)

$$2\times 6 = \left\{ \frac{\min(0.6, 0.8)}{5} \frac{}{6} + - - \cancel{-} - + \frac{}{18} + \frac{}{21} \right\}$$

$$2\times 6 = \left\{ \frac{\min(0.6, 0.8)}{5} + \frac{\min(0.6, 1)}{6} + \cdots \right.$$

$$\left. + \frac{\min(0.8, 1)}{18} + \frac{\min(0.8, 0.7)}{21} \right\}.$$

$$= \left\{ \frac{0.6}{5} + \frac{0.6}{6} + \frac{0.6}{7} + \frac{0.8}{10} + \frac{1}{12} + \frac{0.7}{14} + \frac{0.8}{15} \right.$$

$$\left. + \frac{0.8}{18} + \frac{0.7}{21} \right\}$$

(non convex)

(it is normal fuzzy set)

Fuzzy no is always a convex & normal fuzzy set

⇒ Let A & B be fuzzy set defn on its own universe

$$A = \left\{ \frac{0.2}{1} + \frac{1}{2} + \frac{0.7}{4} \right\}$$

$$B = \left\{ \frac{0.5}{1} + \frac{1}{2} \right\}$$

Find the algebraic product A×B defn on other domain.

$$C = \{ \cancel{+ +} = \left\{ \frac{}{1} + \frac{}{2} + \frac{}{4} + \frac{}{8} \right\}$$

$$= \left\{ \frac{}{1\times 1} + \frac{}{1\times 2} + \frac{}{2\times 1} + \frac{}{2\times 2} + \frac{}{4\times 1} + \frac{}{4\times 2} \right.$$

Extension principle.

using max-min composition (Zadehs)

$$f(A,B) = A\times B = \left\{ \frac{\min(0.2, 0.5)}{1} + \frac{\max[\min(0.2, 1),}{1\times 2} \right.$$

$$+ \frac{\max[\min(0.7, 0.5) \min(1, 1)]}{4} + \frac{\min(0.7, 1)}{8}$$

$$= \left\{ \frac{0.2}{1} + \frac{\max(0.2, 0.5)}{2} + \frac{\max(0.5, 1)}{4} + \frac{0.}{8} \right.$$

$$C = \left\{ \frac{0.2}{1} + \frac{0.5}{2} + \frac{1}{4} + \frac{0.7}{8} \right\}.$$

Unit-2.

Theory of approx Reasoning

* Fuzzy if ---- then statements

Eg If 'hot climate' then 's/w on air conditioner'

If 'motor speed low' then 'increase applied vtg'

rule antecedent — rule consequent

If then involves min operation (ie AND operat)

* Fuzzy if ---- then ---- else

Eg If 'hot climate' then 's/w on air conditioner'
else 's/w off air conditioner'

If 'motor speed low' then 'increase applied vtg'
else 'maintain applied vtg'.

(2 antecedent & 2 consequents)

* Fuzzy propositions

'The value of the error is negative small'
→ notationally → 'E is NS' (simple)

↳ Fuzzy propositions

Simple — Complex or Compound

Eg1. 'E is S and ΔE is M' (Compound proposition)
↓ connected by logical operators)

E → error
S → small
ΔE → change in error
M → Medium.

2. 'If E is S and ΔE is M then V is S'
V → vtg. (Compound proposition)

* Inference rules.

Set of rules formed to carry a particular objective

Types

① Rule uses a fuzzy relation to represent explicitly the connection betn the two fuzzy propositions

① Compositional Rule rule of inference

② Generalised modus ponens → uses if then rule

Eg A is B. → fuzzy proposition
A → object
B → fuzzy set based on its property

compare

Tomato is red

The tomato is red.

If Tomato is red then tomato is ripe

A is B.

If A is B then A is C

B & C are fuzzy sets. A is object

2 The tomato is very red. → rule 1

If tomato is red tomato is ripe → rule 2

∴ tomato is very ripe

↳ inference.

* Inference using compositional rule.

Eg. A is B.

If A is B then A is C

If ... then → and operation.

fuzzy set B & fuzzy set C

'B ∩ C' → relation

Inference is drawn mathematically using relation matrices & operations on fuzzy sets & relations have to be carried out.

* Generalised modus ponens.

/ we dont need mathematical computation.

Eg. If A is B then A is C

It is like a lookuptable (approxim.)

It is most commonly used, very simple & fast

* Inference.

approx char. for using compositional ~~rule~~ rule of ~~inference~~ inference

- Zadeh's..
- mamdani → most commonly used (min operation)
- Godel

Zadeh's implication $\cancel{\max((\min(\mu_{A}(x), \mu_{A}(y)), 1-\mu_{A}(x))}$

$$\max(\min(\mu_A(x)\ \mu_A(y)), 1-\mu_A(x))$$