Lab-11 Certainty Factor

- Absolute Value
- Certainty Theory : Value Interpretation
- Single Premise Rule
- Multiple Premises Rule
    1. *Conjunctive Rules (AND) use min() function*
    2. *Disjunctive Rule (OR) use max() function*
- Min & Max Function
- Similarly concluded rules (3 different scenario)

Absolute value

| A | = -5

= 5

| CF | = -9

= 9

A = -5

CF = -9

Certainty Theory: Values Interpretation

Definitely Not	-1.0
Almost certainly not	-0.8
Probably not	-0.6
Maybe not	-0.4
Unknown	-0.2 to 0.2
Maybe	0.4
Probably	0.6
Almost Certainly	0.8
Definitely	1.0

CFP : Single Premise Rule

- Concerned with establishing the level of belief in rule conclusion (***H***) when the available evidence (***E***) contained in the rule premise is ***uncertain***.

$$CF(H, E) = CF(E) \times CF(RULE)$$

Example:

IF *There are dark cloud* - E

THEN *It will rain* - H **CF = 0.8**

CF (E) = 0.5

CFP = CF (H, E) = 0.5 x 0.8 = 0.4

In words: It ***maybe*** raining

References: Lecture 11 – Slide 14

CFP: Multiple Premises Rule

Conjunctive Rules (AND)

IF $E1$ AND $E2$ AND E_n THEN H **CF** (RULE)

CF (H, $E1$ AND $E2$ AND... E_n) =
min {CF (E_i)} x CF (RULE)

- ***min function*** returns ***minimum value*** of a set of numbers.

References: Lecture 11 – Slide 17

CFP: Multiple Premises Rule

Disjunctive Rule (OR)

IF $E1$ OR $E2$ OR E_n THEN H **CF** (RULE)

CF (H, $E1$ OR $E2$ OR ... E_n) =
max {CF (E_i)} x CF (RULE)

- ***Max function*** returns the ***maximum value*** of a set of numbers

References: Lecture 11 – Slide 19

Min & Max Function

- min() function returns minimum/smallest value of a set of number.
- max() function returns maximum/largest value of a set of number.

min [3, 4]
= 3

max [3, 4]
= 4

References: Lecture 11 – Slide 17 & 19

CFP: Similarly concluded rules
(Formula for Incrementally Acquired Evidence)

$$CF_{combined}(CF1, CF2)$$

$$= (CF1 + CF2) - (CF1 * CF2) \qquad \textit{Both} > 0$$

$$= (CF1 + CF2) + (CF1 * CF2) \qquad \textit{Both} < 0$$

$$= \frac{CF1 + CF2}{1 - \min\{|CF1|, |CF2|\}} \qquad \textit{One} < 0$$

where,

CF1 = confidence in H established by one rule (RULE 1)

CF2 = confidence in H established by one rule (RULE 2)

CF1 = CF1 (H, E)

CF2 = CF2 (H, E)

References: Lecture 11 – Slide 24

(Both value is Positive) $(CF1+CF2) - (CF1*CF2)$ *Both > 0*

CF1 = 0.30
CF2 = 0.40

$CF_{combined}(CF1, CF2)$

$= (CF1 + CF2) - (CF1 \times CF2)$
$= (0.30 + 0.40) - (0.30 \times 0.40)$
$= 0.7 - 0.12$
$= 0.58$

(Both value is Negative)

$(CF1+CF2) + (CF1*CF2)$ *Both < 0*

CF1 = -0.30
CF2 = -0.40

$CF_{combined}$ (CF1, CF2)

= (CF1 + CF2) + (CF1 × CF2)
= (-0.30 + -0.40) + (-0.30 × -0.40)
= -0.7 + 0.12
= -0.58

(one value is negative)

$$\frac{CF1 + CF2}{1 - \min\{|CF1|, |CF2|\}}$$

One < 0

CF1 = 0.50
CF2 = -0.40

$CF_{combined}(CF1, CF2)$

$= (CF1 + CF2) + (CF1 \times CF2)$

$$= \frac{CF1 + CF2}{1 - \min\{|CF1|, |CF2|\}}$$

$$= \frac{0.50 + (-0.40)}{1 - \min\{|0.50|, |-0.40|\}}$$

0.40 is smallest value.

Absolute Value
|-0.40|
= 0.40

$$= \frac{0.50 + (-0.40)}{1 - 0.40}$$

$$= \frac{0.10}{0.60}$$

0.1667