Faculty of Mathematics and Computer Science, University of Lodz
Poland

HOMEWORK 02 – FUZZY LOGIC

Artificial Intelligence (Practical class) 1100-AI0UEN
Course schedule - Winter Semester 2023/2024

Question:

Create a fuzzy control system unit for the given problem (A vacuum cleaner) using any of your familiar programming languages (e.g. MATLAB, Python) and finally, you have to determine the voltage value for the specified condition given any example value as input.

Input variables: Speed, diaphragm
Output: Control voltage

Hint: Use "Mandani" as the graphical technique of inference, you can use any method for defuzzification.

Description: The membership function of the speed (comprised between 0 and 2.5 m/s) of the suction member, determined experimentally and having three predicates, namely "Slow", "Normal" and "Rapid". also, the membership function of the diaphragm (comprised between 0 and 40 mm), defined experimentally and having four predicates, namely "Weak", "Medium", "Strong", and "Very Strong". also, the membership function of the control voltage (comprised between 110 and 230 V) of the motor-fan group, defined experimentally and having five predicates, namely "Very Weak", "Medium", "Fairly Strong", "Strong" and "Very Strong".

The control rules elaborated from experience and transcribed by using fuzzy descriptions of the three variables, respectively the speed the diaphragm and the control voltage can be established in the form of the table below.

SPEED	WEAK	MEDIUM	STRONG	VERY STRONG
SLOW	STRONG	MEDIUM	VERY WEAK	MEDIUM
NORMAL	VERY STRONG	FAIRLY STRONG	MEDIUM	STRONG
RAPID	VERY STRONG	STRONG	VERY STRONG	VERY STRONG

These different control rules can be set as bellow, from above table:

Rule 1: If the speed is slow and the diaphragm is weak, then the control voltage is strong.
Rule 2: If the speed is normal and the diaphragm is weak, then the control voltage is very strong.
Rule 3: If the speed is rapid and the diaphragm is weak, then the control voltage is very strong.
Rule 4: If the speed is slow and the diaphragm is medium, then the control voltage is medium.

Rule 5: If the speed is normal and the diaphragm is medium, then the control voltage is fairly strong.
Rule 6: If the speed is rapid and the diaphragm is medium, then the control voltage is very strong.
Rule 7: If the speed is slow and the diaphragm is strong, then the control voltage is very weak.
Rule 8: If the speed is normal and the diaphragm is strong, then the control voltage is medium.
Rule 9: If the speed is rapid and the diaphragm is strong, then the control voltage is very strong.
Rule 10: If the speed is slow and the diaphragm is very strong, then the control voltage is medium.
Rule 11: If the speed is normal and the diaphragm is very strong, then the control voltage is strong.
Rule 12: If the speed is rapid and the diaphragm is very strong, then the control voltage is very strong.

------END OF THE HOMEWORK-----

Note prepared by: H.L.N.Himanshi