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SP20-BCS-109

Assignment 4

Computational Intelligence

To implement a fuzzy control system for COMSATS grading system with the given marks division, GPA calculation, and final grade determination, follow these steps:

Step 1: Define Linguistic Variables and Membership Functions:

❖ Input Variables:
  ➢ Midterm Exam Score: Low, Medium, High
  ➢ Assignments and Quizzes Score: Low, Medium, High
  ➢ Final Exam Score: Low, Medium, High

❖ Output Variable:
  ➢ Final Grade: Fail, Pass, Merit, Distinction

❖ Assign appropriate membership functions to each fuzzy set for the input and output variables.

Step 2: Define Fuzzy Rules:

❖ Create fuzzy rules based on expert knowledge or established grading criteria. For Example:
  ➢ Rule 1: If Midterm Exam Score is Low and Assignments and Quizzes Score is Low and Final Exam Score is also Low, then Final Grade is Fail.
  ➢ Rule 2: If Midterm Exam Score is Medium and Assignments and Quizzes Score is Medium and Final Exam Score is Medium, then Final Grade is Pass.
  ➢ Rule 3: If Midterm Exam Score is High and Assignments and Quizzes Score is High and Final Exam Score is High, then Final Grade is Distinction.
  ➢ Rule 4: If Midterm Exam Score is Low and Assignments and Quizzes Score is High and Final Exam Score is High, then Final Grade can be Pass as well.
  ➢ Rule 5: If Midterm Exam Score is Low and Assignments and Quizzes Score is Medium and Final Exam Score High, then Final Grade can be Pass.

Step 3: Fuzzy Inference:

❖ Given the inputs (Midterm Exam Score, Assignments and Quizzes Score, Final Exam Score), evaluate the degree of membership of each input variable to the fuzzy sets using the membership functions.

Step 4: Apply Fuzzy Rules:

❖ Use the fuzzy rules to determine the firing strength of each rule based on the degree of membership of the antecedents (input conditions).

Step 5: Aggregate Fuzzy Outputs:

❖ Combine the firing strengths of the rules to obtain the aggregated fuzzy output.

Step 6: Defuzzification:
- ❖ Convert the aggregated fuzzy output into a crisp value (Final Grade) using defuzzification methods such as the centroid, weighted average, or maximum membership.

Step 7: Calculate GPA:
- ❖ Once you have obtained the Final Grade, map it to a corresponding GPA based on the university's grading scale.
- ❖ Determine the GPA calculation formula based on the university's policy. For example, you may assign specific GPA values to each grade (e.g., Fail: 0.0, Pass: 1.3, Merit: 3.0, Distinction: 4.0) and calculate the GPA by taking the weighted average of the grades according to the marks division (25% Midterm Exam + 25% Assignments and Quizzes + 50% Final Exam).

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