Assignment 2: Report

Fuzzy classifier.

DVA427 - Lärande System.

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Explanation of the problem.

This problem consists of classifying data that is given into three different classes. The data represents four different parameters that help distinguish three kinds of iris flowers: setosa, versicolor and virginica.

We need to create a fuzzy classifier that, for each input, classifies the data into short, middle or long, and with that and four given rules, decides which kind of flower we are dealing with.

The AND operator.

In our implementation, the AND operator is the minimization function. This means that, when in a rule two parameters are joined with an “and” expression, we use the minimization function to choose the minimum value out of the two parameters.

The OR operator.

In our implementation, the OR operator is the maximization function. This means that, when in a rule two parameters are joined with an “or” expression, we use the maximization function to choose the maximum value out of the two parameters.

Data flow from inputs to decision.

The inputs given are (0.3, 0.8, 0.2, 0.7). For comprehension reasons, we will refer to them as (x_1,x_2,x_3,x_4).

There are some steps the data follows when solving this problem:

- Calculate the firing strengths.
- Calculate the truth values of the rules.
- Choose the highest truth value out of the rules.
- Compare the result obtained with the expected one.

We are going to start with calculating the firing strengths:

$$x_1 \Rightarrow s = 1 - \frac{0.3}{0.6} = 0.5, m = \frac{0.3}{0.6} = 0.5, l = 0$$

$$x_2 \Rightarrow s = 0, m = 1 - \frac{0.8 - 0.6}{0.4} = 0.5, l = \frac{0.8 - 0.6}{0.4} = 0.5$$

$$x_3 \Rightarrow s = 1 - \frac{0.2}{0.6} = 0.66, m = \frac{0.2}{0.6} = 0.33, l = 0$$

$$x_4 \Rightarrow s = 0, m = 1 - \frac{0.7 - 0.6}{0.4} = 0.75, l = \frac{0.7 - 0.6}{0.4} = 0.25$$

We can proceed now to calculate the truth values of the rules:

R1 = min(max(x_1[S],x_1[L]),max(x_2[M],x_2[L]),max(x_3[M],x_3[L]),x_4[M]) = 0.33

R2 = min(max(x_3[S],x_3[M]),x_4[S]) = 0

R3 = min(max(x_2[S],x_2[M]),x_3[L],x_4[L]) = 0

R4 = min(x_1[M],max(x_2[S],x_2[M]),x_3[S],x_4[L]) = 0

Now we need to choose the maximum result out of the four, which is clearly 0.33, the one of R1's. Given that, R1 is the rule we count as followed, so the kind of flower we are analyzing is versicolor.

The last step would be to compare it with the known results, but since we don't have the answer in this case, this step cannot be completed.

Accuracy of the implemented classifier.

The accuracy of our implemented classifier is 78,66%. In detail, the accuracy of each class is as follows:

- Setosas: 100%.
- Versicolor: 72%.
- Virginica: 64%.