Scott Dickerson
rdickerson3@gatech.edu
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KBAI Assignment 5

How would you use **Learning by Recording Cases** to design an agent that can answer Raven's progressive matrices?

Learning by Recording Cases is the method of calculating the distance between a new case and multiple existing cases to determine which existing case is the closest to the new case. When plotting cases in a 2-dimensional space each case will have two values. To calculate the distance from an existing case to a new case substitute the two values of an existing case for x_c and y_c and the two values of the new case for x_n and y_n in the following formula.

Given existing case at (x_c, y_c)
and new problem at (x_n, y_n)

$$d = \sqrt{(y_c - y_n)^2 + (x_c - x_n)^2}$$

Repeat this calculation for all existing cases. The existing case that results in the lowest calculated value is the one closest to the new case.

Cases with more than two values can also be compared, such as cases in a 3-dimensional space would have three values. To calculate the distance between a new case and multiple existing cases in an k-dimensional space substitute values of an existing case for c_1, c_2 … c_k and values from the new case for p_1, p_2 … p_k in the following formula.

Given existing case at $(c_1, c_2 \ldots c_k)$
and new problem at $(p_1, p_2 \ldots p_k)$

$$d = \sqrt{\sum_{i=1}^{k} (c_i - p_i)^2}$$

Again, repeat this calculation for each existing case. The existing case that results in the lowest calculated value is the one closest to the new case.

So, how would I use **Learning by Recording Cases** to design an agent that can answer Raven's progressive matrices? I attempted to use Learning by Recording Cases to map an object in one figure to an object in another figure. Using the shape, size, fill and angle values of objects, I calculated the distance from an object in one figure to each object in another figure. The theory was that the object in the other figure that resulted in the lowest calculated distance would be the closest match.

I assigned a value to the shape, size, fill and angle attributes of an object as follows:

shape value = number of sides of the shape

size value = percentage of maximum shape size (i.e. large = 100%, small = 25%)

fill value = 0 or 1

angle value = angle

These values I substituted into the k-dimensional formula above to calculate the distance of each object in the target figure to the test object. The theory was that the object in the target figure that resulted in the lowest calculated value would be the object that most closely matched the test object.

The results were quite disappointing. My agent consistently mapped objects incorrectly using this method. I tried added weighting to the different values to assign more or less importance to one value over another, but this technique did not help the method map object correctly. Ultimately, I determined that using Learning by Recording Cases to perform the task of mapping objects between figures was not an appropriate application of the method.

I believe to use Learning by Recording Cases effectively the case values must all share the same unit of measure. That seems obvious now. Oh well, I certainly learned a lot from the effort.