CISC-467

Fall 2019

Assignment

Due December 5, 2019

1. Suppose there is a numeric rating system for politicians, under which a politician can score anything from 0 to 100. We can define fuzzy sets for politicians: Awful, Bad, Mediocre, Good, Great in the natural way.

   Create a set of Fuzzy Inference rules that will allow the calculation of a politician's numeric rating. You will probably want to identify a number of measurable quantities and fuzzy sets.

   For example, one possible rule might be "If Scandal_Count is Very Low and Concern_for_Citizens is Very High, then the politician is Great", and another might be "If Response_Time is Slow or Level_of_Activity is Low, then the politician is Bad" Another might be "If the politician is Very Orange, then the politician is Awful"

   You should come up with at least **four** measurable quantities, and at least **one** inference rule for each of the consequent sets (Awful, …, Great).

   If you can't bear the idea of thinking about politicians - and I don't blame you - then choose another profession such as "doctor" or "teacher" or "journalist" or "circus performer" or where-ever your imagination takes you.

2. Choose a fuzzy implication operator (Kleene-Dienes, Mamdani, etc.) and describe a practical application from the literature in which this is used.

3. Discuss an example of a situation in your daily life where you (perhaps without realizing it at the time) have applied fuzzy logic to make decisions.

4. Let C be a closed simple curve in the plane (that is, C is the result of putting a pen on a sheet of paper, then drawing a line that ends where it started and never crosses itself).

    Here are some examples:
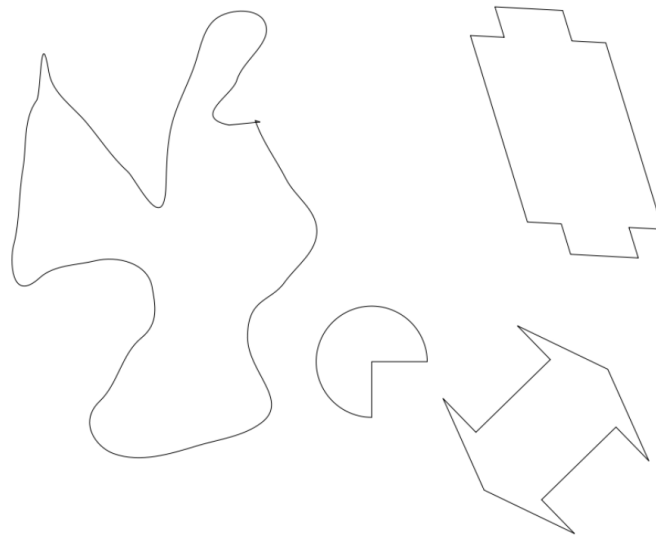
    A perfect circle is easy to define: C consists of all points in the plane that are exactly the same distance d from some specific point (x,y).

    Define a fuzzy set "Circle" in which all closed curves have membership in the range [0..1] .   Decide what attributes of the curve you will measure, and how you will relate them to membership in "Circle". You can use knowledge of geometry, but you don't have to give detailed formulas for the measurable attributes you use. An example might be:
    1. Find the centre of area of C – call this point p (you **don't** need to explain how this is found).
    2. Find the distance from p to the closest point on C – call this d_1
    3. Find the distance from p to the furthest point on C – call this d_2
    4. Compute $\dfrac{d_1}{d_2}$ as the membership of C in "Circle"

    I am sure you can come up with something better than that. You can assume that attributes of the shape such as "total area", "perimeter length", "area of smallest perfect circle that surrounds the shape" **etc** are all measurable.

5. Congratulations, you have been hired by Big And Huge Film Studios to help them cast their next block-buster movie. Their CEO is a big fan of fuzzy logic and wants you to use some of the techniques in which you are now expert.

BAHFS has 200 actors on contract, and they have produced 1000 movies over the last decade (hey, they are Big and Huge!). The studio produces movies in 12 genres: Action, Comedy, Crime, Drama, Fantasy, Historical, Horror, Mystery, Romance, Science Fiction, War, Western. Each movie has a fuzzy membership function for the set of genres. For example, one particular movie's membership function might look like this:

	Action	Comedy	Crime	Drama	Fantasy	History	Horror	Mystery	Romance	Sci Fi	War	Western
Ski Wars: A New Slope	0.7	0.3	0	0.3	0.2	0	1.0	0	0.1	0.4	0.3	0

For each actor there is a fuzzy membership function for the set of all the studio's movies. The values range from 0 ("not in this movie") up to 1 ("played a major character in this movie").

a) Explain how you would use this information to create a fuzzy relation between genres and actors.

b) The studio is planning a new movie whose membership function for the set of genres is known. Explain how you would recommend the 5 most suitable actors to star in this movie.

For both parts of this question, if you use any t-norms, s-norms, negations, or implications, indicate which ones you will use, and why.