CSCU9T6 Spring 2019

Tutorial on Fuzzy Logic and Case-Based Reasoning

1. An industrial process takes place inside an enclosed chamber, whose pressure and temperature are both monitored. The process itself generates heat and it is controlled by adjusting the rate of flow of coolant around the chamber. To maintain optimum levels of pressure and temperature, we may have a fuzzy logic control system, based on rules like the following:

   ```
   IF Pressure High OR Temperature High THEN Coolant Flow High

   IF Pressure Normal AND (Temperature Normal OR Temperature Low) THEN
   Coolant Flow Medium

   IF Pressure Low and Temperature Normal THEN Coolant Flow Low

   IF Pressure Low and Temperature Low THEN Coolant Flow Zero
   ```

   Draw appropriately shaped graphs for the fuzzy sets: `Pressure High`, `Pressure Normal`, `Pressure Low`, `Temperature High`, `Temperature Normal`, `Temperature Low`, `Coolant Flow Zero`, `Coolant Flow Low`, `Coolant Flow Medium`, `Coolant Flow High`.

2. Show in detail how the computation of the appropriate output action (the rate of coolant flow) would proceed if the fuzzy sets representing the inputs have fuzzy measures as follows:

   ```
   Pressure Low            0.2

   Pressure Normal         0.2

   Temperature Normal      1.0

   all others              0.0
   ```

3. A bank wishes to build a knowledge-based system to help to make decisions about whether to grant loans to applicants. At present, these decisions are made by a member of staff who has many years of experience in making such decisions. The bank keeps extensive records of past loan applications, including details about the applicant, whether a loan was granted or not, and, if granted, whether the loan was successfully repaid. There are also documents available that describe the bank's lending policy.

   Discuss in detail what would be involved in implementing this system as a case-based system. How does it compare with the rule-based system of the previous tutorial in terms of how easy it is to build, use, and maintain the system?

4. The diagram below shows the basic workings of a case-based system. We see that there are four main steps in using the system: RETRIEVE, REUSE, REVISE and RETAIN. Explain what is involved in each of these steps. Explain what problems might be encountered at each step, and how they might be addressed.