Fuzzy Logic

Architecture

Fuzzy so far!

Identify the variables of interest

Identify the relevant fuzzy sets

Build membership functions

Build a knowledge base using fuzzy rules

We now need to do inferencing using these rules

Note: The input variables can be crisp or fuzzy

- Load-weight can be measured quite accurately (crisp)
- Fabric-mix is likely to be more subjective (fuzzy)

Architecture of fuzzy inferencing system

Fuzzification Interface

- converts crisp inputs to fuzzy values
- using membership functions

Fuzzy rule base

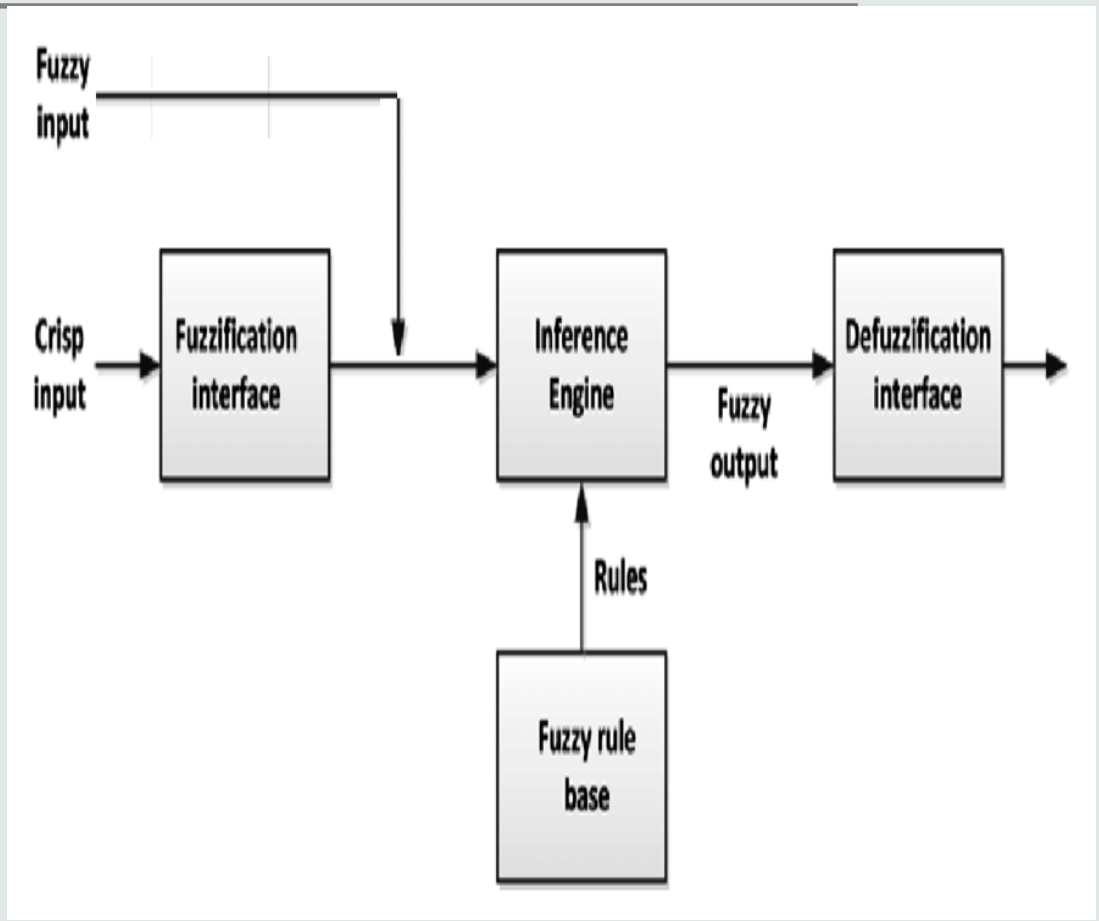
- contains all the fuzzy rules

Inference engine

- produces a fuzzy output
- based on the inputs and rules

Defuzzification interface

- Produces crisp output
- given the fuzzy output of the IE



Example of fuzzification interface

Consider the membership functions

$\mu_{Hot}(Temp.)$, $\mu_{Moderate}(Temp.)$, $\mu_{Cool}(Temp.)$

Consider Temp = 28

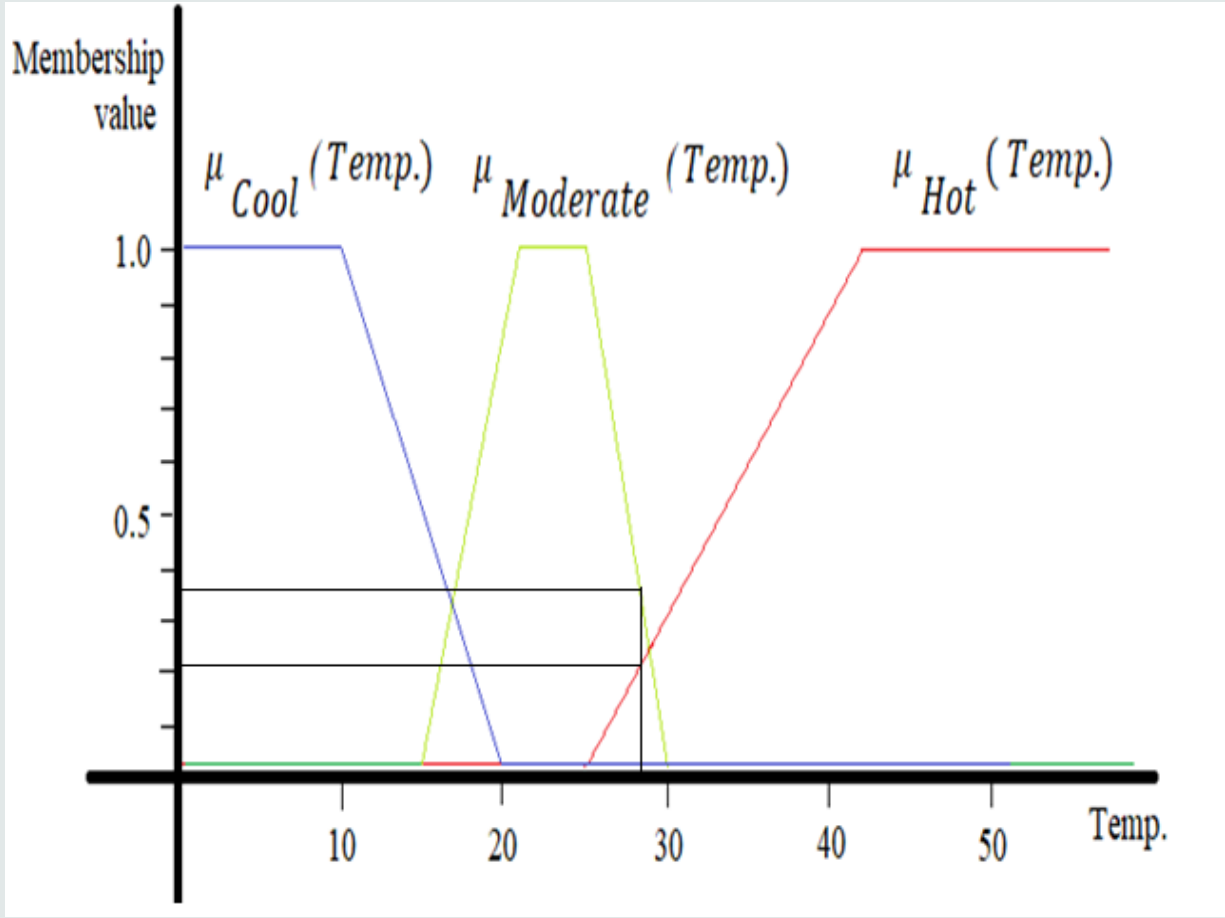
Clearly,

$\mu_{Cool}(Temp. = 28)$ = 0

$\mu_{Hot}(Temp. = 28)$ = 0.21

$\mu_{Moderate}(Temp. = 28)$ = 0.36

Similarly for other temperatures



More than one independent variable

Consider a simplified controller for air conditioners

Needs two inputs, temperature and humidity

We have seen membership functions for Hot, Moderate and Cool

We need to do a similar exercise for humidity

Say, we have three possible ranges for humidity:

- Dry, Moderate, Humid

More than one independent variable

We can control two outputs based on the inputs

The possible outputs are

AC in Cool, Medium or Off

Fan in High, Medium or Off

The rule base can have rules like

If (Temp is Hot and Humidity is Moderate) AC is in Cool and Fan is Off