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System Control Based on the Artificial Intelligence Techniques

Fuzzy Logic Systems (FLS)s are rule-based systems in which an input is first fuzzified (i.e., converted from a crisp number to a fuzzy set) and subsequently processed by an inference engine that retrieves knowledge in the form of fuzzy rules contained in a rule-base. The fuzzy sets computed by the fuzzy inference as the output of each rule are then composed and defuzzified (i.e., converted from a fuzzy set to a crisp number). A fuzzy logic system is a nonlinear mapping from the input to the output space.

IF-THEN rules are able to be obtained by trial and error, by the knowledge about the system, and by intuition of designer about the system. Unlike other motor control systems or car speed control systems, the flexible manipulator has other performance constraints.

Defuzzification operation can be performed by a number of methods of which the center of gravity (also known as centroid) and height methods are common. A centroid defuzzification method calculates the output crispy value corresponding to the center of gravity of the output membership function, which is given by the general shape or another one that we need.

A GA's starts with a population of randomly generated solutions, chromosomes and advances toward better solutions by applying genetic operators, modeled on the genetic processes occurring in nature. In these algorithms we maintain a population of solutions for a given problem; this population undergoes evolution in a form of natural selection.

In each generation, relatively good solutions reproduce to give off springs that replace the relatively bad solutions which die. An evaluation or fitness function plays the role of the environment to distinguish between good and bad solutions. The process of going from the current population to the next population constitutes one generation in the execution of a genetic algorithm.

Although there are many possible variants of the basic GA, the fundamental underlying mechanism operates on a population of chromosomes or individuals (representing possible solutions to the problem) and consists of three operations:

- Evaluation of individual fitness,
- Formation of a gene pool (intermediate population)
- Recombination and mutation.

In general, a neural model is mathematically represented by a basis function (net function) and an activation function (neuron function) and the selection of these functions often depends on the applications of the neural network. In other words, application-driven neural models are only loosely tied to the biological realities.