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Editorial on Fuzzy Neural Network

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Editorial

The primary goal of developing a neural-fuzzy network is to process fuzzy reasoning using the neural network structure. By modifying the network's weight factors, the fuzzy network identifies the fuzzy rules and tunes the membership functions. For process control, there are three main types of neural-fuzzy networks. The method first employs neural networks to forecast future responses of a control variable (for example, cell concentration at the end of a fermentation process), and then employs the deviation from the predicted future response to determine the optimal controller settings.

The second determines the optimal controller settings by analysing the pattern of a given signal (e.g., increasing, decreasing, oscillating, etc.). The final version employs a special neural network structure that serves as a fuzzy-inference system. The neural network predicts the future response of a control variable or its pattern type, which is then fed into the fuzzy-logic controller. The neural network output and any other control input variables that do not require a predictor are converted by a fuzzifier. The fuzzy controller then employs a set of fuzzy rules, akin to an expert system, to determine the best predetermined controller settings.

There are some similarities between neural networks and fuzzy systems. They can be used to solve a problem (for example, pattern recognition, regression, or density estimation) if no mathematical model of the problem exists. They only have a few disadvantages and advantages that are almost completely eliminated by combining both concepts.

Neural networks can only be used if the problem is expressed by a large enough number of observed examples. These observations are fed into the black box, which is then trained. On the one hand, no prior knowledge of the problem is required. On the other hand, extracting comprehensible rules from the structure of a neural network is difficult.The connection weights, propagation and activation functions, and propagation and activation functions of fuzzy neural networks differ significantly from those of a common neural network. There are numerous approaches to modelling a fuzzy neural network. A data-driven learning method derived from neural network theory is used to train a neuro-fuzzy system based on an underlying fuzzy system. This heuristic only considers local information in order to cause local changes in the fundamental fuzzy system.

It can be represented as a set of fuzzy rules at any point in the learning process, including before, during, and after. As a result, the system can be initialised with or without prior knowledge of fuzzy rules. To ensure the semantic properties of the underlying fuzzy system, the learning procedure is constrained. A neuro-fuzzy system approximates an unknown n-dimensional function that is partially represented by training examples. As a result, fuzzy rules can be interpreted as hazy prototypes of the training data.

In the case of cooperative neural fuzzy systems, both the artificial neural network and the fuzzy system operate independently. The ANN attempts to learn the fuzzy system's parameters. This can be done either offline or online while the fuzzy system is in use. The diagram in Figure 2 depicts four different types of cooperative fuzzy neural networks.The upper left fuzzy neural network learns a fuzzy set based on the training data. Typically, this is accomplished by using a neural network to fit membership functions. Offline, the fuzzy sets are determined. They are then used to form the fuzzy system by fuzzy rules that are also given (rather than learned) [1-5].

Conflict of Interest

None.

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