

Decomposed Fuzzy Systems

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Abstract:

In the talk, a novel fuzzy structure termed as the decomposed fuzzy system (DFS) is proposed to act as the fuzzy approximator. The proposed structure is to decompose each fuzzy variable into layers of fuzzy systems and each layer is to characterize one traditional fuzzy set. Similar to forming fuzzy rules in traditional fuzzy systems, layers from different variables will form the so-called component fuzzy systems. The structure of DFS is proposed to facilitate minimum distribution learning effects among component fuzzy systems so that the learning can be very efficient. It can be seen from our experiments that even when the rule number increases, the learning time in terms of cycles is still almost constant. It can also be found that the function approximation capability and learning efficiency of the DFS are much better than that of the traditional fuzzy systems when employed in adaptive fuzzy control systems. Besides, in order to further reduce the computational burden, a simplified DFS is proposed in this study to satisfy possible real time constraints required in many applications. From our simulation results, it can be seen that the simplified DFS can perform fairly with a more concise decomposition structure. Furthermore, when used in modeling, the proposed DFS not only can have much faster convergent speed, but also can achieve a smaller testing error than those of other fuzzy systems.



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