A Fuzzy Neural Architecture for Supervised Learning and Classification of Temporal Sequences

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Abstract

The problem of learning and classifying ordered sequences is approached in this paper and a new architecture is proposed that incorporates elements from the Adaptive Resonance Theory (ART) and the theory of Fuzzy Sets.

The proposed architecture is composed of two stages. The first one is formed by a Fuzzy ART module that takes care of the unsupervised classification of the sequence components, and by a STORE module [1] that converts the sequence of category nodes provided by the Fuzzy ART to a spatial pattern. The second stage consists of another Fuzzy ART module and an associative memory.

The supervision is accomplished at the second stage, where a label is assigned to the global temporal sequence, that is introduced to the system. On the other hand, the spatial pattern produced by the first level is compared to the adaptive weights attached to the associative map, through a local distance that is based on the concept of fuzzy subset. This comparison permits the propagation of the supervision information to the first level, while taking advantage of the special form of the STORE patterns.

The proposed architecture extends the recently proposed Fuzzy ARTMAP [2] to the processing of temporal sequences, incorporating also an error checking mechanism at the level of an individual sequence component.

Experimental results are provided for the problem of on-line recognition of handwritten symbols, where each symbol is considered as a sequence of components. The obtained results compare favorably to those of a neural hierarchy [3] composed by ART2, ARTMAP and STORE modules, where the supervision information cannot be exploited at the symbol component level.

References

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