

# Fuzzy ARTMAP

Fuzzy ARTMAP is a class of neural network architectures that perform incremental supervised learning of recognition categories and multi dimensional maps in response to input vectors presented in arbitrary order.

The architecture, called fuzzy ARTMAP, achieves a synthesis of fuzzy logic and adaptive resonance theory (ART) neural networks by exploiting a close formal similarity between the computations of fuzzy subset hood and ART category choice, resonance, and learning.

Fuzzy ARTMAP also realizes a new mini-max learning rule that conjointly minimizes predictive error and maximizes code compression, or generalization. This is achieved by a match tracking process that increases the ART vigilance parameter by the minimum amount needed to correct a predictive error. As a result, the system automatically learns a minimal number of recognition categories, or "hidden units", to meet accuracy criteria. Category proliferation is prevented by normalizing input vectors at a preprocessing stage. A normalization procedure called complement coding leads to a symmetric theory in which the AND operator and the OR operator of fuzzy logic play complementary roles. Complement coding uses on cells and off cells to present the input pattern, and preserves individual feature amplitudes while normalizing the total on cell/off cell vector. Learning is stable because all adaptive weights can only decrease in time. Decreasing weights correspond to increasing sizes of category "boxes". Smaller vigilance values lead to larger category boxes. Improved prediction is achieved by training the system several times using different orderings of the input set. This voting strategy can also be used to assign confidence estimates to competing predictions given small, noisy, or incomplete training sets. Four classes of simulations illustrate fuzzy ARTMAP performance in relation to benchmark back-propagation and genetic algorithm systems.

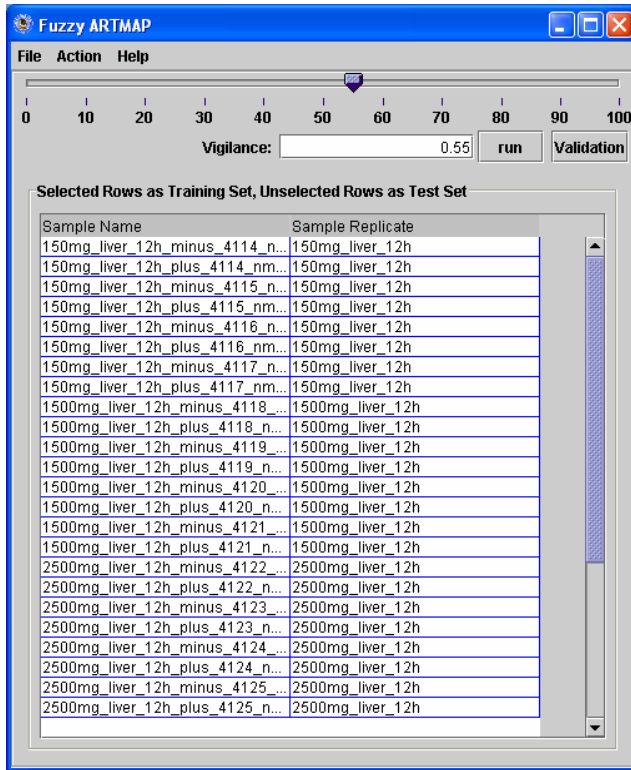
## Reference:

Fuzzy ARTMAP: A neural Network Architecture for Incremental Supervised Learning of Analog Multidimensional Maps

Gail A. Carpenter, Stephen Grossberg, Natalya Markuzon, John H.Reynolds,and David B. Rosen

IEEE Transactions on Neural Networks, Vol.3, No.5, (1992) 698-713.

(1) Validation – User may click button “Validation” to run validation with a given value of vigilance. Validation is to run Fuzzy ARTMAP leave one out as a test set and all rest as training sets.



(2) RUN – User may highlight a set of selected rows as training sets, and the rest of rows as test sets to RUN Fuzzy ARTMAP with a given value of vigilance.

