

## CSCI 447 — Machine Learning: Soft Computing

### Project #2

**Assigned: September 23, 2013; Due October 21, 2013**

This assignment requires you to extend your work from Project 1 by implementing a fuzzy neural network and comparing the result to a simple RBF network and MLP network (both of which were implemented previously). In this case, however, we will use a different problem – character recognition. You will use the following data sets from the UCI Machine Learning Repository:

- Artificial Character:  
<http://archive.ics.uci.edu/ml/datasets/Artificial+Characters>
- Letter Recognition:  
<http://archive.ics.uci.edu/ml/datasets/Letter+Recognition>
- Optical Recognition of Handwritten Digits:  
<http://archive.ics.uci.edu/ml/datasets/Optical+Recognition+of+Handwritten+Digits>
- Pen-Based Recognition of Handwritten Digits:  
<http://archive.ics.uci.edu/ml/datasets/Pen-Based+Recognition+of+Handwritten+Digits>
- Semeion Handwritten Digit:  
<http://archive.ics.uci.edu/ml/datasets/Semeion+Handwritten+Digit>

Your assignment consists of the following steps:

1. Implement the Adaptive Neuro-Fuzzy Inference System (ANFIS), incorporating a gradient descent method (similar to backprop) for adjusting the membership value weights and incorporating a least-squares method for determining the parameters of the polynomials.
2. Train an MLP (topology and parameters are your choice), RBF, and ANFIS network on the five character recognition problems above and assess the performance of the three algorithms on these classification problems.
3. Write a paper that incorporates the following elements, summarizing the results of your experiments:
  - (a) Title and author name
  - (b) A brief, one paragraph abstract summarizing the results of the experiments
  - (c) Problem statement, including hypothesis
  - (d) Description of algorithms implemented
  - (e) Description of your experimental approach
  - (f) Presentation of the results of your experiments
  - (g) A discussion of the behavior of your algorithms, combined with any conclusions you can draw
  - (h) Summary
  - (i) References (you should have at least one reference related to each of the algorithms implemented and any other references you consider to be relevant)
4. Submit your fully documented code, sample runs of each algorithm, and your paper. Your grade will be based 50% on the implementation and 50% on the summary paper.