Detection of Wildfires with Artificial Neural Networks. B.W. Umphlett[1], J.R. Leeman[1], M. Morrissey[1], [1]School of Meteorology, University of Oklahoma 120 David L. Boren Blvd. Suite 5900, Norman, OK, umphlett@ou.edu

Currently fire detection for the National Oceanic and Atmospheric Administration (NOAA) using satellite data is accomplished with algorithms and error checking human analysts. Artificial neural networks (ANNs) have been shown to be more accurate than algorithms or statistical methods for applications dealing with multiple datasets of complex observed data in the natural sciences. ANNs also deal well with multiple data sources that are not all equally reliable or equally informative to the problem.

An ANN was tested to evaluate its accuracy in detecting wildfires utilizing polar orbiter numerical data from the Advanced Very High Resolution Radiometer (AVHRR). Datasets containing locations of known fires were gathered from the NOAA's polar orbiting satellites via the Comprehensive Large Array-data Stewardship System (CLASS). The data was then calibrated and navigation corrected using the Environment for Visualizing Images (ENVI). Fires were located with the aid of shapefiles generated via ArcGIS. Afterwards, several smaller ten pixel by ten pixel datasets were created for each fire (using the ENVI corrected data). Several datasets were created for each fire in order to vary fire position and avoid training the ANN to look only at fires in the center of an image. Datasets containing no fires were also created.

A basic pattern recognition neural network was established with the MATLAB neural network toolbox. The datasets were then randomly separated into categories used to train, validate, and test the ANN. To prevent over fitting of the data, the mean squared error (MSE) of the network was monitored and training was stopped when the MSE began to rise. Networks were tested using each channel of the AVHRR data independently, channels 3a and 3b combined, and all six channels. The number of hidden neurons for each input set was also varied between 5-350 in steps of 5 neurons. Each configuration was run 10 times, totaling about 4,200 individual network evaluations. Thirty network parameters were recorded to characterize performance. These parameters were plotted with various data display techniques to determine which network configuration was not only most accurate in fire classification, but also the most computationally efficient. The most accurate fire classification network used all six channels of AVHRR data to achieve an accuracy ranging from 73-90%.