Automated Wildfire Detection and Prediction through Artificial Neural Networks

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We have tested and deployed Artificial Neural Network (ANN) data mining techniques to analyze remotely sensed multi-channel imaging data from MODIS, GOES, and AVHRR. The goal is to train the ANN to learn the signatures of wildfires in remotely sensed data in order to automate the detection process. We train the ANN using the set of human-detected wildfires in the U.S., which are provided by the Hazard Mapping System (HMS) wildfire detection group at NOAA/NESDIS. The ANN is trained to mimic the behavior of fire detection algorithms and the subjective decision-making by NOAA HMS Fire Analysts. We use a local extremum search in order to isolate fire pixels, and then we extract a 7x7 pixel array around that location in 3 spectral channels. The corresponding 147 pixel values are used to populate a 147-dimensional input vector that is fed into the ANN. The ANN accuracy is tested and overfitting is avoided by using a subset of the training data that is set aside as a test data set. We have achieved an automated fire detection accuracy of 85-90%, depending on a variety of ANN parameters and for different instrument channels among the 3 satellites. We believe that this system can be deployed worldwide or for any region to detect wildfires automatically in satellite imagery of those regions. These detections can ultimately be used to provide thermal inputs to climate models.