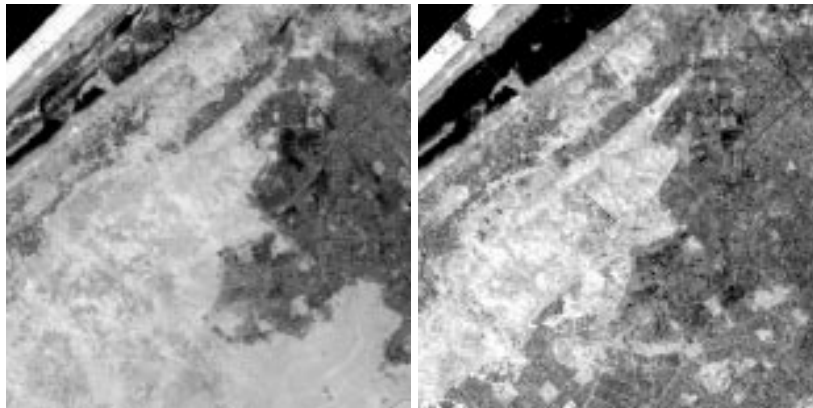


ARTMAP Neural Network Classification of Land Use Change

Gail A. Carpenter, Sucharita Gopal, Scott Macomber, Byron Shock, and Curtis E. Woodcock
Department of Cognitive and Neural Systems
677 Beacon Street, Boston MA 02215
email: bshock@cns.bu.edu

The ability to detect and monitor changes in conditions at the Earth's surface is essential for understanding human impact on the environment and for the assessment of the sustainability of development. In the next decade, NASA will be gathering higher dimensional data, including high resolution multi-spectral and multi-temporal data, that could be used for detecting and monitoring subtle long-term changes. Existing methods in change detection are not sufficient for dealing with subtle long-term changes and high dimensional data. The challenge for the future is to develop a general methodology for reliably detecting and monitoring changes in such data. This project explores several ARTMAP architectures as alternatives to a conventional system for classifying land use changes from a sequence of satellite images.

Landsat thematic mapper (TM) imagery of the Nile River delta provides a testbed for land use change classification methods. A sequence of ten Landsat TM images was taken over a period of ten years from 1984 to 1993. These images were taken at various times of year. Field data were collected during the summer of 1993 for 244 sites in the Nile Delta and surrounding desert areas. The field observations are grouped into the classes *urban*, *urbanization*, *reduced productivity*, *agriculture in delta*, *desert/coast reclamation*, *wetland reclamation*, *agriculture in desert/coast*, and *other*. *Urbanization* and *reclamation* represent land use changes. A particular challenge posed by this database is the unequal representation of various land use categories; *urban* and *agriculture in delta* comprise the vast majority of the database.



Subscene near Alexandria. Images were taken in 1984 (left) and 1993 (right).

More conventional methods of image analysis, based on the thresholding of multitemporal NDVI features, have been used to study change in this dataset [1]. While these methods have proven relatively successful, we will pursue the improvements possible using artificial neural networks. ARTMAP networks have been shown to be successful at classifying data from a single satellite image; similar approaches may be successful at classifying data from a sequence of satellite images. Many ARTMAP variants have been introduced for problems such as sonar classification and medical predictions. These will serve as a starting point for the present analysis.

We report here our pilot study findings as to the feasibility of using ARTMAP architectures for the land use change classification problem.

[1] Pax Lenney, M. et al. 1996. The status of agricultural lands in Egypt: The use of multitemporal NDVI features derived from Landsat TM. *Remote Sensing of Environment*.

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