



Geographic Information Science and Technology

# Geospatial-Temporal Statistics and Data Mining

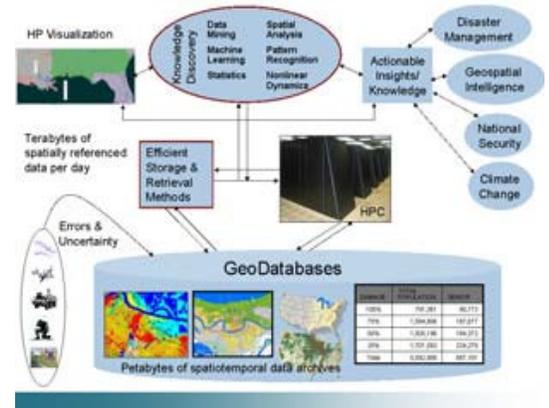
## Knowledge Discovery from Disparate, Dynamic, and Distributed Data

### Geographic Knowledge Discovery Challenge

Terabytes of heterogeneous, dynamic and geographically distributed data are generated each day from satellite and other remote sensors, sensor networks and infrastructures, as well as reports from field personnel. The need to generate predictive insights and actionable knowledge from the data is a pervasive requirement across multiple application domains ranging from climate change and disaster management to intelligence, security, and defense. However, the data analysis rate far exceeds the data acquisition rate, which represents a significant computational and data science challenge and demand innovative solutions.

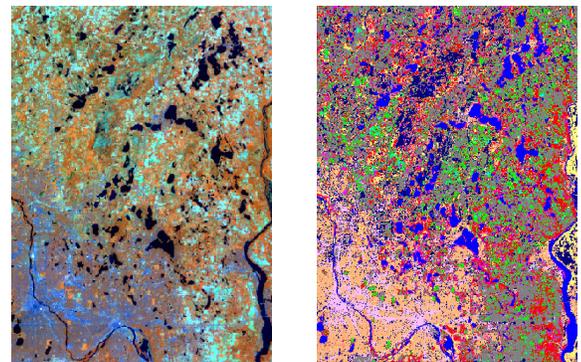
### Processes and Components

The geographical knowledge discovery solution process is defined to include two primary components: pattern detection or data mining and process modeling or data-driven simulations. A data integration component acquires and manages the data required to drive either component, while risk analysis and decision support frameworks transform the actionable predictive insights generated from offline discovery to tools for end-users, analysts and policy-makers. The focus on geospatial-temporal statistics and data mining is primarily on the pattern detection component of the overall process.



Geographic data analysis

- Data Science Tools:** The primary interest is in analyzing data that exhibit dependence among learning samples, which include most real-world time series, spatial and spatio-temporal data. The algorithmic and computational requirements must be expanded even as independence assumptions, or other commonly assumed limiting conditions, need to be relaxed. Our methodologies draw strength from traditionally disparate disciplines like statistics, data mining, computer science, nonlinear dynamics, signal processing, GIS and econometrics.
- Domain Science Solutions:** New methodologies have been developed, and existing or traditional techniques have been adapted in new ways, for scientific solutions in domains ranging from geospatial intelligence, climate change, disaster management, transportation security, infrastructural risk management, social behavior modeling, and threat cognizance.



Land Cover Classification

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