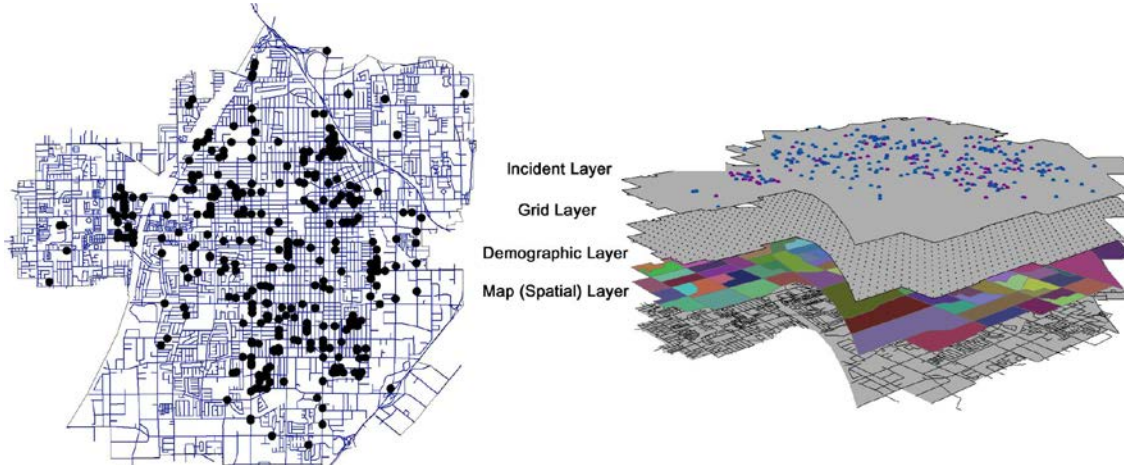
# Big Data Research Group




Our research group focuses its research on computational statistics and simulations as well as predictive technologies. Our research involves modeling, analyzing, and simulating dynamic systems characterized by complex logic and uncertain behaviors. Methodological interests in these areas include data-mining, simulation-optimization methods, and spatial-temporal data analysis. We are particularly interested in the representation, storage, dissemination, processing, analysis, and interpretation of large data sets.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"Developing the infrastructure and skills needed to handle big data."

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## Data Mining

During the recent years, the disciplines of data mining and operations research have been increasingly connected to each other. While the roots of both areas as wells as some particular issues are different, there are many main elements they have in common. Working with quantitative models in order to solve real-world problems in companies and organizations is perhaps the most visible aspect. Data mining contains many approaches that can support problem discovery; our group has a long history of developing new data mining algorithms for varied applications such as crime prediction, threat assessments, and health-status monitoring analysis of behavioral patterns.

## Data Fusion and Predictive Modeling

We have developed a data fusion process capable of taking data from multiple sources and combine using hierarchical models. These hierarchical models have components that represent the different sources of data and enable the estimation of the dependencies between the components. For example, we can combine multiple layers of remotely sensed data about an area such as slope, vegetation, surface materials, roads, hydrology, and man-man obstacles and use the resulting integrated model to predict land use. To make predictions for evolving or changing processes we use dependency structures. The methods we have developed can exploit massive amounts of contextual data but they can also use other aspects of the dynamic environment, such as, movements by objects and the changing characteristics of objects in the area. The overall hierarchical modeling framework we have constructed has broad applicability. However, it is only now being implemented in high performance environments for use on large, multi-type data integration problems.

## RECENT RESEARCH DEVELOPMENTS

- We designed the Culturally Aware Asymmetric Threat Tracker (CAATT) to enable soldiers to quickly understand the cultural context for their operations. The results from this work show that the CAATT has the potential to significantly improve cultural awareness, threat assessment, and operational planning.
- Chronic Obstructive Pulmonary Disease (COPD) affects millions of Americans and causes almost 140,000 deaths per year. Our work has examined the effects of environmental conditions on COPD admission at the zip code level to provide medical alerts.

## RECENT GRANTS

- DOD/Army – Integrated Culturally Aware Asymmetric Threat Tracking.
- Mitre – Environmental Surveillance Modeling
- Technology Service Corporation– Asymmetric Threat Tracking for Expeditionary and Counterinsurgency Basing

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