UCGIS to Host
Geospatial Visualization and Knowledge Discovery Workshop
November 18-20, 2003
National Conference Center, Lansdowne, Virginia

The University Consortium for Geographic Information Science (UCGIS) will hold a three-day workshop on geospatial visualization and knowledge discovery research. The workshop is sponsored through a grant from the Advanced Research and Development Activity (ARDA) and the United States Geological Survey (USGS).

The opening session of the workshop will be held on Tuesday, November 18th, from 10:00am to 2:30pm at the Center, and is open to all those interested in attending. This plenary session will provide an overview of the field's major research topics.

Advance registration is required. Please register on-line at http://www.ucgis.org/Visualization/ by November 11th. There is no fee and lunch is provided. Transportation will be provided from USGS Headquarters in Reston, Virginia. Other travel arrangements are being explored.

Schedule

10:00am—10:30am	Introduction and Overview Dr. Barbara Buttenfield Professor, University of Colorado at Boulder
10:30am—11:05am	Plenary 1 Geospatial and Spatio-temporal Knowledge Discovery: Overview and Agenda Dr. Harvey Miller Professor, Department of Geography University of Utah
11:05am—11:40am	Plenary 2 GIS Representation for Visualizing and Mining Geographic Dynamics Dr. May Yuan Associate Professor, Department of Geography University of Oklahoma
11:40am—12:00 noon	Discussion Question and Answer Plenary 1 and 2 Moderator Dr. Barbara Buttenfield
12:00noon—1:00pm	Lunch National Conference Center Cafeteria (included)
1:00pm—1:35pm	Plenary 3 The Integration Of Dynamic Data Within The Georgia Tech Virtual Geographic Information System (GTVGIS) Global Framework Dr. Nicolas Faust Image Interpretation and Visualization Branch Systems Analysis, Test and Simulation Division Electro-Optics, Environment and Materials Laboratory Georgia Tech Research Institute
1:35pm—2:10pm	Plenary 4 Wearable GIS for Homeland Security Applications: Accomplishments, Prospects and Research Issues Dr. Keith Clarke Professor and Chair, Department of Geography University of California at Santa Barbara
2:10pm—2:30pm	Discussion Question and Answer Plenary 3 and 4 Moderator Dr. Lynn Usery

Abstracts

Plenary 1: Geospatial and Spatio-temporal Knowledge Discovery: Overview and Agenda

Dr. Harvey J. Miller
http://www.geog.utah.edu/~hmiller/vita.html
harvey.miller@geog.utah.edu
801-585-3972 (voice)

Geographic information science has moved from a data-poor and computation-poor to a data-rich and computation-rich environment. The scope, coverage and volume of digital geographic datasets are exploding. Public and private sector agencies are creating, processing and disseminating digital data at very detailed levels of geographic resolution.

New high spatial and spectral resolution remote sensing systems and other monitoring devices are gathering vast amounts of geo-referenced digital imagery, video, and sound. Geographic data collection systems allow field researchers to collect unprecedented amounts of data. Location aware technologies such as cell phones, in-vehicle navigation systems and wireless Internet clients allow tracking of individual movement behavior in space and time. Information infrastructure initiatives such as the U. S. National Spatial Data Infrastructure are facilitating data sharing and interoperability. Digital geographic data repositories on the World Wide Web are growing rapidly in both number and scope. The amount of data that geographic information processing systems can handle will continue to increase exponentially through the mid-21st century.

This presentation provides an overview and identifies research frontiers in geographic and spatio-temporal knowledge discovery. I will first provide an overview of knowledge discovery from databases (KDD), including its rationale, generic techniques and the role of visualization in this complex process. I then argue that geospatial knowledge discovery (GKD) is a meaningful, non-trivial extension of KDD since: i) geospatial information has unique and underexploited properties; ii) geographic knowledge can enhance geographic information systems and science; iii) geographic science in general is experiencing a fundamental shift due to the new data-rich environment. I also identify some research frontiers in GKD. In the final part of the presentation, I will outline the possibilities and challenges of knowledge discovery in human space-time activities. This includes the underlying theories that dictate a shift in focus from place to person, the concept of unusual activities in space and time, and issues surrounding spatio-temporal privacy protection.

Plenary 2 GIS Representation for Visualizing and Mining Geographic Dynamics

Dr. May Yuan
http://geography.ou.edu/people/myuan.html
myuan@ou.edu
405-325-4293 (voice)

Geographic dynamics refers to the development of processes that shape our environment. While geographic dynamics is central to geographic understanding, the current GIS technology is incapable of capturing information that reflects the working of geographic processes, such as spread of a wildfire, development of a weather system, and propagation of a disease. Failure to represent geographic dynamics excludes GIS capability to mine information about spatiotemporal behaviors which can lead to new insights into understanding evolution and influences of geographic processes. Since geographic dynamics is, by definition, spatial and temporal, GIS data models must be able to handle temporal information to represent geographic dynamics. The current GIS data models organize data based on how data are collected and are location-based because geographic data are collected at a location or from an area. Geographic semantics (meanings) of a location are considered as attributes of the location. When time becomes necessary, geographic semantics of the location will be updated accordingly.

However, geographic dynamics requires an alternative approach to represent geography. One popular approach to discern geographic dynamics is through visualization: animate snapshot views of the process in a time sequence. In an animated view, the user identifies an object of interest and keeps track of its development. To automate identification of geographic dynamics in GIS, the alternative approach shall simulate the visualization process to represent geography. The focus should be placed upon geographic semantics that corresponds to processes. GIS data models should maintain spatial properties and

attributes of these processes over time, and hence represent geographic dynamics. In doing so, GIS can provide direct support to analyze and visualize spatiotemporal behaviors of processes, retrieve and compare geographic processes, understand the dynamics involved in geography. The presentation will outline the alternative approach in contrast with other spatiotemporal GIS data models, examine hierarchies of geographic semantics, space, and time, and suggest a research agenda to advance geographic representation that can facilitate visualization and mining geographic dynamics.

Plenary 3 Dr. Nicolas Faust
nick.faust@gtri.gatech.edu
404-894-0021 (voice)

Georgia Tech has been involved in the development of Virtual GIS capability since the middle 1990's and has developed tools for data discovery and visualization of extremely large data stores. GIS query and other GIS functions occur within the 3 and 4 D visualization environment. The GTVGIS framework is being integrated with dynamic numerical models such as the Penn State MM5 weather model and various 2 and 3 D plume models for atmospheric dispersion. A joint (Georgia Tech/ University of Oklahoma) NSF funded project for large data visualization has focused on the true 4 dimensional visualization of weather radar data from NEXRAD systems and the application of detection algorithms to the reflectivity and velocity data for multiple radars. This project involves a significant collaboration between the project schools and the National Severe Storm Laboratory (NSSL) in Norman Oklahoma. The key is to develop new ways to visualize the raw weather data and to assist in the development of the next generation detection algorithms for severe weather in conjunction with NSSL. New volumetric visualization techniques are being developed in an integrated framework based on the quadtree and octtree structures of GTVGIS. Research is being conducted in the dynamic assimilating of the massive amounts of data available over OpenGIS and ArcIMS interfaces and their insertion into the efficient architectures necessary for real time visualization on personal computers.

Plenary 4: Wearable GIS for Homeland Security Applications
Dr. Keith Clarke
http://www.geog.ucsb.edu/~kclarke
kclarke@ncgia.ucsb.edu
805-893-7961 (voice)

Under the NSF-funded Digital Government Initiative Project Battuta (http://dg.statlab.iastate.edu/dg/) valuable experience has been gained about the design, construction and use of a wearable system that combines basic GIS functionality and augmented reality display to assist human navigation. A UCSB wearable system has been designed and built, and a prototype user interface for the system (GEORGE) coded and implemented in Java. In this presentation, the accomplishments and findings from Battuta will be summarized, and used to provide an informed view of the possible capabilities of future systems. To get to this future, key research obstacles must first be overcome, and some of these are cataloged and assessed. Central among them are asic human cognitive responses to navigation assistance, human-computer interface concerns, problems of cognitive overload and stress, and distraction problems similar to those for cellular telephones. While it remains to be proven that wearable computing, using today's technology, is superior to other types of navigational assistance, this will clearly not remain the case for very long. Probably the dominant theme in the near future will be the migration to a standard wearable platform based on commercial off-the-shelf technology melded with custom software for visualization.

The National Conference Center is located at:
18980 Upper Belmont Place
Lansdowne, VA 20176
http://www.conferencecenter.com

For more information please contact:
Susan McDonald Jampoler
UCGIS Executive Director
execdir@ucgis.org
http://www.ucgis.org/Visualization
703-779-7980 (voice)
703-771-1635 (fax)