SPARCS Lab

COMPUTATIONAL GEOMETRY IN SPATIAL ANALYSIS: ON THE PATH TO CONVERGENCE

About us

- SPARCS Laboratory for Spatial Analysis and Computational Science

  Location: ICT 725, 7th Floor

- Co-Founded by
  - Dr. Stefania Bertazzon,
  - Dr. Marina Gavrilova

- Sponsored by:
  - GEOIDE Network of Excellence,
  - Dept. of Geography,
  - Dept. of Computer Science
  - Faculty of Science,
  - Faculty of Social Sciences,
  - Faculty of Medicine,
  - MGIS Program,
  - Geo/SQL,
  - OptimaNumerics Technologies

Research Goals

- To develop the methodology for spatial autocorrelation analysis based on the weighted metric functions
- To identify the set of applied problems for which the methodology would result in the significant improvement over existing methods for spatial analysis, as well as public/private sector agencies that would benefit from such developments
- To analyze the spatial variation of heart disease and investigate the relationship between disease incidence and lifestyle indicators
- To link socio-economic, geographic and environmental factors to enhances the predictive capacity of the model

Secondary Research Objectives

- To specify a dynamic model for the detection of spatio-temporal trends. The model can serve for cross-temporal comparisons, and for studying the evolution of the functional parameters, their statistical significance, and their elasticity.
- To use alternative distance metrics for an accurate measurement of the spatial autocorrelation in the data: this measurement ensures the *efficiency* of the model.
- To apply the proposed metrics for the measurement of distance for route design and the provision of routine and emergency services, and optimal facility location using location-allocation models.
- To implements the uni- and multi-variate (auto)correlation indices and to definition the topology based contiguity among different spatial objects.
- To investigation spatial patterns using advanced computational methods, closely related to the methodology used to develop the spatial regression model.
- To implement adequate visualization tools for the representation of spatial data and the communication of analytical results.

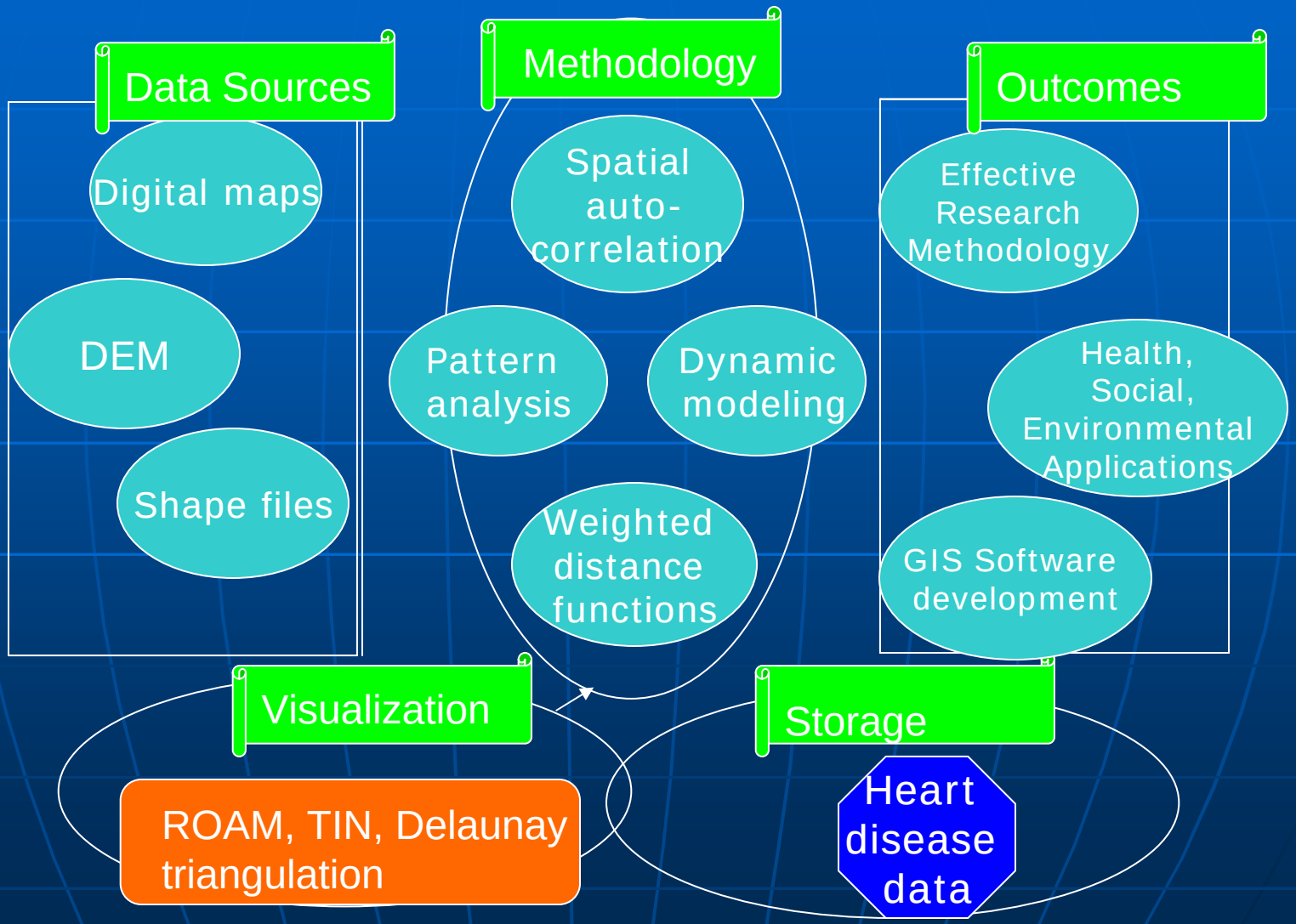
Focus of Research

- Computational methods in spatial analysis
- Investigation of spatio-temporal phenomena
- Application of the spatial analysis to health and social sectors
- GIS real-time terrain modeling and visualization
- Autocorrelation studies using weighted distance functions
- Methods for selection of Lp norms for city planning
- Dynamic grid-based approach to statistical analysis of census and population data
- Pattern matching and point pattern analysis using computational geometry methods
- Application of the Voronoi diagram and Delaunay triangulation methodology to GIS problems

Geometric proximity and topology

- Methods based on concepts of proximity of geometric sets and extracting and utilizing topological information on the data are:
  - Techniques for computing the parametric surface, boundary or medial axis transform for the region
  - Distance distribution computation using weighted metric functions
  - Use of Voronoi diagram and Delaunay triangulation for data processing and analysis
  - Topology-based approach for point pattern analysis
  - Computational geometry methods for pre-processing and pattern matching
  - Nearest-neighbor computation for autocorrelation
  - Visualization of spatial patterns and relationships among variables using topology-based models such as TIN, PM and ROAM models.
  - Use of generalized Delaunay triangulation for representation of diverse attributes (medical, socio-economical and environmental).

Methodology



CG methods

Sponsors

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- Industry:
- Heuchera Technologies
- Microsoft Inc.
- GEO SQL
- Auto-Trol Technoligies
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International and National Collaborators

- GEOIDE Network of Excellence, Canada
- International Center for Voronoi Diagram Research, Korea
- University of Santa Barbara, USA
- Hong Kong Polytechnic University, Hong Kong
- University of Tokyo, Japan
  University of Texas, USA
- University of Vancouver, Canada
- University of Victoria, Canada
- University of Halifax, Canada