



Center for Spatially Integrated Social Science

# The CSISS Tools Project

**Luc Anselin**

University of Illinois, Urbana-Champaign

anselin@uiuc.edu

# Outline

---

- **Background**
- **Overview of Activities**
- **Future Directions**

---

# Background

# Background

---

- **Lack of spatial data analysis software seen as major impediment**
  - **much progress** made
    - » SpaceStat, S+SpatialStats, ArcGIS Geostats Analyst
    - » point patterns and geostats in Systat, SAS, etc.
    - » open source modules, R, XlispStat
  - **tension**
    - » need for user-friendliness, access to basic methods
    - » state of the art spatial econometric methods
  - **both functionality and training/education**

# Delivery Mechanisms

---

- **Commercial Platforms (Closed Source)**
  - start from GIS
  - start from statistical/econometric software
    - » implemented as macros, scripts, libraries, modules
    - » new technologies: COM/CORBA components
    - » need to handle data models for spatial information
- **Open Source**
  - self-contained (no other software needed) or based on **toolboxes** (R, XlispStat)
  - **cross-platform**
  - extensible, open architecture

# CSISS Tools Program Efforts

---

- **Software Tools Clearing House**
- **Dynamic ESDA with GIS**
- **The OpenSpace Project**
- **The WebSpace Project**

---

# Activities Overview

# 1. Software Tools Clearing House

---

## ➤ Search Engine

- specialized searches focused on spatial data analysis methods and software

## ➤ Links to Portals

- portals with links to spatial data analysis sites

## ➤ Links to Tools

- selected software sites, academic, commercial, public sector, individuals




Center for Spatially Integrated Social Science (CSISS) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Mail News RSS User

Address <http://www.csis.org/> Go



**The CSISS Mission** recognizes the growing significance of space, spatiality, location, and place in social science research. It seeks to develop unrestricted access to tools and perspectives that will advance the spatial analytic capabilities of researchers throughout the social sciences. CSISS is funded by the [National Science Foundation](#) under its program of support for infrastructure in the social and behavioral sciences.

**CSISS News** [Apply now for the 2002 CSISS Summer Workshops!](#)

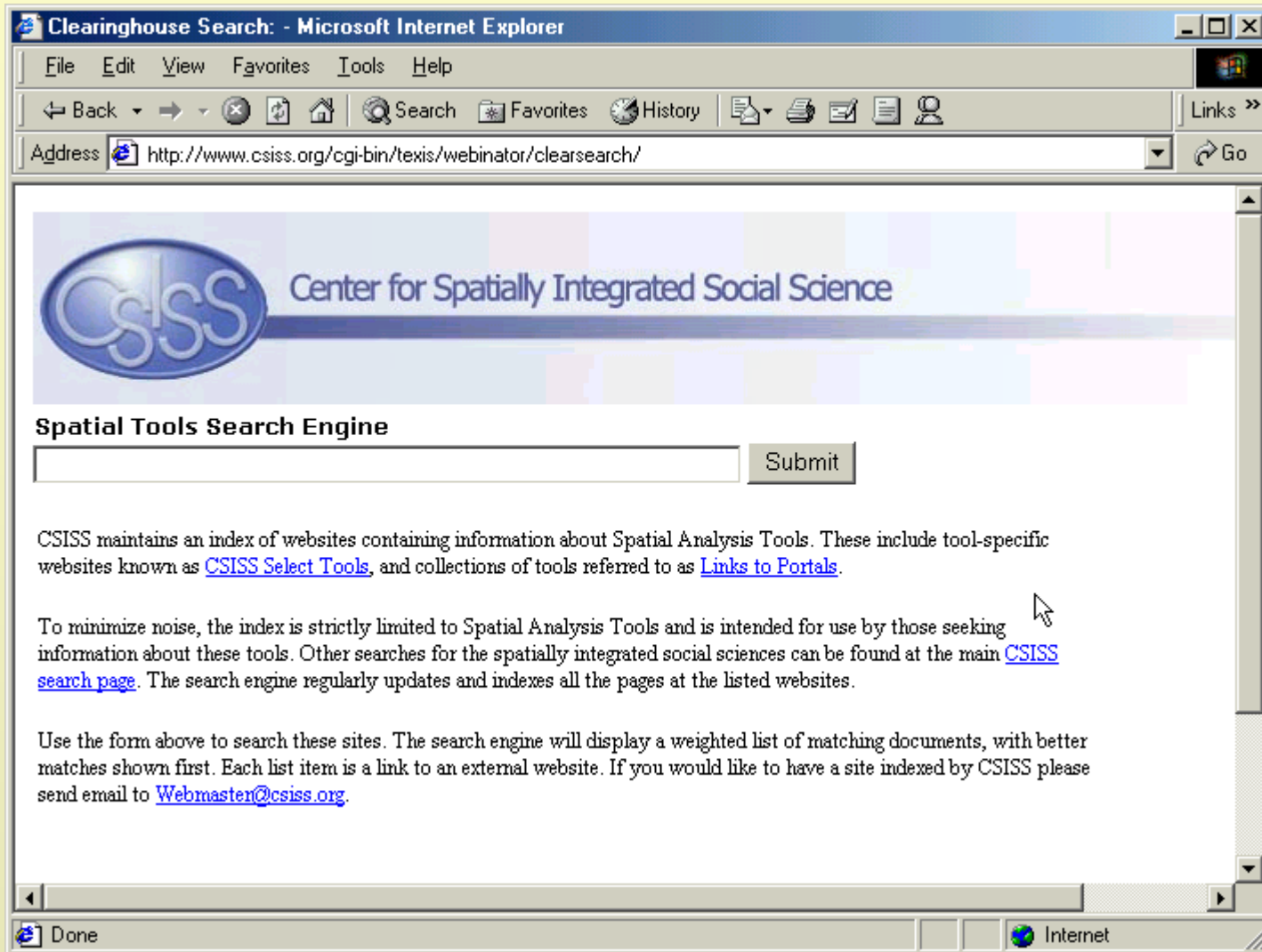
Core Programs	Learning Resources	Spatial Resources	Spatial Tools
These six infrastructure programs form the core of the Center's activities.	These introductory materials include <a href="#">CSISS Classics</a> and <a href="#">select video clips</a> from the CSISS summer workshops.	CSISS has compiled e-journals, bibliographies, and other spatial resources for the social sciences.	<a href="#">Spatial Tools Search Engine</a> <a href="#">Select Tools</a> <a href="#">Links to Portals</a>
Search Engines	CSISS Events	Community Center	About CSISS
Try CSISS's custom search engine to find spatial analysis resources on the Internet.	Here's where you'll find information and registration for workshops, conferences and specialist meetings.	Join one of the forums on topics such as spatial equity, spatial externalities, and spatial econometrics.	CSISS people, programs and the original NSF proposal are described here.

[Core Programs](#) | [Learning Resources](#) | [Spatial Resources](#) | [Spatial Tools](#) | [Search Engines](#) | [CSISS Events](#) | [Community Center](#) | [About CSISS](#)  
[Site Map](#) | [Site Search](#) | [Contact CSISS](#) | [Plug-ins](#) | [Privacy Policy](#) | [Site Credits](#) | [Home](#)

Copyright © 2001 by Regents of University of California, Santa Barbara

Internet

# Spatial Tools Search Engine




Clearinghouse Search: - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Mail News RSS User Links >>

Address <http://www.csiss.org/cgi-bin/texis/webinator/clearsearch/> Go

 Center for Spatially Integrated Social Science

## Spatial Tools Search Engine

CSISS maintains an index of websites containing information about Spatial Analysis Tools. These include tool-specific websites known as [CSISS Select Tools](#), and collections of tools referred to as [Links to Portals](#).

To minimize noise, the index is strictly limited to Spatial Analysis Tools and is intended for use by those seeking information about these tools. Other searches for the spatially integrated social sciences can be found at the main [CSISS search page](#). The search engine regularly updates and indexes all the pages at the listed websites.

Use the form above to search these sites. The search engine will display a weighted list of matching documents, with better matches shown first. Each list item is a link to an external website. If you would like to have a site indexed by CSISS please send email to [Webmaster@csiss.org](mailto:Webmaster@csiss.org).

Done Internet

# Links to Spatial Tools Portals


**Spatial Tools Links to Portals - Microsoft Internet Explorer**

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Print Mail News RSS

Address <http://www.csiss.org/clearinghouse/links.php3> Go

Return Home Core Programs Learning Resources Spatial Resources **Spatial Tools** Search Engines CSISS Events Community Center About CSISS

 Center for Spatially Int

**Spatial Tools Links to Portals**

Below is a list of *portals*, i.e., collections of links, found useful to researchers of spatial phenomena in the social sciences. All portals listed here have been comprehensively indexed and are searchable at the [CSISS Spatial Tools Search Engine](#).

If you have comments, have found an error, or would like to nominate a portal for inclusion please contact the Tools Manager, Luc Anselin at [anselin@uiuc.edu](mailto:anselin@uiuc.edu).

**Spatial Analysis Tools**

- [AI-Geostats](#). Large collection. The central place for GIS and Spatial Statistics on the web.
- [Social Science Statistical Lab.](#) Spatial Analysis links for social scientists from Yale University.
- [Spatial Analysis Starting Points](#). Additional GIS and Spatial Analysis Links from Georgia.

Done Internet

# Select Tools


**Spatial Tools Clearinghouse - Microsoft Internet Explorer**

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History Links

Address <http://www.csiss.org/clearinghouse/select-tools.php3> Go

[Return Home](#) [Core Programs](#) [Learning Resources](#) [Spatial Resources](#) **[Spatial Tools](#)** [Search Engines](#) [CSISS Events](#) [Community Center](#) [About CSISS](#)

 **Center for Spatially Interacting Systems**

[Spatial Tools Search Engine](#) [Select Tools](#) [Links to Portals](#) [back](#)

## CSISS Select Tools

Below is a list of *Spatial Analysis Tools*. CSISS researchers have chosen these tools for their usefulness in aiding the exploration and analysis of spatial phenomena in the social sciences. This list is by no means complete and, it is hoped, will continue to grow with input from the research community. Inclusion on this list is not an endorsement by CSISS. If you have comments, have found an error, or would like to nominate a tool for inclusion please contact the Tools Manager, Luc Anselin at [anselin@uiuc.edu](mailto:anselin@uiuc.edu).

All websites on this page have been comprehensively indexed by the [CSISS Spatial Tools Search Engine](#).

### Cartographic Data Visualizer (CDV)

<http://www.kinds.ac.uk/kinds/cdv.htm>  
A visual, interactive, graphic front end for analyzing spatial datasets.

### ClusterSeer

[http://www.terraseer.com/csr/clusterseer\\_features.html](http://www.terraseer.com/csr/clusterseer_features.html)  
ClusterSeer provides statistics for evaluating disease clusters in space and time.

### CrimeStat

<http://www.icpsr.umich.edu/NACJD/crimestat.html>  
A spatial statistics program for the analysis of crime incident locations.

### Fragstats

<http://www.umass.edu/landeco/research/fragstats/fragstats.html>  
Computation of wide variety of landscape metrics for categorical map patterns.

Done Internet

## 2. Dynamic ESDA with GIS

---

### ➤ Goal

- add ESDA functionality to a GIS functionality through **dynamically linked windows**

### ➤ DynESDA2

- freestanding executable in MapObjects
- exploratory spatial data analysis of lattice data (points, regions as objects)

# DynESDA Antecedents

---

- **Link ArcInfo-SpaceStat**
- **Link ArcView-SpaceStat**
  - SpaceStat Extension for ArcView
    - » visualize **ESDA results** from SpaceStat
    - » construct **spatial weights**
  - DynESDA Extension for ArcView
    - » **dynamic linking** of View and statistical graphs
    - » link map, histogram, box plot, scatterplot
    - » Moran Scatterplot

# DynESDA2 Design

---

- **Map as One of the Views**
  - no longer ArcView driven
  - MapObjects Lite for mapping functionality
  - **multiple maps** linked
  - transparent selection identifier
- **Modular Design**
  - modules for statistical graphics
    - » histogram, box plot, scatterplot
  - modules for mapping function
  - linked through common bitmap

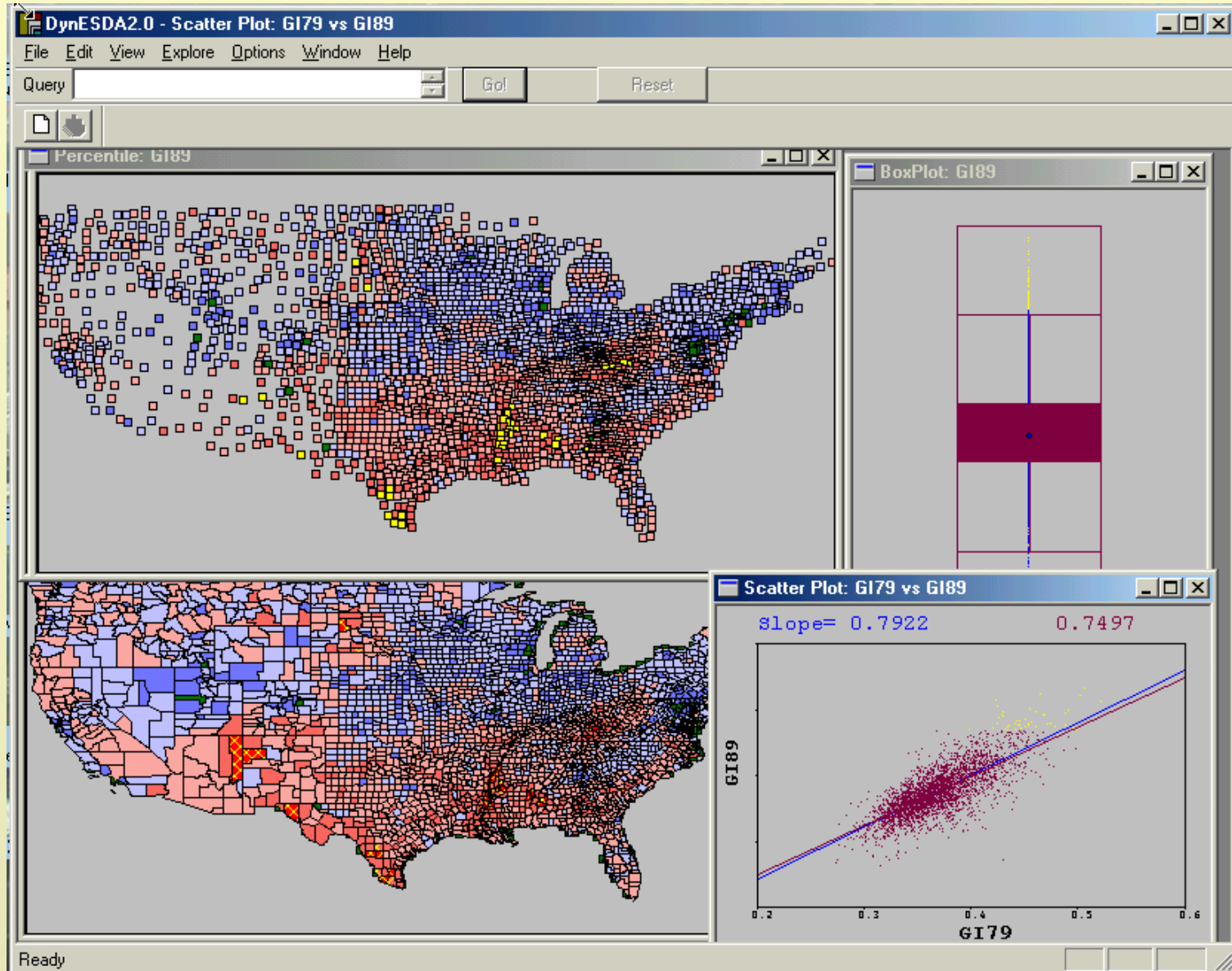
# New Features

---

- **Data Structure**
  - both **polygon and point** shape files
  - Thiessen polygons – centroids
- **Brushing**
  - brushing of **multiple maps**
  - **map movie**
  - linking to table
- **Visualizing Spatial Autocorrelation**
  - **generalized Moran** scatterplot
  - linking and brushing **LISA maps**



# Linking Point and Polygon Maps



# 3. OpenSpace Project

---

## ➤ Goal

- develop collection of open source spatial data analysis modules that incorporate state of the art methods
  - » moving target requires open environment

## ➤ Organization

- core development team at UIUC
- facilitating a community of collaborators

# OpenSpace Development

---

## ➤ Cross Platform Tools

- open source software development
  - » Python + Numpy, Java
  - » to run on linux, windows, mac
- open source toolboxes
  - » R, XlispStat, ...

# OpenSpace Functionality

---

## ➤ Modular

- common kernel of basic classes
- develop collection of modular components
  - » library, modules, packages
  - » all the basic techniques (estimation, diagnostics)
  - » open design allows for high end users/programmers

# 4. The WebSpace Project

---

## ➤ Goal

- incorporate spatial data analysis functionality into internet mapping

## ➤ Organization

- built on **GeoTools**, Java applets
- funded in part by NCOVR
  - » application to homicide rate analysis

# WebSpace Functionality

---

- **Outlier Mapping**

- percentile, box maps

- **Rate Smoothing**

- rate mapping
- empirical Bayes and spatial rate smoothing

- **Spatial Autocorrelation**

- global and local spatial autocorrelation

---

Future

# What's Next

---

- **Tool Developers Specialist Meeting**
  - compendium/showcase of tools
  - discussion (white paper) on **standards, interoperability, functionality, dissemination**
- **Ongoing Population of Search Engines**
  - establish clearing house as major resource for social science researchers
- **DynESDA2 Beta Release**
  - self-contained executable
  - late spring 02



# What's Next (2)

---

- **Template for Linear Regression**
  - libraries in XlispStat, Python, Java
  - links to related work (R project)
    - » diagnostics for spatial effects
    - » ML estimation of spatial regression
    - » IV/GMM estimation of spatial regression
- **Web-Based Spatial Analysis**
  - built on GeoTools (Java) applets
    - » mapping, smoothing rates, global and local spatial autocorrelation
  - on-line late spring 02

# Future Directions

---

- **Performance Issues**
  - extend DynESDA functionality to very large data sets
    - » spatial data mining
- **Extend Spatial Regression Tools**
  - space-time regression models
  - spatial probit
  - Bayesian methods
- **New Platforms**
  - enhance web-based spatial data analysis
  - explore new delivery platforms