Center for Spatially Integrated Social Science

The CSISS Tools Project

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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

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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 **CSISS Classics** and **select video clips** from the CSISS summer workshops.	CSISS has compiled e-journals, bibliographies, and other spatial resources for the social sciences.	**Spatial Tools Search Engine** **Select Tools** **Links to Portals**

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.

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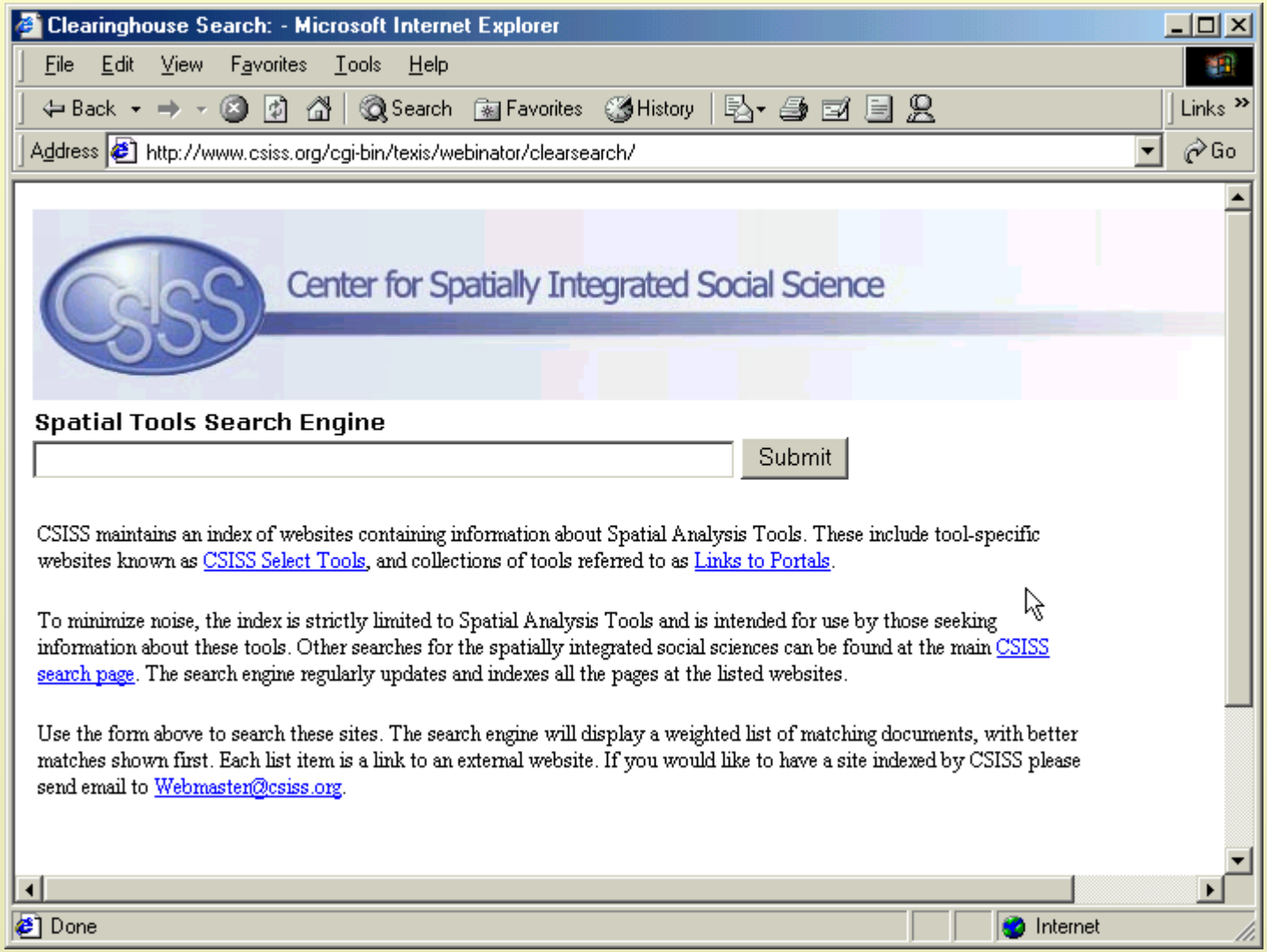
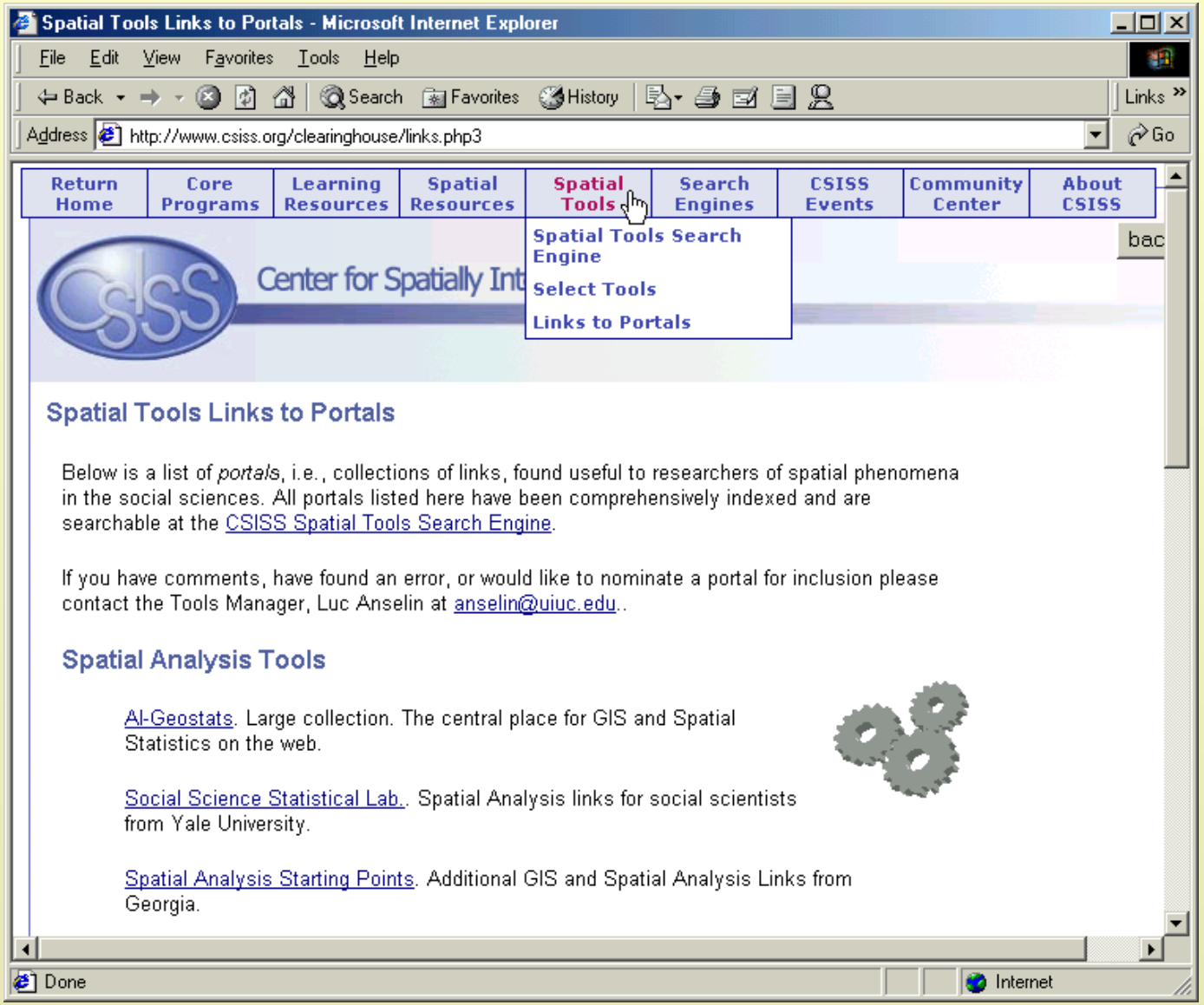
Internet

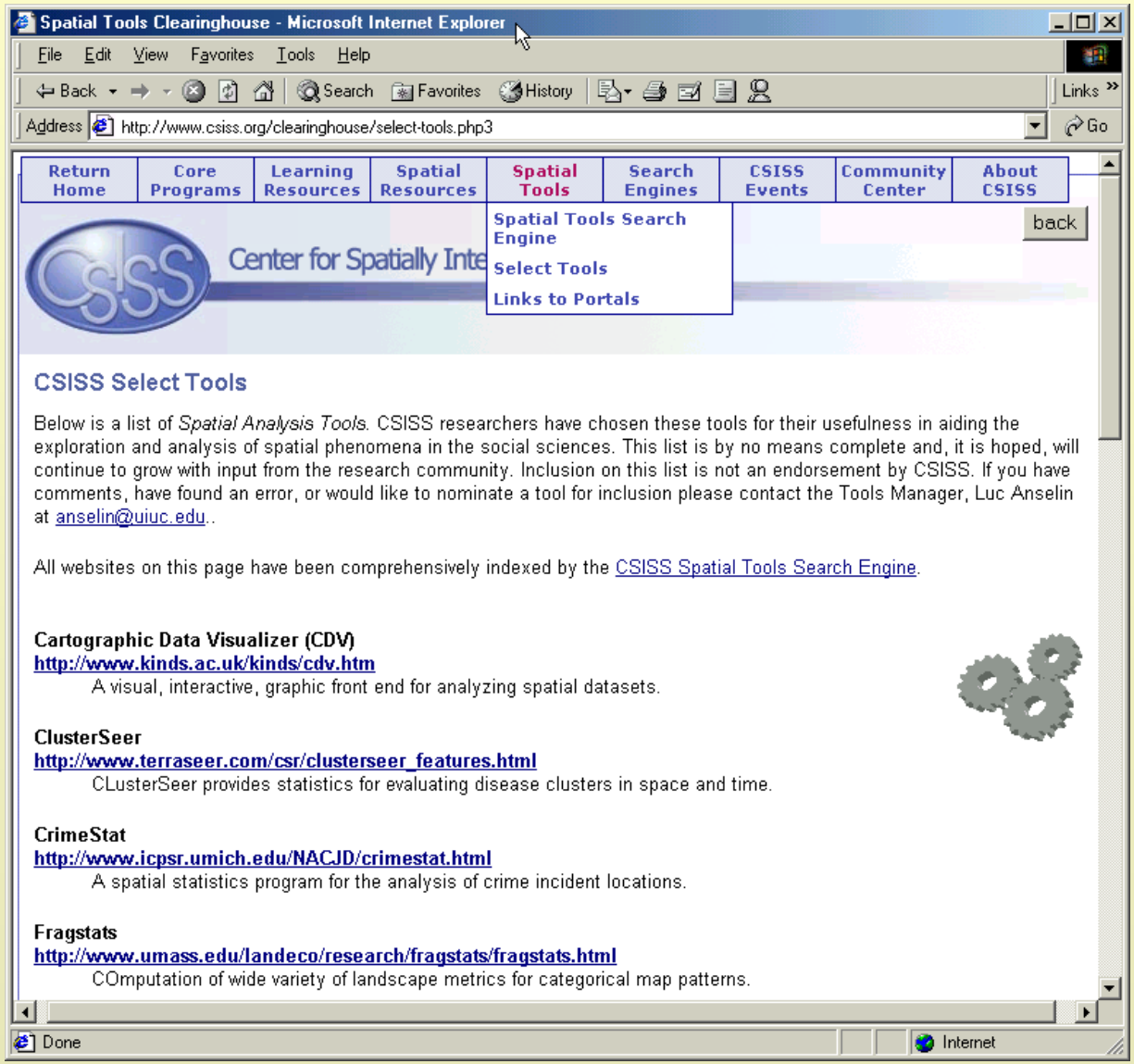
Spatial Tools Search Engine



Links to Spatial Tools Portals



Select Tools



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

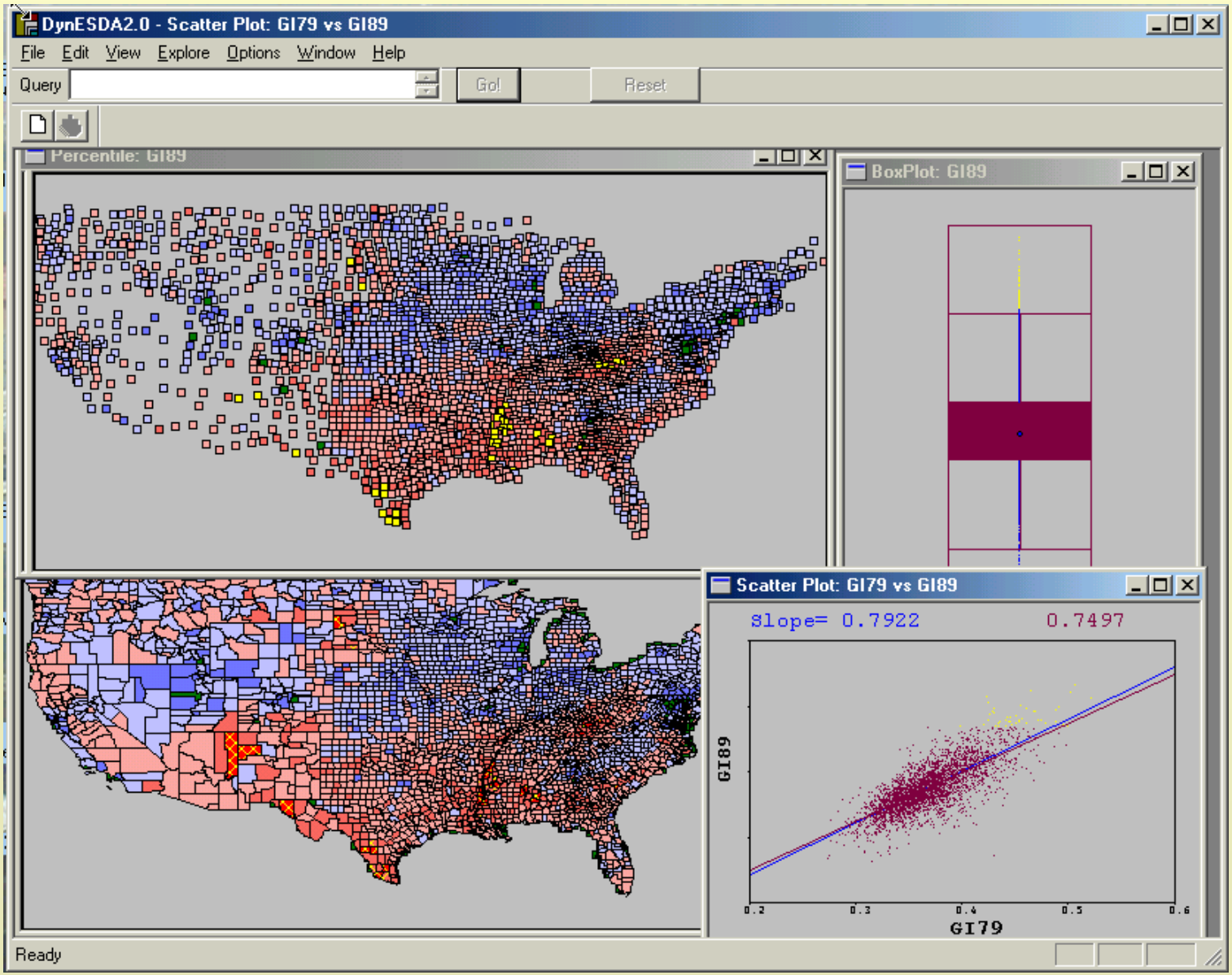
DynESDA2 Design

- **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