

Introduction to Geographic Information Analysis

SERGIO REY

Geographic Information Analysis

School of Geographical Sciences and Urban Planning
Arizona State University



Geographic Information Analysis by Sergio Rey
is licensed under a Creative Commons Attribution 4.0 International License.

1 GIS and Spatial Analysis

- Big Picture
- What is Spatial Analysis?

2 EDA and ESDA

- Exploratory Data Analysis (EDA)
- Exploratory Spatial Data Analysis (ESDA)

1 GIS and Spatial Analysis

- Big Picture
- What is Spatial Analysis?

2 EDA and ESDA

- Exploratory Data Analysis (EDA)
- Exploratory Spatial Data Analysis (ESDA)

GIS Then



GIS Then





Nearby: [North Austin](#) [South Austin](#) [West Humboldt Park](#) [Ward 30](#) [Ward 37](#)

Categories

Latest news

Bike rack installations

Building permits

Business licenses

Business reviews

City press releases

Crimes

Filming

Liquor license applications

Lost and found postings

News articles

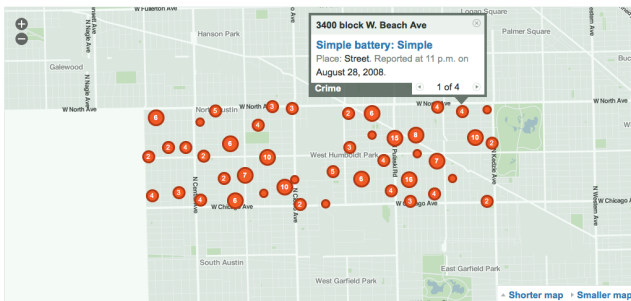
Photos

Property transfers

Latest news in 60651

Timeline [By news type](#)

Stay up to date: [Custom RSS feeds](#) [E-mail updates](#)



NEW ON EVERYBLOCK YESTERDAY

DECEMBER 1, 2008

1 news article

About

[Survivors talk about Our Lady of Angels fire](#)

[Avers and Iowa](#)



Have you found any news nearby that we don't know about? [Please](#)

Anselin-Getis (1992) Taxonomy

- Input
- Storage
- **Analysis**
- Output

Many other taxonomies

Goodchild (1992)

- cross-disciplinary
- **central** role for spatial analysis
- scientific **glue**

1 GIS and Spatial Analysis

- Big Picture
- What is Spatial Analysis?

2 EDA and ESDA

- Exploratory Data Analysis (EDA)
- Exploratory Spatial Data Analysis (ESDA)

What is Spatial Analysis?

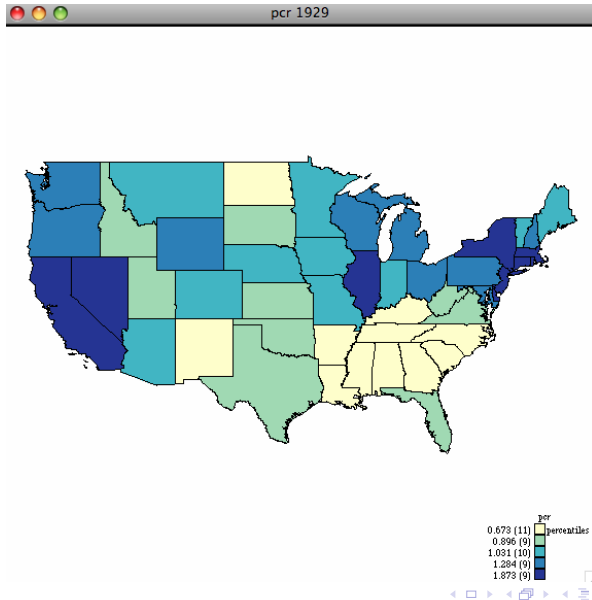
From Data to Information

- **Beyond** mapping
- **added value**
- transformations, manipulations and application of analytical methods to spatial (geographic data)

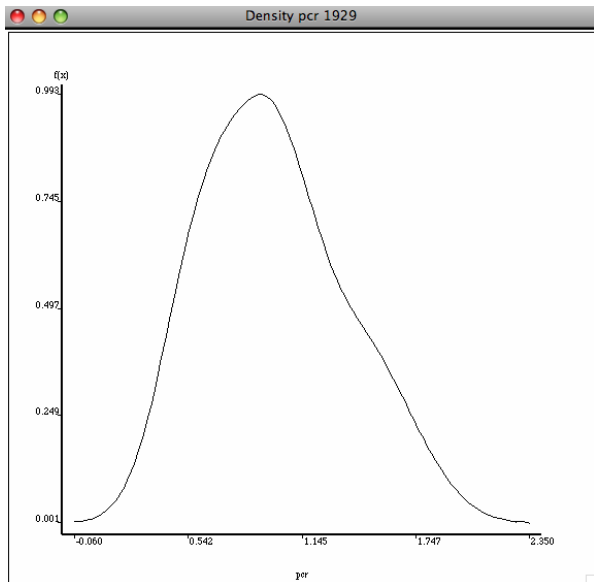
How Insights Change with location

- spatial analysis is **not** locationally invariant
- the results change when the locations of the study objects change
- **where** matters

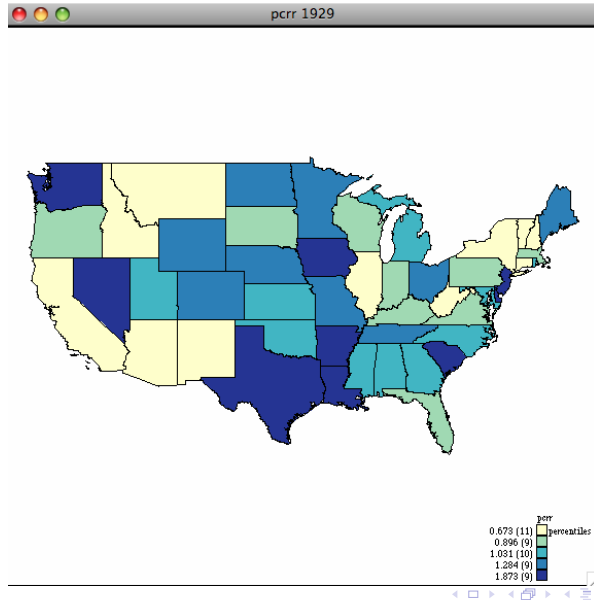
State Income Distributions 1929



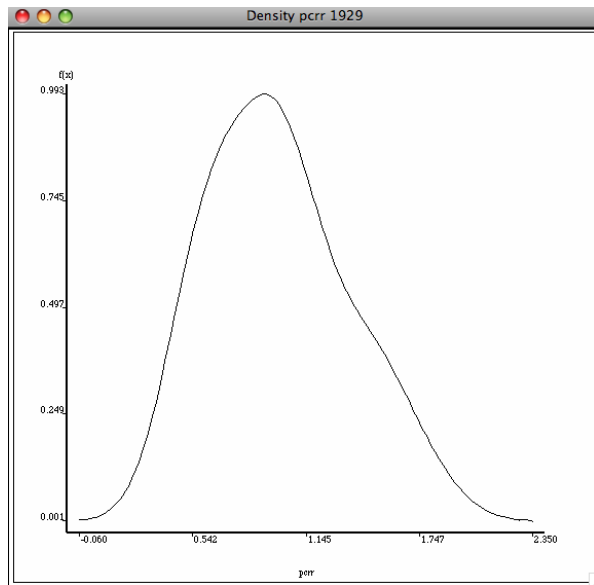
State Income Distributions 1929



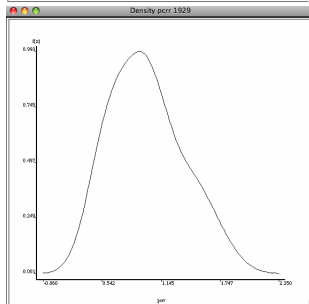
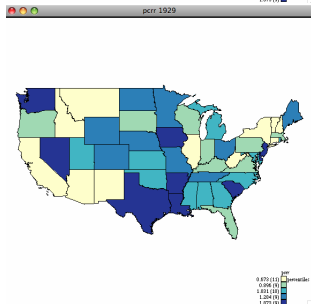
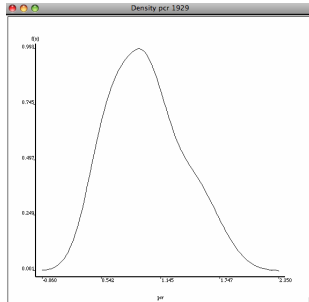
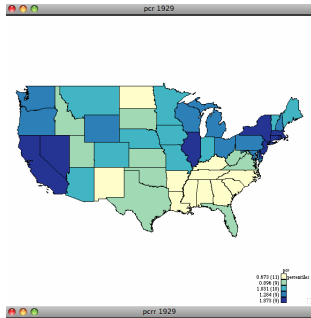
Randomized Income Distribution 1929



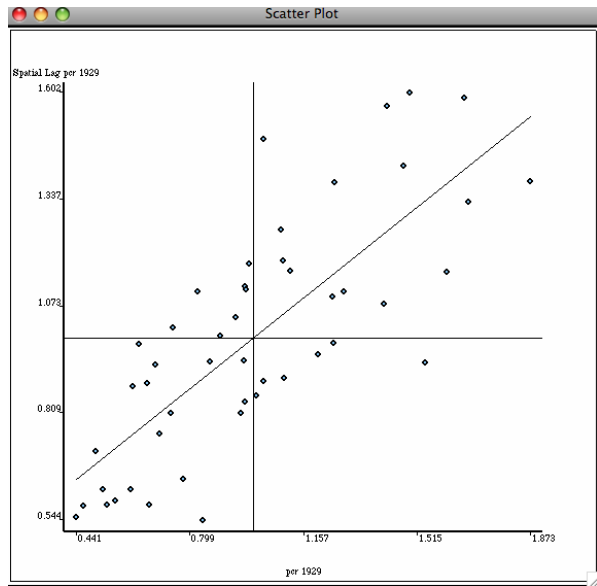
Randomized Income Density 1929



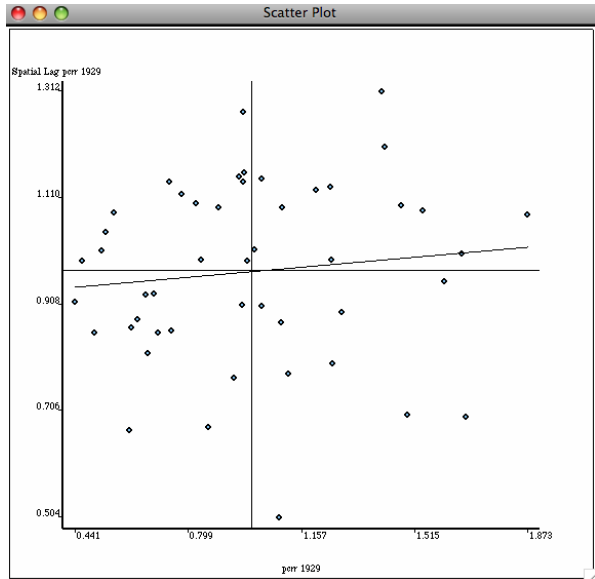
Locational Invariance



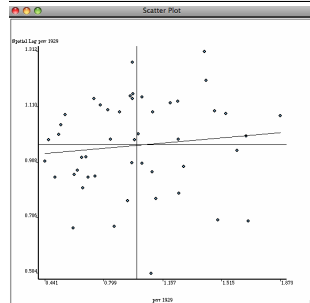
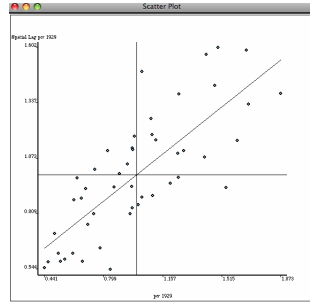
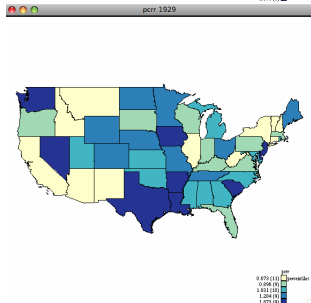
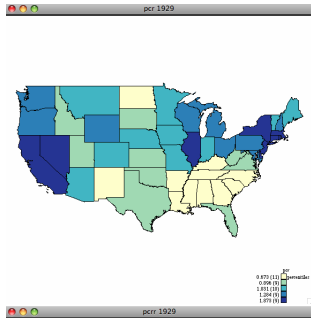
Spatial Autocorrelation Income 1929



Spatial Autocorrelation Randomized Income 1929



Locational Variance



Components of Spatial Analysis

Mapping and Geovisualization

showing interesting patterns

Exploratory Spatial Data Analysis

discovering interesting patterns

Spatial Modeling

explaining interesting patterns

Summary: Spatial Analysis

Beyond Mapping

Central role for **analysis**

Distinguished by Locational Variance

Location matters

Components

Showing, discovering, explaining

1 GIS and Spatial Analysis

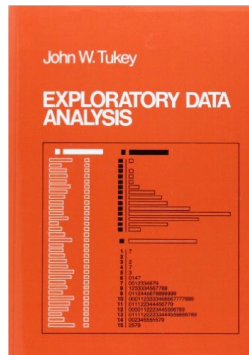
- Big Picture
- What is Spatial Analysis?

2 EDA and ESDA

- Exploratory Data Analysis (EDA)
- Exploratory Spatial Data Analysis (ESDA)

EDA: John Tukey (1977)

- EDA is an approach, not simply a set of techniques, but an attitude/philosophy about how a data analysis should be carried out.
- Postpones the usual assumptions about what kind of model the data follow

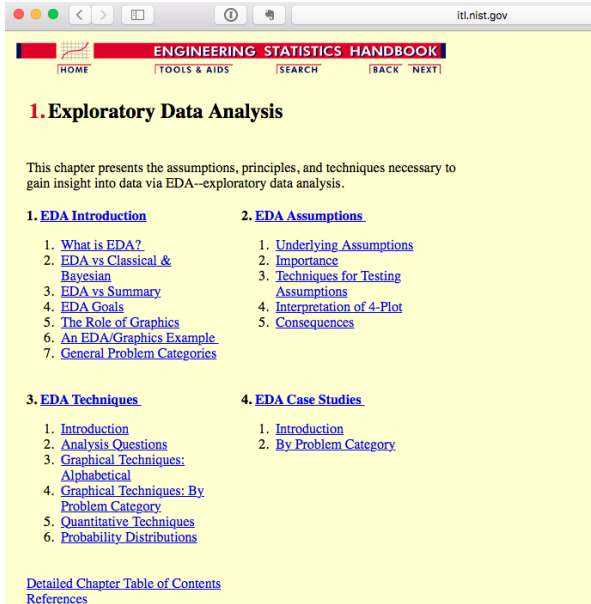


Goals and Purpose of EDA

Set of techniques to

- maximize insight into a data set
- uncover underlying structures
- extract important variables
- detect outliers and anomalies
- test underlying assumptions
- suggest hypotheses
- develop parsimonious models

EDA Components



The screenshot shows a web browser window with the URL itl.nist.gov. The page is titled "ENGINEERING STATISTICS HANDBOOK" and has navigation links for HOME, TOOLS & AIDS, SEARCH, BACK, and NEXT. The main heading is "1. Exploratory Data Analysis". Below this, a paragraph states: "This chapter presents the assumptions, principles, and techniques necessary to gain insight into data via EDA--exploratory data analysis." The page is organized into four main sections, each with a list of sub-topics:

- 1. [EDA Introduction](#)**
 - [1. What is EDA?](#)
 - [2. EDA vs Classical & Bayesian](#)
 - [3. EDA vs Summary](#)
 - [4. EDA Goals](#)
 - [5. The Role of Graphics](#)
 - [6. An EDA/Graphics Example](#)
 - [7. General Problem Categories](#)
- 2. [EDA Assumptions](#)**
 - [1. Underlying Assumptions](#)
 - [2. Importance](#)
 - [3. Techniques for Testing Assumptions](#)
 - [4. Interpretation of 4-Plot](#)
 - [5. Consequences](#)
- 3. [EDA Techniques](#)**
 - [1. Introduction](#)
 - [2. Analysis Questions](#)
 - [3. Graphical Techniques: Alphabetical](#)
 - [4. Graphical Techniques: By Problem Category](#)
 - [5. Quantitative Techniques](#)
 - [6. Probability Distributions](#)
- 4. [EDA Case Studies](#)**
 - [1. Introduction](#)
 - [2. By Problem Category](#)

At the bottom of the page, there are links for [Detailed Chapter Table of Contents](#) and [References](#).

Statistical Graphics

- EDA relies heavily on statistical graphics
- EDA is not identical to statistical graphics
- Graphics support pattern recognition and open-minded exploration
- Interactive graphics push this even further

Quantitative Methods

Although heavily graphic in orientation, there are also a number of numerical techniques in EDA.

EDA Versus Confirmatory Analysis

Confirmatory Analysis (e.g. regression)

Problem → Theory → Model → Data → Conclusion

Exploratory Analysis

Problem → Data → Analysis → Model

1 GIS and Spatial Analysis

- Big Picture
- What is Spatial Analysis?

2 EDA and ESDA

- Exploratory Data Analysis (EDA)
- Exploratory Spatial Data Analysis (ESDA)

What is ESDA?

Definitions

- Type of EDA
- Extended to include spatial attributes of the data

Cross fertilization

- Applying classic EDA to spatial data
- Developing new EDA methods for spatial data
- Interactions between EDA and ESDA

How does ESDA fit in spatial analysis?

Spatial Modeling?

- Modeling based on assumptions
- ESDA largely model free
- Matter of degree (e.g., clustering)

Mapping?

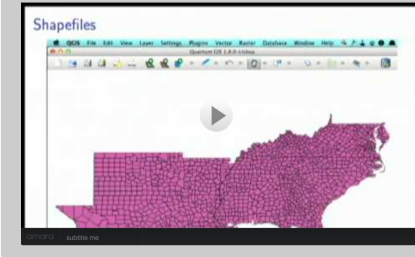
- Maps play a critical role in ESDA
- Does a map = ESDA?
- No. ESDA = map, manipulation + visualization

PySAL and ESDA (Video)

pyvideo.org

Browse

Search



PySAL: A Python Library for Exploratory Spatial Data Analysis and Geocomputation

Description

This talk presents an overview and update of PySAL. PySAL is designed to support the development of high level applications in exploratory spatial data analysis and geocomputation. The library includes a comprehensive suite of modules that cover the entire spatial data analysis research stack from geospatial data processing and integration, to exploratory spatial data analysis, spatial dynamics, regionalization, and spatial econometrics. A selection of these modules are illustrated drawing on research in spatial criminology, epidemiology and urban inequality dynamics. A number of geovisualization packages that have been implemented using PySAL as an analytical core are also demonstrated. Future plans for additional modules and enhancements are also discussed.

Category
[SciPy 2012](#)

Speakers
[Sergio Rey](#)

Language
English

Recorded
July 18, 2012

Last updated
April 8, 2014

Video origin
http://youtube.com/watch?v=FN1nH4Fkd_Y

Download
[mp4](#)

Metadata
[JSON](#)

Copyright/License Information
CC BY-SA

Tags