
GWF
GEOSPATIAL WORLD FORUM
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The Spatial Sciences at the University of Southern California

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U.S. Seminar on Academia's Role in Advancing Geospatial Science and Technologyat the Geospatial World Forum
15 May, 2024

USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

Spatial Sciences Institute

Discussion points …

- Cutting-edge research and breakthroughs in geospatial technologies and methods
- Innovative education and training programs, nurturing the next generation of geospatial experts and problem solvers
- Dynamic partnerships and collaborations across sectors, harnessing the power of geospatial techniques to tackle complex problems

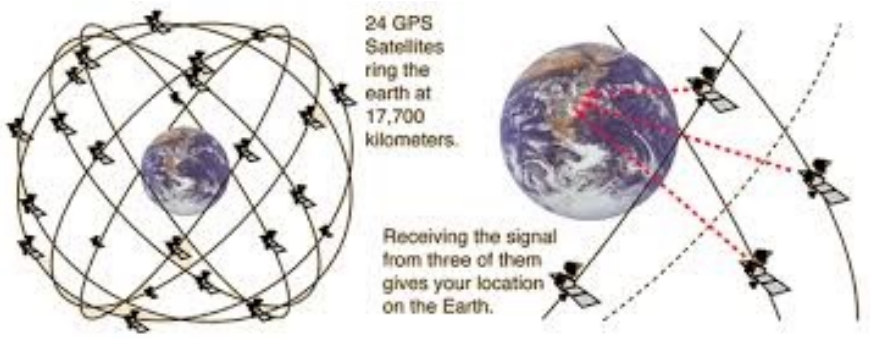
Sisi Wang

Trang Vo-Pham

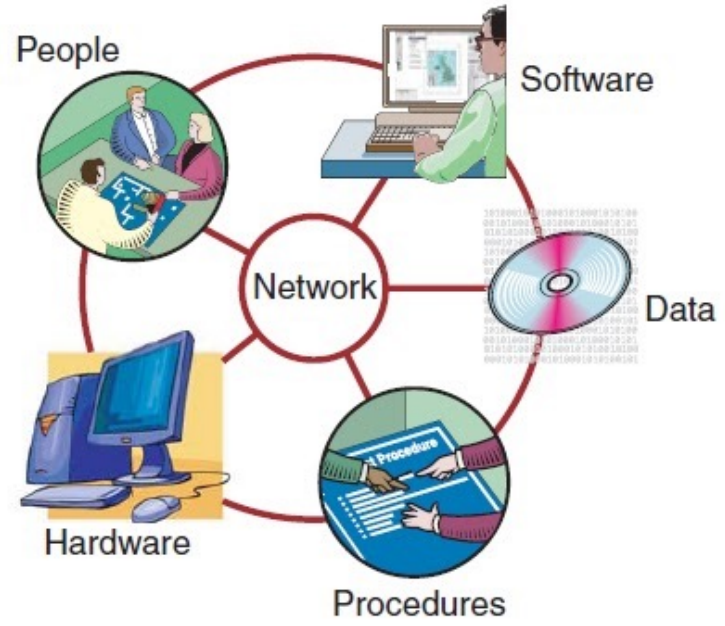
The Geospatial World
50 Rising Stars

The spatial sciences …

Combine multidisciplinary fields of scientific study with geospatial technologies including Geographic Information Systems, Global Positioning Systems, and Remotely Sensed Imagery



http://hyperphysics.phy-astr.gsu.edu/hbase/gps.html



https://umar-yusuf.blogspot.com/2016/11/Difference-between-GISystem-GIScience-and-GIService.html

Spatial sciences graduates …

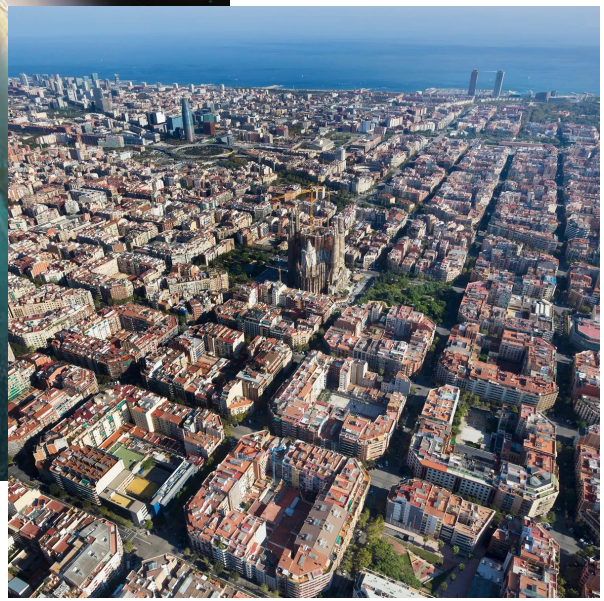
- Will possess an advanced knowledge of these technologies, experience in the interpretation and processing of satellite images as well as other digital data streams, a broad understanding of computer applications and database management …

and the spatial principles and methods used to characterize the role of location in the functioning of the Earth and everything people do on it

Spatial connects the local and the global

Night light images paint accurate picture of China GDP

Climate • Freshwater • Biosphere
UN Sustainable Development Goals



Barcelona's car-free 'superblocks' could save hundreds of lives

Undergraduate programs

- **Geodesign B.S.**
- **Global Geodesign B.S.**
- **Human Security and Geospatial Intelligence B.S.**

- Minor in GIS and Sustainability Science
- Minor in Human Security and Geospatial Intelligence
- Minor in Spatial Studies

Price School of Public Policy

USC School of Architecture

STEM

These programs have served 100-150 majors and minors during the past years

Backgrounds → Interests → Aspirations

Masters programs

- **Geographic Information Science and Technology M.S.**
- **Global Security Studies M.A.**
- **Human Security and Geospatial Intelligence M.S.**
- **Spatial Data Science M.S.** (with Department of Computer Science, Viterbi School of Engineering)
- **Spatial Economics and Data Analysis M.S.** (with Department of Economics, Dornsife College of Letters, Arts and Sciences)

STEM

In-person

Online

Synchronous

Asynchronous

These programs have served 150-200 masters students during the past 5 years

Backgrounds → Interests → Aspirations

Graduate certificate programs

- Geographic Information Science and Technology
- **Geospatial Intelligence**
- Geospatial Leadership
- **Remote Sensing and Earth Observation**

- **Geodesign, Environment and Health M.S.**
  (with the Department of Population and Public Health Sciences, Keck School of Medicine)

STEM

In-person

Online

Synchronous

Asynchronous

These programs have served 25-50 students during the past 5 years

Backgrounds → Interests → Aspirations

Individual Classes (n = 17)

Applied Geospatial Intelligence Problem Solving

Cartography & Visualization **Concepts for Spatial Thinking**

Geospatial Intelligence Tradecraft

GIS Programming & Customization GIS Technology Project Management

Human Security & Disaster Management

Master's Thesis

Practice of Geospatial Leadership

Remote Sensing Applications & Emerging Technologies

Remote Sensing for GIS

Spatial Analysis & Modeling Spatial Data Acquisition

Spatial Data Science Spatial Databases Spatial Econometrics

Web & Mobile GIS

Doctoral programs

Ph.D. in Population, Health, and Place

USC Dornsife College of Letters, Arts and Science

USC Dworak-Peck School of Social Work

Keck School of Medicine of USC

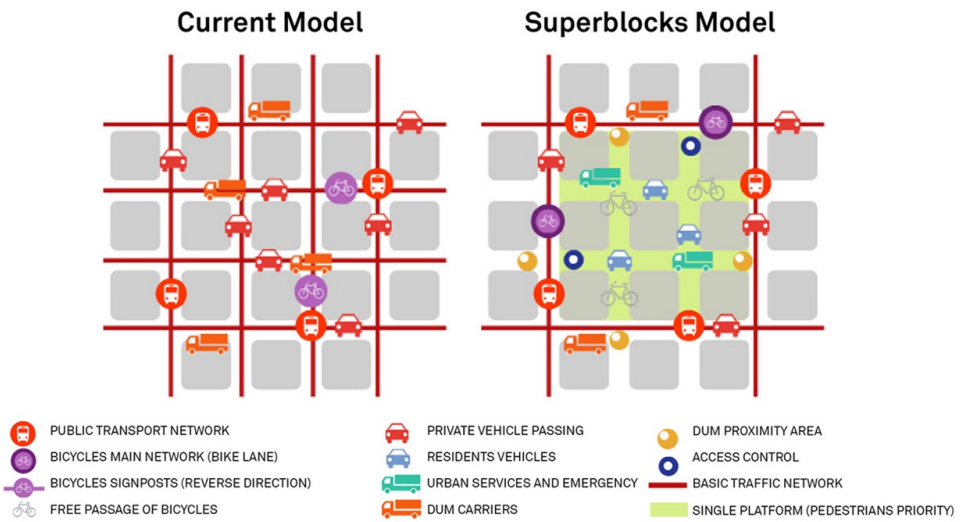
USC Leonard Davis School of Gerontology

Spatial Analytics Graduate Certificate

Backgrounds → Interests → Aspirations

Cutting-edge research & problem solving

- **Descriptive**
  - What, where, when, who
- **Diagnostic**
  - Why
- **Predictive**
  - What could happen
- **Prescriptive**
  - What should be done



Superblocks in Barcelona, Spain

Image by Ajuntament de Barcelona (https://barcelonarchitecturewalks.com/superblocks/)

Geospatial Big Data

- **Location-based devices and services**
- **Volunteered and ambient geographic information**
- **Remote sensing**
  - In-situ sensing
  - Traditional satellite & high-altitude airborne remote sensing systems
  - Nanosatellites
  - Street-level imagery
  - Unmanned aerial systems
- **Internet of Things and sensors**
- **3D Modeling, Video, Virtual and Augmented Reality Systems**
  - Digital twins & building information models
  - 3D city models
  - Spatial video
  - Virtual & augmented reality

Geospatial technologies

Database Management!

Data Mining!

Deep Learning!

Machine Learning!

Cloud Computing!

Remote Sensing!

GIS

Scientific Programming!

Statistical Analysis!

Geospatial methods

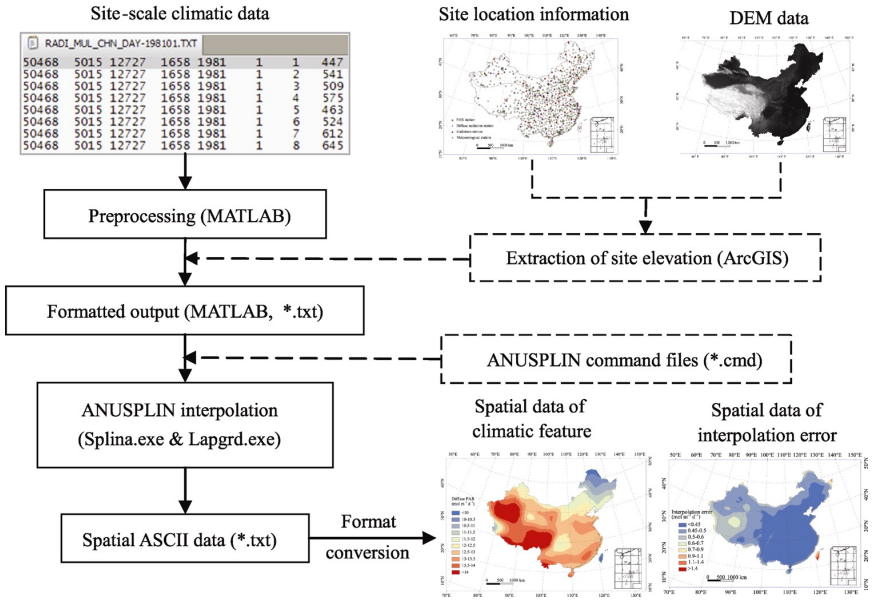
Geographically weighted regression

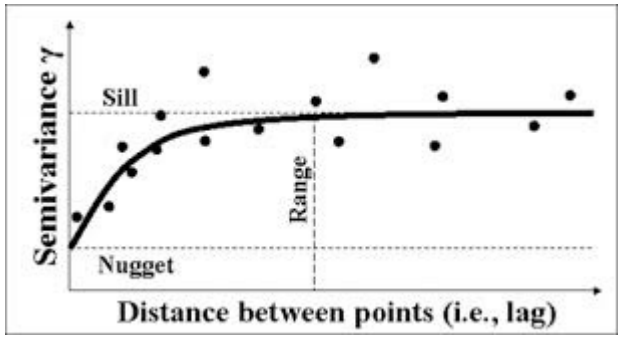
dependent variable; regression coefficients; residual variable

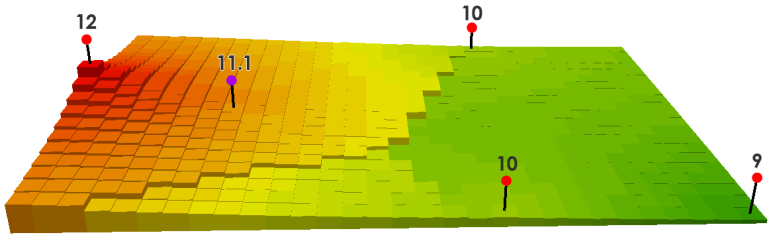
$$y_i = \sum_{j=0}^{M} \beta_j x_{ij} + \varepsilon_i$$

$i = 1 \ldots N$ (number of observations)
$j = 0 \ldots M$ (number of ind. variables)

the j'th variable at observation i







Thin plate splines

Kriging

Future spatial research and work

- The role of the cloud and web services will continue to grow and standalone systems and tools will fade into the background
  - **Think spatial computing anywhere, anytime**
- Geospatial data will continue to grow in terms of volume, velocity, variety, veracity and value
  - **Think sensors, IoT, BIM, imagery, video, text**
- Geospatial tools will continue to evolve and we will all use a mix of proprietary and open source resources to complete projects
  - **Think coding, scripting, artificial intelligence, machine learning, deep learning**
- Geospatial work will become more collaborative and engage individuals from multiple fields with varied training and interests
  - **Think of ways to build more diverse spatial communities**
- Geospatial work will become more collaborative and engage everyday people
  - **Think VGI, community engagement, shared decision-making**