

Course Syllabus for Special Lecture

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Motivations

In many developing countries, data collection is hindered by several challenges:

- **Geographical Constraints:** Difficult terrain and remote locations make data collection arduous.
- **Limited Budget:** Financial constraints restrict large-scale data gathering and analysis.
- **Insufficient Technical Skills:** A shortage of trained personnel hampers effective data management.
- **Underdeveloped Infrastructure:** Inadequate transportation and telecommunications impede data accessibility.

Despite these challenges, the rise of digital technologies has created an abundance of digital footprints from economic and social activities. These have become valuable open data sources that reflect behaviors and transactions in near real-time. For example:

- **Google Trends and Twitter:** Publicly accessible platforms offering insights into societal trends and public opinion.
- **Satellite Imagery:** Available via online platforms, enabling timely analysis of physical environments and human activity.

Moreover, the development and proliferation of open-source software have empowered researchers and practitioners to utilize these data sources effectively. Key advantages include:

- **Low Cost:** Eliminating the financial barriers of proprietary software and data.
 - **Timely Global Information:** Providing up-to-date, worldwide data.
 - **Cloud-Based Storage and Computation:** Supporting large-scale data processing without the need for extensive local infrastructure.
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Purpose of the Lecture Series

This lecture series introduces spatial analytical techniques and open data as tools to overcome the limitations of traditional data collection. By utilizing publicly available data and open-source tools, researchers can address resource constraints and enhance research capabilities in the social sciences and related fields.

Key Features of the Lecture

This lecture series will cover:

- **Open Data:** Introduction to data platforms such as Google Earth Engine and OpenStreetMap.
 - **Interdisciplinary Approach:** Integration of technology and social science to address practical issues.
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Detailed Lecture Outline

Day 1: Tuesday, April 15, 2025

Session Time: 17:00–18:30

Introduction to GIS and Satellite Imagery

- The role of GIS and remote sensing in overcoming data collection challenges in developing countries.
- Types of satellite imagery and their applications.

Applications of Remote Sensing in Social Sciences

- **Archaeological Discoveries and Landscape Reconstruction:** Using satellite imagery to identify ancient sites and reconstruct historical landscapes.
- **Urban Development and Social Change:** Analyzing urban sprawl, land use, and informal settlements.
- **Environmental History and Resource Management:** Studying deforestation, desertification, and agricultural practices.
- **Conflict Analysis and Human Rights Monitoring:** Documenting destruction in conflict zones and monitoring human rights violations.
- **Population Studies and Migration Patterns:** Estimating population densities and tracking migration trends.
- **Disaster Impact and Recovery Analysis:** Assessing the societal effects of natural disasters.

Publication Example:

Puttanapong, N., Prasertsoong, N., & Peechapat, W. (2023). Predicting provincial gross domestic product using satellite data and machine learning methods: A case study of Thailand. *Asian Development Review*, 40(2), 39–85. https://doi.org/10.1162/adev_a_00218

Day 2: Friday, April 18, 2025

Session Time: 08:45–10:15

Introduction to Geospatial Data and Cloud-Based Spatial Analysis

- **Types of Spatial Data and GIS Functionalities:** Introduction to spatial data structures (vector, raster) and GIS capabilities.
- **Categories and Key Features of Geospatial Data:** Classification by resolution, scale, source (e.g., satellite, administrative), and temporal coverage.

Introduction to Basic GIS

- Overview of traditional GIS platforms.

Fundamentals of Google Earth Engine (GEE)

- Interface, data catalog, and scripting environments (JavaScript/Python).
- Examples of environmental, socioeconomic, and land-use studies using GEE.
- Demonstrations of cloud-based spatial computation and visualization.

Limitations of Satellite Data in Economic Applications

- Discussion of resolution constraints, measurement errors, and the mismatch between economic activities and remotely sensed proxies.
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Day 3: Friday, April 18, 2025

Session Time: 17:00–18:30

Spatial Statistics and Spatial Econometrics

- **Introduction to Spatial Statistics:** Importance of spatial analysis in the social sciences.
- Challenges including spatial dependence and heterogeneity.

Spatial Weight Matrix and Spatial Autocorrelation Analysis

- Moran's I and Local Indicators of Spatial Association (LISA).
- Identifying clusters and spatial outliers.

Introduction to Spatial Regression

- Limitations of OLS under spatial dependence.
- Issues of model misspecification and biased inference.

- **Spatial Autoregressive Model (SAR):** Spatial spillovers.
 - **Spatial Error Model (SEM):** Spatially autocorrelated errors.
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Conclusion

This lecture series introduces students to the potential of spatial data and open-source tools for addressing data limitations in social science research. In contexts where traditional data collection is difficult, satellite imagery and volunteered geographic information provide viable alternatives.

While not focused on technical skill development, the course offers a conceptual foundation for incorporating spatial thinking and publicly available data into research and policy analysis. Students will gain insight into key applications and limitations, laying the groundwork for deeper engagement with geospatial methods.