Introduction to Geospatial Data Visualization

Lecturers: Viktor Lagutov, Katalin Szende, Joszef Laszlovsky. Ruben Mnatsakanian
Duration: Fall term (September – December)
Credits: 2
Course level: PhD / MA
Maximum number of students: 15
Pre-requisites: none
Software: GoogleEarthPro, qGIS, online mapping tools (e.g. GoogleMaps, ArcGISonline)

Rapidly growing cross-disciplinary recognition and availability made Geospatial Methods in general, and Mapping, in particular, a popular approach in many research areas. Till recently, maps development had been a prerogative of cartographers and, later, experts in specialized mapping packages. Latest advances in hardware and software have opened this area to researchers in other disciplines and allowed them to enhance traditional research methods. The wide spectrum of such technologies and approaches is often referred as Geographic Information Systems (GIS) and includes, among others, mapping packages, geospatial analysis, crowdsourcing with mobile technologies, drones, online interactive data publishing. The geospatial literacy is becoming not an optional advantage for researchers and policy officers, but a basic requirement for many employers.

The aim of the course is to develop basic understanding of spatially referenced data use and to explore potential applications of GIS in various research areas. The sessions provide both theoretical understanding and practical use of geospatial data and technologies for mapping societal and environmental phenomena. Students will learn basic features of GIS packages and the ways to utilize them for own research.

The course is focused on practical skills in geospatial data visualization (mapping) and consists of

- Theoretical sessions on principles of geospatial data visualization, cartography and GIS basics;
- Practicals on learning GIS methods and getting mapping skills using free open source packages;
- Supervised and independent students' work on individual course projects.

By the end of the course students should be able to

- understand principles of data mapping and benefits of using different packages;
- acquire geospatial and other related datasets useful for mapping;
- develop own datasets based on different data sources;
- create simple maps using several mapping packages and online mapping tools (e.g. qGIS and GEPro).

The most widespread basic geospatial software packages will be used to showcase the modern techniques of geospatial *data collection, generation, and visualization*. Several file formats for storing geospatial data will be introduced (vector, raster). Alternative ways of collecting geospatial data will be considered, including both online data mining and datasets development by researchers. Many geospatial datasets, e.g. Google Earth format (kml), are freely available for researchers online, yet they are greatly underutilized. Participants will learn what kind of data can be stored in these datasets, how to obtain, develop and share such datasets. In addition, participatory science (geospatial data crowdsourcing) will also be discussed as one of data generation techniques.

Both desktop and online packages will be considered. Geospatial data visualization will be conducted using free open sourced software packages: GoogleEarthPro, Google Maps, QuantumGIS (qGIS). Specific features of each software package will be explored as well as combining packages into a single workflow in order to achieve the desirable mapping outcomes. qGIS package, the most popular Freeware Open Source Geographic Information System, will be used for most practical sessions and course project. Using this package participants learn the basics of a typical GIS package and mapping principles.

Computer lab-based presentations and in-class exercises will be followed by participants' individual practical work on homeworks and course projects. The course is based on "learn-by-doing" approach: the principles and tools described during the laboratory-based presentations will be accompanied by students' individual and supervised work on course projects. Successful participation in and completion of the course depends on student's ability for independent work and self-education.

The course will be accompanied by a series of university wide public lectures and workshops on mapping methods and applications conducted under the framework of Spatial Mapping and Analysis Research Group

(SMARG). Students interested in further studies of geospatial methods and exploration of their potential application can consider joining the course on Introduction to Geospatial Analysis (using ArcGIS) offered by the CEU Department of Environmental Sciences and Policy in winter semester.

Key topics and students' workload

Topics	**Educational Activities**	**Workload (h)**
Intro to GIS, cartography and data visualization	Lectures, reading	5
Practical skills of data visualization and sharing with GEPro	Lab-based practicals	10
Practical skills of data visualization and sharing using online mapping tools	Lab-based practicals	5
Practical exercises on map creation with qGIS	Lab-based practicals	25
Datasets development (digitizing, geo-referencing)	Lab-based practicals	10
Development and implementation of Mapping Project	Individual and Supervised work on term project, reading, consultations	55
Awareness of mapping applications in public policy, humanities and social studies	Case studies presentations by instructors, Presentations of mapping projects by course participants	10
Total		120

Sessions outline

N	**Session description**	**Instructors**	**exercises**
1	Intro to cartography and geodata visualization - mapping basics, Map design and components Projections	V.Lagutov, TAs	Submit Ideas for Individual Project
2	Intro to GIS - Mapping software (GIS) basics, Data formats; Vector Raster data representation	TBC	Find any maps online to illustrate phenomena of interest
3	Using GoolgeEarth/Pro - GoogleEarth (GE) basics, Retrieving sites location; maps development, maps overlay, etc	V.Lagutov, TAs	Create a dataset in GE (kml) describing any phenomena
4	Online mapping tools	V.Lagutov, TAs	Create a map/s using kml dataset
5	Online mapping tools (cont.) Crowdsourcing and GPS basics - Application of GPS technologies for field work	V.Lagutov, TAs	Develop a map using provided built in datasets
6	Data sources for mapping - Existing data sources and Internet data search; Online databases; Development of own datasets	V.Lagutov, TAs	Find and use different datasets
7	Desktop mapping - practical mapping skills, map creation using qGIS	V.Lagutov, TAs	map/s development in qGIS
8	Desktop mapping (cont.) - qGIS features	V.Lagutov, TAs	map/s development in qGIS
9	Various mapping techniques - georeferencing maps, digitizing, data manipulation, querying	V.Lagutov, TAs	Develop a dataset using georeferencing
10	Application of spatial methods in Humanities and Social Studies	All faculty / visiting	Individual project
11	Application of spatial methods in Environment	All faculty / visiting	Individual project
12	Conference (Projects Presentations)	All faculty	Individual project

Grading Policy

The course enrollment is only for grade, what is based upon student's performance through:

- 10% class participation: active participation in class discussions is expected and encouraged;
- 20% practical sessions: several in-class exercises to be completed;
- 70% graded individual project: mapping project to be developed and presented at the final conference.

A topic for course mapping project can be selected from the list provided or suggested by students. It can be relevant to thesis research or other courses. The developed projects are to be presented through the open conference at the end of the course.

Readings

Gregory, I. and Ell, P. 2007. Historical GIS: Technologies, Methodologies and Scholarship, New York: Cambridge University Press

Peterson, G. N. 2009. GIS Cartography: A Guide to Effective Map Design. Seattle: CRC Press