# Applied Econometrics Using GIS Techniques
## Winter Term 2021/22

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Office Hours: Wednesday, 14:00-15:00

During the semester break: appointment by e-mail

**Course Information:**

**Lecture**: Wednesday, 14:00 - 16:00, A04 1-139

**Exercise**: Thursday, 16:00 - 18:00, A04 1-139

Start: 20th of October 2021; End: 3rd of February 2022

**Course Description:**

The use of geographic information systems (GIS) has become increasingly popular among economists. The broad term GIS encompasses a set of tools (both software and hardware) to collect, store, visualize and analyze spatial data from the real world. GIS techniques allow economists to use data on geography and weather as sources of exogenous variation for estimating the causal impact of a wide range of treatments (e.g., infrastructure, mass media, slave trade, land suitability for agriculture, and terrain ruggedness). Satellite images from the earth's surface, which can be analyzed with geo-processing tools in GIS, allow economists to construct geo-spatial indicators (e.g., temporal changes in the intensity of night-time light and patterns of deforestation) that more closely reflect the local actors and underlying mechanisms of interest. Scanned old maps can be used in GIS to identify the location of ethnic groups for estimating the causal impact of geographic partitioning of ethnic homelands during colonization on local conflict patterns in Africa. The increasing availability of disaggregated, high-resolution spatial data for the earth's surface permits the construction of geospatial indicators of any kind and at arbitrary smaller units of analysis. This capability of GIS has opened new pieces of economics research that had previously escaped the researcher's attention but can now be conducted.

For this course, we will be using ArcGIS Desktop 10 produced by ESRI, the most common software tool used to analyze geospatial data. This course provides an introduction to some fundamental geo-processing operations using ArcGIS that are most relevant for economics research. It discusses the GIS programming tools available in ArcGIS and provides state-of-the-art applications based on various pieces of empirical economics research. A non-exhaustive list of geo-processing tools using ArcGIS

includes performing mathematical functions on spatial data, the calculation of geographic distances between various forms of spatial units, aggregating geospatial data within polygons, and drawing maps. A core concept when working with geospatial data is map projection and geographic coordinate systems. The reason is that all spatial maps introduce some kind of geographic distortions when projecting the earth's 3-dimensional sphere to a plain 2-dimensional map. Thus, a basic understanding of map projections and coordinate systems is essential for assessing the kind of distortions acting on the specific properties of the sphere (e.g., area, distance, and shape). In addition, this course provides an introduction to programming in Python for the purpose of automation and replication of geo-processed spatial datasets.

**Course Structure:**

The lecture will be accompanied by a computer lab that enables students to gain practical experience with the implementation of geo-processing tools using ArcGIS. During the lab, we will replicate spatial datasets for some of the actual pieces of economics research. In this way, students will be able to apply GIS tools to new spatial datasets. More importantly, students will be able to acquire the necessary data management skills to export spatial data in a suitable file format that can be directly imported into standard econometric software packages such as R or Stata.

# References

[1] **Harder, Christian, and Brown, Clint (2016).** The ArcGIS Imagery Book: New View. New Vision. First Edition, Esri Press, 380 New York Street, Redlands, California, United States of America.

[2] **Harder, Christian, and Brown, Clint (2017).** The ArcGIS Book: 10 Big Ideas about Applying The Science of Where. Second Edition, Esri Press, 380 New York Street, Redlands, California, United States of America.

[3] **Heywood, Ian, Cornelius, Sarah, and Carver, Steve (2011).** An Introduction to Geographical Information Systems. Fourth Edition, Pearson Education Limited, Harlow, England.

[4] **Keranan, Kathryn, and Malone, Lyn (2017).** Instructional Guide for The ArcGIS Imagery Book. First Edition, Esri Press, 380 New York Street, Redlands, California, United States of America.

[5] **Keranan, Kathryn, and Malone, Lyn (2018).** Instructional Guide for The ArcGIS Book. Second Edition, Esri Press, 380 New York Street, Redlands, California, United States of America.

[6] **Law, Michael, and Collins, Amy (2018).** Getting to Know ArcGIS Desktop. Fifth Edition, Esri Press, 380 New York Street, Redlands, California, United States of America.

[7] **Zandbergen, Paul A. (2013).** Python Scripting for ArcGIS. First Edition, Esri Press, 380 New York Street, Redlands, California, United States of America.

[8] *Additional documents, including lecture slides, literature, data, etc. will be made available on Stud.IP.*