

Data Science for Economic Development

Pierre Biscaye, Chaire de Professeur Junior

Email : pierre.biscaye@uca.fr

Université Clermont Auvergne

Masters 2 AED / Magistère 3

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Course objectives

- Understand how to think about using data in applied economic research
- Build a foundation for using important tools in data science for economics: generative AI, big data, geospatial analysis, machine learning, and more
- Develop competency in working with different types of data using Python

Course logistics

- Language of instruction: English
- Class time: 20 hours of *cours magistraux* in 10 two-hour sessions
 - o Salle 212 RO
 - o **Bring your laptops** to class!
- Office hours: Thursdays from 9-11am, Office 425
- Assignments: weekly coding practice, not graded
- Evaluation:
 - o 1-hour final exam
 - o Mémoire: Preparation of short original research paper using tools from class to answer an economic question
 - In groups of 3-4
 - Paper: 10-15 pages including references and exhibits
 - 15-20 pages for groups of 4
 - Code: must submit the set of code files used to produce the paper exhibits from original data (not graded)
 - Presentation: 5-minute presentation of proposed research in last lecture

Course outline and schedule

1. Introduction and Python basic (9 January)
 - a. Lecture: Course overview and introduction to data science
 - b. Python
 - i. Using Jupyter Notebook
 - ii. Python basics: variables, types, indexing
 - iii. Python errors/debugging
2. Reproducibility, more Python basics (13 January)
 - a. Lecture: Reproducibility, organizing files and code
 - b. Python
 - i. Functions and methods
 - ii. Loops, conditionals, list comprehension
 - iii. Importing modules/packages
 - iv. Working with Files

- v. Writing code well
- 3. Data wrangling and visualization (January 15)
 - a. Lecture: Value of data visualization
 - b. Python
 - i. Pandas and data frames
 - ii. Importing, subsetting, joining data
 - iii. Summary statistics
 - iv. Scatter plot, bar plot, histogram
 - v. Using matplotlib
 - vi. Simple linear regression
- 4. Generative AI and big data (January 16)
 - a. Lecture
 - i. Generative AI: What is generative AI; Large Language Models/Chatbots; Applications of generative AI in economics
 - ii. Big Data: Data types, data sources, big data, tools for working with big data
- 5. Geospatial analysis 1 (January 21)
 - a. Lecture: Introduction to spatial data
 - b. Python
 - i. Tabular spatial data
 - ii. Shapely and geopandas
 - iii. Rasters
 - iv. Visualizing spatial data
 - v. Map algebra
- 6. Geospatial analysis 2 (January 23)
 - a. Lecture: Remote sensing in economics
 - b. Python
 - i. Satellite imagery and remote sensing
 - ii. Google Earth Engine
 - iii. Accessing spatial data
 - iv. Preparing spatial data for analysis
 - v. Point-level data analysis
- 7. Machine learning 1 (January 28)
 - a. Lecture: Intro to ML, supervised ML
 - b. Python
 - i. Regression as machine learning foundation
 - ii. Fitting and regularization
 - iii. Validation
 - iv. Pre-processing
- 8. Machine learning 2 (January 30)
 - a. Lecture: Unsupervised ML, bias and issues with ML
 - b. Python
 - i. Classification
 - ii. Machine learning pipeline
 - iii. Unsupervised ML: clustering and dimensionality reduction
 - iv. Other topics
- 9. Web scraping and text analysis (February 5)
 - a. Lecture: Additional tools for accessing data for economics research
 - b. Python
 - i. Web APIs

- ii. Web scraping
 - iii. Text preprocessing
 - iv. Bag-of-words
 - v. Word embeddings
- 10. Wrapping up, project discussion (February 6)
 - a. Cover spillover material from previous lectures
 - b. Lecture: Key lessons
 - c. Presentation of research proposals for mémoire

Python Resources

1. Guide to setting up Anaconda, Python, and Jupyter Notebooks for the course: https://github.com/pbiscaye/IntroDataScienceEcon/blob/main/Data_Science_Class_Setup_Guide.pdf
2. All links below as well as many others are included in my list of useful data science resources: <https://github.com/pbiscaye/Teaching/blob/main/Data%20science%20resources%20index.pdf>
3. Getting started with jupyter notebooks: <https://www.dataquest.io/blog/jupyter-notebook-tutorial/>
4. UC Berkeley D-Lab Python resources: <https://github.com/dlab-berkeley/python-berkeley>
5. UC Berkeley D-Lab Python fundamentals: <https://github.com/dlab-berkeley/Python-Fundamentals>
6. Arthur Turrell Python for data science: <https://aeturrell.github.io/python4DS/welcome.html>
7. Gabor Bekes coding for data analysis with Python: <https://github.com/gabors-data-analysis/da-coding-python>
8. Data camp data scientist with Python: <https://app.datacamp.com/learn/career-tracks/data-scientist-with-python?version=5>
9. NYU Python data bootcamp: <https://nyudatabootcamp.gitbook.io/thebook/>
10. NYU intro to Python for science: <https://physics.nyu.edu/pine/pymanual/html/pymanMaster.html>