Fall 2023

Instructor: Marta Gonzalez (martag@berkeley.edu)

Lectures: TuTh 2:00P-3:29P 502 Davis;

Units: 3

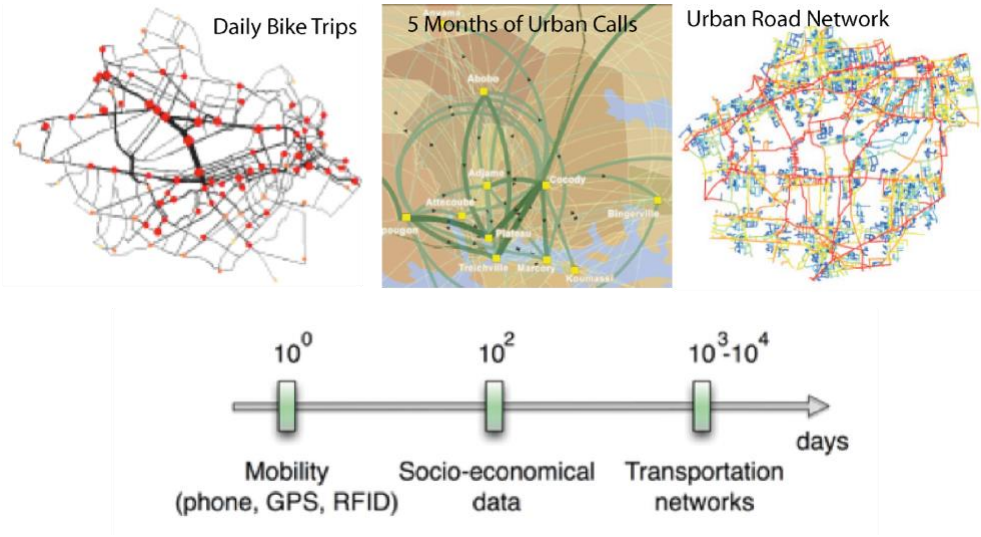
OH: Tuesdays 3:30-5:30, room 615 Davis

GSI: Alben Bagabaldo (bagabaldo@berkeley.edu);

Recitations: Fr 1-2 150 GSPP

OH: Monday, 9-10 AM, 222 Wurster Hall;

Friday, after Discussion Class from 2-4 PM, 305 Davis Hall



Objectives:

Students learn techniques for analyzing individual daily activities and travels both at urban and at global scale. This course is designed for graduate students interested in methods to analyze human dynamics, and their interactions with the built and the natural environment.

We cover four parts each of which is centered in a seminal research paper. Students learn to reproduce the results of the selected paper in the classroom via computer labs, and through a related data analysis and modeling assignments.

The final project trains the student in formulating a research contribution using methods to extract information from data.

Programming language is Python.

Prerequisites: An undergraduate-level understanding of statistics, and programming skills are assumed.

Each module covers four lectures

Module 1 Network Science and Network Models
Module 2 Structure in Routine: Principal Component Analysis
Module 3 Human Mobility: Parsing Trajectories
Module 4 Transportation Networks
Module 5 Clustering and Community Detection

- Problem sets

	Covers	Due
Assignments Module 1	L1-L4	09/07 and 09/14
Assignments Module 2	L5-L8	09/23 and 09/30
Assignments Module 3	L9-L12	10/07 and 10/14
Assignments Module 4	L13-L16	10/21 and 10/28
Assignments Module 5	L17-L20	11/11 and 11/30
Final Presentation		12/5, 12/7, 12/9
Final Paper		12/13

Assignments
- 5 homework assignments divided in two parts each.
- One final project: written report and oral presentation

- Unless stated otherwise, problem sets should be solved individually. Electronic versions must be uploaded to the bourses site.
- 15% for each problem set and the exercise presentation (5x15 =75%)
- 10% class activities
- 10% project presentation
- 5% for final project paper

- Lectures: TTh 3:30-4:30 PM

- Contact information:
  - Prof. Marta C. Gonzalez
    Office hours: T 3:30-5:30 PM
    TBD; martag@berkeley.edu.edu

Required Readings:

Watts, D., Strogatz, S. Collective dynamics of ‘small-world’ networks. *Nature* **393**, 440–442 (1998). https://www.nature.com/articles/30918

Eagle, Nathan, and Alex Sandy Pentland. "Eigenbehaviors: Identifying structure in routine." *Behavioral ecology and sociobiology* 63.7 (2009): 1057-1066. https://dspace.mit.edu/handle/1721.1/49446

Brockmann, D., Hufnagel, L. & Geisel, T. The scaling laws of human travel. *Nature* **439**, 462–465 (2006). https://doi.org/10.1038/nature04292

González, M., Hidalgo, C. & Barabási, AL. Understanding individual human mobility patterns. *Nature* **453**, 779–782 (2008). https://doi.org/10.1038/nature06958

Lenormand, Maxime, Aleix Bassolas, and José J. Ramasco. "Systematic comparison of trip distribution laws and models." *Journal of Transport Geography* 51 (2016): 158-169. https://arxiv.org/abs/1506.04889

Simini, F., González, M., Maritan, A. *et al.* A universal model for mobility and migration patterns. *Nature* **484**, 96–100 (2012). https://doi.org/10.1038/nature10856

Guimera, Roger, et al. "The worldwide air transportation network: Anomalous centrality, community structure, and cities' global roles." *Proceedings of the National Academy of Sciences* 102.22 (2005): 7794-7799. https://www.pnas.org/doi/abs/10.1073/pnas.0407994102

Textbook:
A First Course in Network Science Filippo Menczer , Santo Fortunato , Clayton A. Davis Frontmatter, Cambridge University Press 978-1-108-47113-8

Course Policy:

- For every deadline there is a grace period of 48 hours. There is a 20% reduction for late assignments more than 48 hours, and the new date to turn in needs to be agreed in person or by email with the professor.
- A laptop is needed for class exercises. If you plan to take the class and do not have one, please see the instructor in advance.
- Please sign up at bcourses. I will confirm your enrollment for the course, then you will be able to see the course page.
- Regular attendance and participation are essential and expected.
- It is expected that the students are familiar with academic honesty, lack of knowledge of the policy is not a reasonable explanation for a violation.