Instructor: Marta C. González, 1-153, Phone: 617-715-4140

Office Hours: Fri. 10:00-11:00 AM or by appointment

Readings: PDFs of relevant book chapters and articles will be available on-line

Prerequisites: 1.001 and 1.010

Course Outline:

Week 1
Sept 7:

• Course Goals and Motivation. Students presentation and expectations.
• Road map of the course

1. Article: Rhythms of social interaction: messaging within a massive online network (Scott Golder, Dennis Wilkinson, and Bernardo Huberman)

Week 2
Sept 12:

• Behavioral data identifying structure in routine

Sept 14:

• Matlab Exercises to determine Eigenbehaviours

1. Article: Eigenbehaviors: identifying structure in routine (Nathan Eagle & Alex Sandy Pentland)

Week 3
Sept 19:

• Fractals

Sept 21:

• Matlab Exercises Fractals

1. Book: Chapter 1, Ben-Avraham and Havlin. Diffusion and Reactions in Fractals and Disordered Systems
2. Article: Geographic routing in social networks (David Liben-Nowell, Jasmine Novak, Ravi Kumar, Prabhakar Raghavan, and Andrew Tomkins)

Week 4
Sept 26:

• Continuous Time Random Walk and the Dollar Bill Experiment.

Sept 28:

• Exercises in Perl to parse GPS Trajectories.

* or permission of instructor
1. Nature Article: Human Travel Patterns (Brochmann et al.)
2. IFOCOM2006: Extracting a mobility model from real user traces. (M. Kim, D. Kotz and S. Kim)

Week 6
Oct 3:
- Analyzing Individual Travel at Large Scales.

Oct 5:
- Exercises Analyzing Trajectories.

1. Nature Article: Understanding individual human mobility patterns (González et al.)
2. Science Article: Limits of Predictability in Human Mobility (Song et al.)
3. Project Option: Nature Physics Article, Modelling the scaling properties of human mobility (Song et al.)

Week 7
Oct 17:
- Introduction to Complex Networks

Oct 19:
- Exercises Complex Networks

1. Review Physics Reports Spatial Networks (Marc Barthélemy)
2. Optional Reading: Review Physics Reports "Complex Networks: Structure and Dynamics" (Boccaletti et al.)
3. Optional Reading: Review of Modern Physics “Statistical mechanics of complex networks” (Albert et al.)

Week 8
Oct 24:
- Properties of Complex Networks

Oct 26:
- Distinguished Engineering and Science Speakers Seminar Series László Barabási.

1. Review Physics Reports Spatial Networks (Marc Barthélémy)
2. Optional Reading: Review Physics Reports "Complex Networks: Structure and Dynamics" (Boccaletti et al.)
3. Optional Reading: Review of Modern Physics “Statistical mechanics of complex networks” (Albert et al.)

Week 9
Oct 31: Exercises Networks

Nov 2: Modelling Transportation Networks (Air Transportation)

1. Article PNAS: "The Architecture of complex weighted networks" (Barrat et al.)

Week 10
Nov 7:
- Exercises Air Transportation Networks
Nov 9:

• Modelling Spatial Networks

1. Article PRE "The Spatial Structures of Networks" (Gastner et al.)
2. Project Option: Article PRL "Modeling Urban Street Patterns" (Barthély et al.)
3. Project Option: Article PRL "Networks and Cities: An information Perspective" (Rosvall et al.)
4. Project Option: Article PRL "Price of Anarchy in Transportation Networks" (Youn et al.)

Week 11

Nov 14:

• Exercises Fitting Power Laws

Nov 16:

• Presentations of Papers and Work Projects

1. Article PLoS ONE: "Commuting in a Polycentric City" (Roth et al.)
2. Project Option: Environment and Planning B "The structure of Inter-Urban traffic: A weighted network analysis" (De Montis et al.)

Week 12

Nov 21:

• No Classes (Project Preparation)

Nov 23:

• No Classes (Project Preparation)

Week 13

Nov 28:

• Measuring Commuting (Gravity Model)

Nov 30:

• Commuting Networks

2. Article Science: Synchrony, Waves, and Spatial Hierarchies in the Spread of Influenza (Viboud et al.)
3. Article PNAS: Multiscale mobility networks and the large scale spreading of infectious diseases (Balcan et al.)

Week 14

Dec 5:

• Final Projects due

Dec 7:

• Final Projects due
Evaluation

In-class Participation (Especially Reading Connections) ...................... 5%

Assignments (5 × 15%) ................................................................. 75%

1. HW1 Eigenbehaviours, due 09/24
2. HW2 Fractals, due 10/05
3. HW3 Human Trajectories, due 10/19
4. HW4 Characterizing and Modelling Networks, due 11/02
5. HW5 Papers Review and Project Ideas, due 11/16

Project .......................................................... 20%

1. Final presentation, due 12/07 (%10)
2. Final written report, due 12/14 (%10)