Course 1.204 From Human Mobility to Transportation Networks  
Fall 2013  
1:00 - 2:30 PM, Room: 1-371

Instructor: Marta C. González, 1-153, Phone: 617-715-4140
Office Hours: Fridays 2-3 PM, after class or by appointment
Readings: PDFs of relevant book chapters and articles will be available on-line
Prerequisites: 1.001 and 1.010 or any programming experience.

Course Outline:

Week 1: Opening  
Sept 5:
- Course Goals and Motivation.
- Students presentation and expectations.

Week 2: Extracting Behavior from Human Digital Traces  
Sept 10:
- Behavioral data identifying structure in routine
Sept 12:
- Matlab Exercises to determine Eigenbehaviours
  1. Article Behavioral Ecology and Sociobiology (Eagle et al)

Week 3: Extracting Behavior from Human Digital Traces  
Sept 17:
- Student Group Guided Activity: Review Eigenbehaviours
Sept 19:
- Modelling Urban Growth
  1. Chapter 1, Ben-Avraham and Havlin. Diffusion and Reactions in Fractals and Disordered Systems
  3. P. Ball, Why Society is a Complex Matter: Meeting Twenty-first Century Challenges with a New Kind of Science (Chapter 9)

*or permission of instructor

**Week 4: Characterizing Urban Population Density**

**Sept 24:**
- Density of Population Exercises

**Sept 26:**
- Student Group Guided Activity: Review of Density of Populations and Cities

1. P. Ball, *Why Society is a Complex Matter: Meeting Twenty-first Century Challenges with a New Kind of Science* (Chapter 9)

**Week 5: Commuting**

**Oct 1:**
- Models of Commuting

**Oct 3:**
- Models of Commuting

1. Article PloS ONE (Simini et al.)

**Week 6: Human Mobility**

**Oct 8:**
- Student Group Guided Activity: Review Models of Commuting

**Oct 10:**
- Analyzing Individual Trajectories

1. Project Lachesis: Parsing and Modeling Location Histories.

**Week 7: Human Mobility**

**Oct 17:**
- Individual Mobility Patterns

1. Nature Article: Human Travel Patterns (Brochmann et al.)
2. Nature Article: Individual Travel Patterns (Gonzalez et al.)

**Week 8: Human Mobility and Visualizing Trajectories**

**Oct 22:**
- Student Group Guided Activity: Review Individual Trajectories

**Oct 24:**
• Student Group Guided Activity: Visualizing Trajectories

1. Processing.org documentation and examples.

Week 9: Networks Science

Oct 29:
• Complex Networks Models

Oct 31:
• Networks Measures


Week 10: Networks Science

Nov 5:
• Student Group Guided Activity: Review Network Models

Nov 7:
• Project Plan Presentations


Week 11: Network Science

Nov 12:
• Spatial Networks

Nov 14:
• Spatial Networks

1. Article EPJB "The Spatial Structures of Networks" (Gastner et al.)
2. Review Physics Reports Spatial Networks (Marc Barthelemy)

Week 12: Networks Science

Nov 19:
• Student Group Guided Activity: Review Network Packages and Measures

Nov 21:
• Structure of the Air Transportation Network

1. Article PNAS: Air Transportation Networks (Guimera et al.)
2. Article PNAS: Weighted Networks (Vespignani et al.)
Week 14: Networks Science
Nov 26:

- Structure of Urban Movements: Polycentric Activity and Entangled Hierarchical Flows
  1. Article PLoS ONE: A universal model for mobility and migration patterns (Roth et al.)

Week 15: Closing Week
Dec 3:

- Wrap-up and Questions about the project presentations

Dec 5:

- Final Projects due

Week 16: Projects Presentation
Dec 10:

- Final Projects due

Evaluation

Assignments (4x15%) ................................................................. 60%

1. HW1 Eigenbehaviours due 09/19
2. HW2 Density of Population 09/28
3. HW3 Human Travels, due 10/24
4. HW4 Characterizing and Modelling Networks, due 11/21

Guided Activity ................................................................. 20%

1. Group 1 Eigenbehaviours, on 09/17
2. Group 2 Density of Population, on 09/26
3. Group 3 Commuting, on 10/08
4. Group 4 Human Trajectories, on 10/22
5. Group 5 Visualizing Trajectories, on 11/19
6. Group 6 Networks Models, on 11/05
7. Group 7 Network Packages, on 11/19

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

1. Final presentation, due 12/04 & 12/06 (%10)
2. Final written report, due 12/07 (%10)
1. **Project Option Eigenbehaviors**: Jiang *et. al* Clustering Daily Patterns of Human Activities in the City.


3. **Project Option Individual Mobility**: Chaoming Song, et al., Limits of Predictability in Human Mobility, Science 327, 1018 (2010);

4. **Project Option Individual Mobility**: Nature Physics Article, Modelling the scaling properties of human mobility (Song et al.)

5. **Project Option Individual Mobility**: Unravelling Daily Mobility Motifs (Schneider et. al)

6. **Project Option Population Density**: Collective behavior in the spatial spreading of obesity (Makse et.al)

7. **Project Option Population Desity**: Laws of population growth (Stanley et. al)

8. **Project Option Commuting**: Article PNAS: Multiscale mobility networks and the spatial spreading of infectious diseases (Balcan et al.)

9. **Project Option Networks and Mobility**: Spatial Networks a Review (Marc Barthelemy)

10. **Project Option Networks and Mobility**: Understanding metropolitan patterns of daily encounters (Axhausen et al.)

11. **Project Option: Networks and Mobility**: User Movement in Location-Based Social Networks (Leskovec et al.).


13. **Project Option**: Review Physics Reports Spatial Networks (Marc Barthelemy)

14. **Project Option Networks**: Article PRL "Modeling Urban Street Patterns" (Barthelemy et al.)

15. **Project Option Networks**: Article PRL "Networks and Cities: An information Perspective" (Rosvall et al.)

16. **Project Option Networks**: Article PRL "Price of Anarchy in Transportation Networks" (Youn et al.)