New York University
Center for Urban Science + Progress

Civic Analytics and Urban Intelligence
CUSP-GX.7003-001
FALL 2017
Tuesdays 9:30am to 12:20pm
Location: 2 Metrotech, Room 820

Instructor:
Constantine E. Kontokosta, PhD, PE
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Director, Urban Intelligence Lab
Deputy Director, CUSP

Office hours: Mondays, 2pm to 4pm
Office location: NYU CUSP, 1 Metrotech Center, 19th Floor

Recitation Leaders:
Yuan Lai, PhD Candidate, NYU Dept. of Civil and Urban Engineering & CUSP
Sokratis Papadopoulos, PhD Candidate, NYU Dept. of Civil and Urban Engineering & CUSP
Office Hours TBD

Course Description
Cities are increasingly data-rich environments, and data-driven approaches to operations, policy, and planning are beginning to emerge as a way to address global social challenges of sustainability, resilience, social equity, and quality of life. Understanding the various types of urban data and data sources – structured and unstructured, from land use records to social media and video – and how to manage, integrate, and analyze these data are critical skills to improve the functioning of urban systems, more effectively design and evaluate policy intervention, and support evidenced-based urban planning and design. While the marketing rhetoric around Smart Cities is replete with unfulfilled promises, and the persistent use (and mis-use) of the term Big Data has generated confusion and distrust around potential applications. Despite this, the reality remains that disruptive shifts in ubiquitous data collection (including mobile devices, GPS, social media, and synoptic video) and the ability to store, manage, and analyze massive datasets require students to have new capabilities that respond to these innovations.

This course introduces students to computational approaches to urban challenges through the lens of city operations, public policy, and urban planning. Students are exposed to a range of analytical techniques and methods from the perspective of urban decision-making. Issues of city governance, structure, and history are presented to understand how to identify and assess urban problems, collect and organize appropriate data, utilize suitable analytical approaches, and ultimately produce results that recognize the constraints faced by city agencies and policymakers. This is not an easy task, and requires an understanding of urban social and political dynamics and a significant appreciation of data governance, privacy, and ethics. Specific attention is given to domain areas of energy and building efficiency, transportation, public health and emergency response, waste, water, and social connectivity and resilience, as well as the deployment of urban technology at the neighborhood

scale. The role of civic engagement and community participation in the context of open data and citizen science is explored, as well as the evolving relationship between, and influence of, informatics on urban governance. Top-down and bottom-up models of innovative service delivery are discussed and debated in the context of public decision-making. Case studies and best practice examples from U.S. and global cities are used extensively, with a particular focus on New York City.

Prerequisites
- Graduate standing in CUSP. Non-CUSP students by permission of the Instructor.

Course Objectives
- Understand the overall structure and governance of urban operations
- Analyze the key constraints and metrics of each urban domain
- Understand the relationship of public citizens to the effective functioning of urban systems
- Evaluate and assess the efficiency of urban operations and existing and proposed technology-driven interventions
- Understand the role of information and communications technologies in cities and opportunities and constraints to employing ICT to improve the effectiveness of city operations

Course Requirements
In addition to weekly readings and lectures, the course requirements include two problem set assignments and a team project with presentation. Class discussion is an integral part of the course and will factor into the final grade. Students are expected to attend all classes and complete all readings prior to the session indicated in the course outline below. The two problem sets are designed to test your ability to bring analytical tools to urban problems.

Data
Data for assignments or course discussion will be posted on a class GitHub repository or on NYU Classes. This will be announced in class.

A Note on Written Submission and Presentation Requirements:
All written work will be submitted at the beginning of class. Word or LaTeX are acceptable. For Word submission, please use 1.5-spacing in Times New Roman 12-point font, with 1" margins. All charts, graphs, and tables should be embedded in the paper and appropriately referenced in the text. Pages and charts should be numbered appropriately. All sources used should be appropriately cited in the text and included in a list of references at the end of the paper. Spelling, grammar, format, and style of the written work will all factor into the grade, so please be make sure to leave sufficient time to proof-read and edit your work.

Weekly innovation updates are brief (1-page maximum) summaries of novel data science or technological approaches to topics relevant to the week the update is due. Each student will do a total of three (3) weekly innovation updates, including the Week 2 discussion paper. More details on the final team project (including specific written submission and presentation requirements) will be distributed during the first weeks of the semester.

<u>Grading</u>
All requirements must be completed by the date specified and handed in at the beginning of class or they will not be counted toward the final grade. No late assignments will be accepted.

- Weekly "Urban Innovation" Update – 10%
- Problem Set Assignments – 30% (15% each)
- Final Team Project and Presentation – 50%
    - Breakdown of Final Project grading: Milestone deliverables – 10% each; Peer review – 10%; Final Presentation – 20%; Final paper – 40%
- Class Participation and Attendance – 10%

<u>NYU Classes</u>
You must have access to the NYU Classes site (http://classes.nyu.edu/). All announcements and class-related documents (supplemental and suggested readings, discussion questions, etc.) will be posted there.

Some class announcements will be distributed via NYU e-mail. Thus, it is important that you actively use your NYU e-mail account, or have appropriate forwarding set up on NYU Home (https://home.nyu.edu/).

<u>Required Readings (subject to change)</u>
All readings listed in the Course Outline below are required, unless noted as optional.

Required readings are available through NYU online libraries on Google Scholar or ScienceDirect. Some readings will be posted on NYU Classes or distributed in class.

<u>Recommended/Suggested Readings</u>

Batty, M. (2013). *The new science of cities*. MIT Press.

Goldsmith, S., & Crawford, S. (2014). *The responsive city: Engaging communities through data-smart governance*. John Wiley & Sons.

Glaeser, E. (2011). *Triumph of the city: How our greatest invention makes us richer, smarter, greener, healthier, and happier*. Penguin.

Revell, Keith. *Building Gotham: Civic Culture and Public Policy in New York City, 1898-1938*, Baltimore: Johns Hopkins Press: 2003

Doig, Jameson. *Empire on the Hudson: Entrepreneurial Vision and Political Power at the Port of New York Authority*, New York: Columbia University Press, 2001

Caro, Robert. *The Power Broker: Robert Moses and the Fall of New York*, New York: Vintage Books, 1975.

Vernon, Raymond. *Metropolis 1985: An Interpretation of the Results of the New York Metropolitan Region Study*, Cambridge; Harvard University Press, 1960.

Jacobs, Jane. *The Death and Life of Great American Cities: The Failure of City Planning*

Castells, Manuel. *Rise of the Network Society.* 2nd edition. Oxford: Blackwell: 2000

Frieden, Bernard and Lynne Sagalyn (1989). *Downtown, Inc.: How America Rebuilds Cities.* Cambridge, MA: MIT Press.

Fainstein, Susan S. (1994). *The City Builders: property, politics, and planning in London and New York.* Oxford: UK; Cambridge, MA.: Blackwell.

Sassen, Saskia (1991). *The Global City: New York, London, Tokyo. Princeton*, NJ: Princeton University Press.

Nagle, R. (2013). *Picking Up: On the Streets and Behind the Trucks with the Sanitation Workers of New York City.* Macmillan.

Noveck, B. S. S. (2009). *Wiki government: how technology can make government better, democracy stronger, and citizens more powerful.* Brookings Institution Press.

Flood, Joe. *The Fires: How a Computer Formula, Big Ideas, and the Best of Intentions Burned Down New York City--and Determined the Future of Cities.* New York: Riverhead Books: 2010.

Katz, Bruce and Jennifer Bradley. *The Metropolitan Revolution: How Cities and Metros Are Fixing Our Broken Politics and Fragile Economy.* Washington, D.C.: Brookings Institution Press: 2013.

Statement of Academic Integrity
NYU CUSP values both open inquiry and academic integrity. Students graduate programs are expected to follow standards of excellence set forth by New York University. Such standards include respect, honesty, and responsibility. The program does not tolerate violations to academic integrity including:

- Plagiarism
- Cheating on an exam
- Submitting your own work toward requirements in more than one course without prior approval from the instructor
- Collaborating with other students for work expected to be completed individually
- Giving your work to another student to submit as his/her own
- Purchasing or using papers or work online or from a commercial firm and presenting it as your own work

Students are expected to familiarize themselves with the University's policy on academic integrity and CUSP's policies on plagiarism as they will be expected to adhere to such policies at all times – as a student and an alumni of New York University.

The University's policies concerning plagiarism, in particular, will be strictly followed. Please consult the *Chicago Manual of Style* for guidelines on citations. Do not hesitate to ask if you have any questions regarding writing style, citations, or any academic policies.

Course Outline (subject to change)

SECTION 1: SENSING THE CITY

Session 1 – September 5th – Data and Cities – Limits and Opportunities

Topics: Introduction; New York City and the physical, social, and economic patterns of urban growth; Innovation in cities; Course overview – assignments and grading, outline, expectations, etc.

Readings: Anderson, Chris. The End of Theory: The Data Deluge Makes the Scientific Method Obsolete, Wired Magazine, June 23, 2008.
http://archive.wired.com/science/discoveries/magazine/16-07/pb_theory/

Bettencourt, L. and G. West. 2010. A unified theory of urban living. Nature 467 (7318), 912-913.

Session 2 – September 12th – Understanding Cities: Perspectives from Engineering and the Physical and Social Sciences

Topics: A brief history and theory of cities; the "smart city" discourse in context; urban science, urban informatics, and a science of cities.

Readings: Davis, K. The Origin and Growth of Urbanization in the World. *The American Journal of Sociology, 60* (5), 429-437.

Jacobs, J. *Death and Life of Great American Cities.* Chapter 22.

Klosterman, Richard. 1985. "Arguments For and Against Planning," *Town Planning Review* 56: 5-20.

Allwinkle, S., & Cruickshank, P. (2011). Creating smart-er cities: An overview. *Journal of Urban Technology*, *18*(2), 1-16.

Assignment: **Discussion paper due (5 pages max.). Please respond to the following question:** *Do urban data scientists need theory to inform their work and have impact? Why or why not?*

Session 3 – September 19th – Urban Data – Sources, Types, Uses, and Limits

Topics: The implications of large-scale data on city operations and planning; Understanding urban data – sources, quality, uses; Transparency and open data; Civic engagement, privacy, and ELSI issues.

Readings: Batty, M. (2012). Smart cities, big data.

Zheng, Y., Capra, L., Wolfson, O., & Yang, H. (2014). Urban computing: concepts, methodologies, and applications. *ACM Transactions on Intelligent Systems and Technology (TIST)*, *5*(3), 38.

Zook, M., Barocas, S., Crawford, K., Keller, E., Gangadharan, S. P., Goodman, A., ... & Nelson, A. (2017). Ten simple rules for responsible big data research. *PLoS computational biology*, *13*(3), e1005399.

Assignment: Weekly innovation updates start (based on group).

Session 4 – September 26th – Solving Problems with Analytics: What Works?

Topics: The analytical toolkit; How cities, industry, and citizens use data; Understanding the urban problem typology – operations, policy, and planning.

Readings: Donella Meadows, Dancing with Systems. *Handout.*

Lindblom, Charles. 1959. "The Science of 'Muddling Through'," *Public Administration Review* 19: 79-88.

Provost, F., & Fawcett, T. (2013). Data science and its relationship to big data and data-driven decision making. *Big Data*, *1*(1), 51-59.

Case Study: HBS New Urban Mechanics

Assignment: Project - Problem selection and data inventory due.

SECTION 2: URBAN OPERATIONS

Session 5 – October 3rd – 311 & e-Government – Bias and Machine Learning

Topics: Self-reported data for city service delivery; bias and representativeness; predictive modeling

Readings: Minkoff, S. L. (2016). NYC 311: A Tract-Level Analysis of Citizen–Government Contacting in New York City. *Urban Affairs Review*, *52*(2), 211-246.

Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, *27*(3), 264-271.

Session 6 – October 10th – Crime – Spatial Prediction Models

Topics: Predictive policing and data-driven crime prevention strategies; challenges of spatial correlation

Readings: Weisburd, D., Mastrofski, S. D., McNally, A., Greenspan, R., & Willis, J. J. (2003). Reforming to Preserve: CompStat and Strategic Problem Solving in American Policing. *Criminology & Public Policy*, *2*(3), 421-456.

Goel, S., Rao, J. M., & Shroff, R. (2016). Precinct or prejudice? Understanding racial disparities in New York City's stop-and-frisk policy. *The Annals of Applied Statistics*, *10*(1), 365-394.

Case Study: HBS ShotSpotter

Assignment: Problem Set #1 due.

Session 7 – October 17th – Pedestrian Mobility – Wifi, Cell Phone, and Social Media Data

Topics: Real-time population dynamics and trajectories using WiFi, social media, and count data; What drives pedestrian activity in cities?

Readings: Kontokosta, C. E., & Johnson, N. (2017). Urban phenology: Toward a real-time census of the city using Wi-Fi data. *Computers, Environment and Urban Systems*, *64*, 144-153.

Gonzalez, M. C., Hidalgo, C. A., & Barabasi, A. L. (2008). Understanding individual human mobility patterns. *Nature*, *453*(7196), 779-782.

Qian, C., Kats, P., Malinchik, S., Hoffman, M., Kettler, B., Kontokosta, C., & Sobolevsky, S. (2017, July). Geo-Tagged Social Media Data as a Proxy for Urban Mobility. In *International Conference on Applied Human Factors and Ergonomics* (pp. 29-40). Springer, Cham.

SECTION 3: POLICY

Session 8 – October 24th – Energy Efficiency – Behavior, Markets, and Policy

Topics: Building energy efficiency; energy supply and demand management; incentives and regulations for efficiency; energy markets and pricing; green building labels and certifications (and their limits).

Readings: Kontokosta, C. E. (2013). Energy disclosure, market behavior, and the building data ecosystem. *Annals of the New York Academy of Sciences*.

Kontokosta, C. E. (2015). A market-specific methodology for a commercial building energy performance index. *The Journal of Real Estate Finance and Economics*, *51*(2), 288-316.

Palmer, K., & Walls, M. (2017). Using information to close the energy efficiency gap: a review of benchmarking and disclosure ordinances. *Energy Efficiency*, *10*(3), 673-691.

Assignment: Literature review section due.

Session 9 – October 31st – Waste – Designing Equitable Incentive Structures

Topics: Urban solid waste management; predicting and modeling refuse and recycling; data-driven policy strategies.

Readings: The Department of Sanitation's Residential and Street Basket Waste Characterization Study (WCS), 2004-2005, Executive Summary.

Oskamp, S., Harrington, M. J., Edwards, T. C., Sherwood, D. L., Okuda, S. M., & Swanson, D. C. (1991). Factors influencing household recycling behavior. *Environment and behavior*, *23*(4), 494-519.

Case Study: HBS BigBelly

Session 10 – November 7th – Homelessness, Housing, and Zoning – Policy Evaluation

Topics: Low-income housing provision and policy; homelessness and shelter systems; residential segregation and discrimination

Readings: Shinn, M., Gottlieb, J., Wett, J. L., Bahl, A., Cohen, A., & Baron Ellis, D. (2007). Predictors of homelessness among older adults in New York City: Disability, economic, human and social capital and stressful events. *Journal of Health Psychology*, *12*(5), 696-708.

Kontokosta, C. E. (2014). MIXED-INCOME HOUSING AND NEIGHBORHOOD INTEGRATION: EVIDENCE FROM INCLUSIONARY ZONING PROGRAMS. *Journal of Urban Affairs*, *36*(4), 716-741.

Assignment: Problem Set #2 due.

SECTION 4: PLANNING AND URBAN DEVELOPMENT

Session 11 – November 14th – Urban Development and Gentrification – Impact Modeling

Topics: Urban planning in practice; data-driven planning tools and strategies; evidenced-based design; regulations, zoning, and building codes; exclusionary zoning; financing growth and infrastructure investment; real estate and capital markets; Gentrification and neighborhood change

Readings: Forester, John (1987). "Planning in the Face of Conflict." *Journal of the American Planning Association* Vol. 53, No. 3, (Summer).

Glaeser, E. L., Gyourko, J., & Saks, R. (2003). *Why is Manhattan so expensive? Regulation and the rise in house prices* (No. w10124). National Bureau of Economic Research.

Freeman, L., & Braconi, F. (2004). Gentrification and displacement New York City in the 1990s. *Journal of the American Planning Association*, *70*(1), 39-52.

Assignment: Project - Methods and descriptive analysis section due.

Session 12 – November 21st – Sustainability and Resilience – Metrics and Measurement

Topics: Understanding the balance between economics, environment, and equity; Carbon reduction and energy efficiency; buildings and the built environment; Resilience planning; hazard mitigation and vulnerability assessment

Readings: Campbell, S. (1996). Green cities, growing cities, just cities?: Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association*, *62*(3), 296-312.

Rosenzweig, C., Solecki, W., Hammer, S. A., & Mehrotra, S. (2010). Cities lead the way in climate-change action. *Nature*, *467*(7318), 909-911.

L. M. A. Bettencourt, G. B. West Bigger cities do more with less Scientific American 305 (3), 52-53.

NYC Mayor's Office, *A Stronger, More Resilient New York* (read the impacts section and the section for the particular domain of interest)

Session 13 – November 28th – Social Equity and Environmental Justice

Topics: Parks and urban trees and their impact on quality-of-life and real estate values; Equity issues in park planning and access; Intersection of open space and public health.

Readings: Wolch, J., Wilson, J. P., & Fehrenbach, J. (2005). Parks and park funding in Los Angeles: An equity-mapping analysis. *Urban geography*, *26*(1), 4-35.

Conway, D., Li, C. Q., Wolch, J., Kahle, C., & Jerrett, M. (2010). A spatial autocorrelation approach for examining the effects of urban greenspace on residential property values. *The Journal of Real Estate Finance and Economics*, *41*(2), 150-169.

**Assignment: Paper sent to reviewers – Tuesday, November 28th by 5pm.
Peer review due – Friday, December 1st by 5pm.**

Session 14 – December 5th – Wrap-up and Final Presentations

Topics: Wrap-up and discussion of the implications of data and technology on city operations, policy, and planning. Final presentations.

Assignment: Final presentation and paper due.