CTR FOR URBAN SCI AND PROGRESS (CUSP-GX)

CUSP-GX 900X Guided Studies (1-3 Credits)
Typically offered Spring and Summer
Students may engage in independent original research under the supervision of a CUSP or CUSP-affiliated faculty member. Students must come up with an original research topic under the direction of their faculty mentor and write a five-page research proposal that includes a description of and rationale for the study, and potential methodology, a brief literature review, and anticipated deliverables. The proposal must be submitted to the academic advisor for approval.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 5053 Geographic Information Systems (3 Credits)
Typically offered Spring
This course will provide an accessible introduction to the fundamental concepts and operations that underpin Geographic Information Systems (GIS). At its core, GIS relies on geography as an interface to structured and unstructured data that are stored and managed in what are often complex information systems. The course will introduce students to the central components of GIS as commonly deployed in enterprise software, free and open source code libraries, and experimental systems. The course treats the methodology underlying GIS (particularly in spatial and computer science) and the software operations that collectively enable GIS functionality and applications (particularly data structures, spatial data access, and geometric operations). Hands-on lab sessions will walk students through GIS methods in popular software, including the Google Maps Javascript Application Programming Interface (API), ESRI ArcGIS (ArcMap and ArcGIS Pro), GeoDa, and GIS libraries in R Studio. The course is intended to prepare students for more advanced coursework at NYU CUSP, particularly Urban Spatial Analytics and Advanced Spatial Analytics.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 6023 Introduction to Programming for Solving Urban Challenges (3 Credits)
Typically offered Fall
A variety of technical skills are needed to build analyses that can help us to solve urban challenges. This course is designed to develop programming skills and to gain familiarity with the techniques, concepts, and models of urban informatics computing. Students will learn to program in python through a series of online tutorials, and will be exposed to the leading thinking on urban challenges through readings and discussion. Weekly lectures will demonstrate how these skills can be used to construct analyses through detailed code reviews. Finally, students will have the opportunity to practice these skills as they build an analysis of an urban challenge using real data.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 6033 Urban Data Science (3 Credits)
Typically offered Spring
The course targets current and future urban practitioners looking to harness the power of data in urban practice and research. This course builds the practical skillset and tools necessary to address urban analytics problems with urban data. It starts with essential computational skills, statistical analysis, good practices for data curation and coding, and further introduces a machine learning paradigm and a variety of standard supervised and unsupervised learning tools used in urban data science, including regression analysis, clustering, and classification as well as time series analysis. After this class, you should be able to formulate a question relevant to Urban Data Science, locate and curate an appropriate data set, identify and apply analytic approaches to answer the question, obtain the answer and assess it with respect to its certainty level as well as the limitations of the approach and the data. The course will also contain project-oriented practice in urban data analytics, including relevant soft skills – verbal and written articulation of the problem statement, approach, achievements, limitations, and implications.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 6043 Civic Analytics, Urban Intelligence and Data-Informed Leadership (3 Credits)
Typically offered Fall
This course provides an overview of city government, operations, and management of information and communication technologies within cities and related policy domains. There will be an emphasis on new approaches to urban governance and data leadership ranging from performance management to innovation delivery units to smarter cities frameworks and public entrepreneurship. Throughout the course we will focus intently on the importance of data and how to collect it; and also how it should be presented from a policy, management, and political perspective to ensure impact. In addition, the role of civic engagement and community participation is explored. Case studies and best practice examples will be used extensively.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 7000 Data Governance, Ethics and Privacy (0 Credits)
Typically offered Fall
Course Description: This class will teach you to recognize where and understand why ethical issues can arise when applying analytics to urban problems. You will consider issues across the lifecycle of projects that aim to improve city life through data-driven decision-making, starting with collection and moving through the management, sharing, and analysis of data. You will learn how to parse the unique privacy implications of persistent monitoring of activities in putatively public space, the introduction of sensors and other forms of instrumented measurement into the built environment, the repurposing of government data for uses not anticipated at the time of collection, and the kind of analytic techniques that turn these data into actionable insights. The class will also teach you how to assess whether these result in fairly rendered decisions and how to evaluate the desirability of their consequences (from the perspective of various stakeholders). Finally, the class will force you to consider what ethical obligations you may have to those who figure in your research, as well as those to whom the lessons are later applied. You will learn to think critically about how to plan, execute, and evaluate a project with these concerns in mind, and how to cope with novel challenges for which there are often no easy answers or established solutions. To do so, you will develop fluency in the key technical, ethical, policy, and legal terms and concepts that are relevant to a normative assessment of these novel analytic techniques. You will learn about some of the common approaches and tools for mitigating or managing the ethical concerns that these tend to provoke. And by exposing you to a variety of policy documents, the class will help you understand the current regulatory environment and anticipate future developments.
Grading: Grad Poly Pass/Fail
Repeatable for additional credit: No

CUSP-GX 7013 Introduction to Applied Data Science (3 Credits)
Typically offered Fall
This course builds the foundation of the skills and tools necessary to address urban analytics problems with urban data. It starts with basic computational skills, statistical analysis, good practices for data curation and coding, and further introduces a machine learning paradigm and a variety of common supervised and unsupervised learning tools used in urban informatics, including regression analysis, clustering and classification. After this class you should be able to formulate a question relevant to Urban Informatics, locate and curate an appropriate data set, identify and apply analytic approaches to answer the question, obtain the answer and assess it with respect to its certainty level as well as the limitations of the approach and the data. The course will also contain project-oriented practice in urban informatics, including relevant soft skills – verbal and written articulation of the problem statement, approach, achievements, limitations and implications..
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 7020 Ph.D. Colloquium (0 Credits)
Typically offered Fall and Spring
A dynamic and interactive seminar course that promotes understanding the problems that city stakeholders face and identifying innovative urban solutions centered around them. This promotes communication and teamwork across disciplines in the Interdisciplinary doctoral Track in Urban Science: Complexity, Informatics, and Sensing at CUSP while building community in the student body. This seminar course will consist of a four-week rotation of activities. Twice a month, students will discuss the seminal papers on the emerging field of Urban Science (covering different theoretical and methodological perspectives from different disciplines at CUSP) with faculty. Once a month, there will be guest lecture workshops with professionals from the city and private sectors, and academics. Whenever possible, students will actively participate in lived-experience sessions, in which enrollees can gain hands-on experience on the issues faced by stakeholders. Finally, once a month, they will participate in internal presentations.
Grading: Grad Poly Pass/Fail
Repeatable for additional credit: Yes

CUSP-GX 7023 Applied Data Science (3 Credits)
Typically offered Spring
This course equips students with the skills and tools necessary to address applied data science problems with a specific emphasis on urban data. Building on top of the Principles of Urban Informatics (prerequisite for the class) it further introduces a wide variety of more advanced analytic techniques used in urban data science, including advanced regression analysis, time-series analysis, Bayesian inference, foundations of deep learning and network science. The course will also contain a team data analytics project practice. After this class the students should be able to formulate a question relevant to urban data science, find and curate an appropriate data set, identify and apply analytic approaches to answer the question, obtain the answer and interpret it with respect to its certainty level as well as the limitations of the approach and the data. | Prerequisite: CUSP-GX 7013
Grading: Grad Poly Graded
Repeatable for additional credit: No
Prerequisites: CUSP-GX 7013.

CUSP-GX 7033 Machine Learning for Cities (3 Credits)
Typically offered Spring
Student teams engage in projects through the integration and analysis of data, definition and testing of possible solutions, identification of implementation strategies and constraints, and recommendation of preferred solutions and implementation plans. Student teams are challenged to utilize classroom learning within the real-world constraints of city operations and development, while cognizant of political, policy, and financial considerations and issues of data privacy, validity, and transparency. In so doing, student teams are tasked with creating innovative and replicable solutions to pressing urban problems.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 7043 Civic Analytics and Urban Intelligence (3 Credits)
Typically offered occasionally
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.*
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 7053 Innovative City Governance (3 Credits)
Typically offered Fall
This course will introduce you to urban governance and its current innovation trends. Urban governance comprises of the various forces, institutions, and movements that guide economic, politic, social and physical development, the distribution of resources, social interactions, and other aspects of daily life in cities. Public-sector innovation is indispensable to solve the complex urban challenges we are facing and can bring significant improvements in the services that the government has a responsibility to provide, including those delivered by third parties. Following a Discovery-Design-Delivery approach, students will learn the complex nature of cities, different strategies to solve public problems, how urban administration works and how public policies are crafted, how we can promote urban governance innovation, why collaboration is a must and which are the best tactics to promote effective public-private partnerships and networks, how we can support public engagement at all stages of the policymaking cycle, how to promote effective communications using current technology available, ethical issues that may arise when applying analytics to policy problems, how we can connect artificial and collective intelligence, and different approaches to measuring organizational performance. This course will help students to become public entrepreneurs that know how to effectively deliver data and innovation projects into an urban environment.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 7103 Capstone Urban Science Intensive I (3 Credits)
Typically offered Spring
The Urban Science Intensive (USI I) is part of a two-semester capstone sequence that is the experiential learning focus of the program. USI I takes place over 14 weeks in the Spring semester and prepares students for delivering Capstone Projects in the summer. The core of the course is team-based work on a real-world urban problem, combining problem identification and evaluation, data collection and analysis, data visualization and communication, and finally, solution formulation and testing. This project-based course begins with the Social Impact Project, where students are introduced and immersed in problem definition and project delivery skills. The course also lays the foundation for the Capstone Projects, where students work on integrated teams with Agency and Industry Partners, immersed in the public aspects of the project. * *The Urban Science Intensive I course introduces students to their projects and the Agency and Industry mentors involved and develops team-building; students meet with various officials at the relevant agencies and industry partners, tour relevant projects and facilities, and begin to engage the community; student teams define the problem and craft a strategy to identify solutions, inventory available and needed datasets, and explore possibilities for new instrumentation and citizen engagement to support project objectives. This course involves a combination of lectures, student team project work, in-class group work, site visits, and guest speakers.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 7113 Capstone Urban Science Intensive II (3 Credits)
Typically offered Summer term
Student teams engage in projects through the integration and analysis of data, definition and testing of possible solutions, identification of implementation strategies and constraints, and recommendation of a preferred solution and implementation plan. Student teams are challenged to utilize urban informatics within the real-world constraints of city operations and development, while cognizant of political, policy, and financial considerations and issues of data privacy, validity, and transparency. In so doing, student teams will be tasked with creating innovative and replicable solutions to pressing urban problems. The end product of the Intensive sequence is intended to be the result of the integration of multiple skill sets from each student's area of specialization in domain, discipline, and entrepreneurial/organizational leadership focus. | Prerequisite: CUSP-GC 7103
Grading: Grad Poly Graded
Repeatable for additional credit: No
Prerequisites: CUSP-GX 7103.

CUSP-GX 8015 Large Scale Data Analysis I (1.5 Credits)
Typically offered Spring
The past decade has seen the increasing availability of very large scale data sets, arising from the rapid growth of transformative technologies such as the Internet and cellular telephones, along with the development of new and powerful computational methods to analyze such datasets. Such methods, developed in the closely related fields of machine learning, data mining, and artificial intelligence, provide a powerful set of tools for intelligent problem-solving and data-driven policy analysis. These methods have the potential to dramatically improve the public welfare by guiding policy decisions and interventions, and their incorporation into intelligent information systems will improve public services in domains ranging from medicine and public health to law enforcement and security. The LSDA course series will provide a basic introduction to large scale data analysis methods, focusing on four main problem paradigms (prediction, clustering, modeling, and detection). The first course (LSDA I) will focus on prediction (both classification and regression) and clustering (identifying underlying group structure in data), while the second course (LSDA II) will focus on probabilistic modeling using Bayesian networks and on anomaly and pattern detection. LSDA I is a prerequisite for LSDA II, as a number of concepts from classification and clustering will be used in the Bayesian networks and anomaly detection modules, and students are expected to understand these without the need for extensive review.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8033 Urban Spatial Analytics (3 Credits)
Typically offered Fall
In this course, students will learn how spatial analysis can support the exploration of geographical properties, patterns, and phenomena in urban context. The course will cover the foundations of spatial analysis in the spatial sciences, examining in particular how spatial science influences data collection, data modeling, data analysis, and data interpretation. The course will explore the derivation of core spatial statistics and geostatistics that are routinely used in geographical analysis. The course will also examine the use of spatial analysis in supporting spatial modeling. Students are expected to have undertaken prior coursework in Geographic Information Systems (GIS). Labs will focus on how to run spatial analysis methods from GIS platforms. Example sets in the course will focus on urban applications.*
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8043 Advanced Spatial Analytics (3 Credits)
Typically offered Spring
In this course, students will learn about ongoing advances in the field of spatial analysis, particularly in current research and development contexts, including (1) process-based spatial modeling, (2) time-enabled spatial analysis, and (3) spatial analysis on new forms of spatial data. Although the class will explore several of these topics using software-based labs, the course is rooted in an exploration of the methodology underpinning spatial analysis and the derivation of analysis schemes. Students are expected to have prior coursework experience in Geographic Information Systems and spatial analysis. Example sets in the course will focus on urban analysis. | Prerequisites: CUSP-GX 7002
Grading: Grad Poly Graded
Repeatable for additional credit: No
Prerequisites: CUSP-GX 8033.

CUSP-GX 8053 Urban Decision Models (3 Credits)
Typically offered Fall
This course provides an introduction to computer-based optimization and simulation models for decision-making for government officials and policy makers. The emphasis is on models that are widely used in diverse functional areas, including every day operations such as waste collection, policing and transportation to policy making on environment/climate change to sheltering the homeless. Applications will include resource allocation, workforce planning, revenue management, asset-liability management (public sector finance models), environmental policy modeling, pension and bonding planning, and political campaign management, among others. The aim of the course is to help students become intelligent consumers of these methods. To this end, the course will cover the basic elements of modeling -- how to formulate a model and how to use and interpret the information a model produces. The course will attempt to instill a critical viewpoint towards decision models, recognizing that they are powerful but limited tools.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8063 Urban Sensing (3 Credits)
Typically offered Spring
Remote sensing technologies are becoming increasingly available at better resolution levels and lower costs. This course will provide an overview of some of the most common technologies in the areas of imagery, video, sound, and hyperspectral data that can be facilitated through smart phones or other readily accessible means. Students will be given a formal introduction to the aforementioned four areas and then be afforded an opportunity for hands on training in data collection and data analysis. In the course will have the opportunity to work in small groups to investigate an urban problem of interest to them at a site of their choosing. The teams will use these new learned technologies in tandem with other publicly accessible data (either formally available or also collected by the researchers) to investigate a working hypothesis about their chosen urban problem for their particular site.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8073 Big Data Analytics for Public Policy (3 Credits)
Typically offered Spring
The goal of the Big Data Analytics for Public Policy class is to develop the key computer science and data science skill sets necessary to harness the wealth of newly-available data. Its design offers hands-on training in the context of real microdata. The main learning objectives are to apply new techniques to analyze social problems using and combining large quantities of heterogeneous data from a variety of different sources. It is designed for graduate students who are seeking a stronger foundation in data analytics.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8083 Big Data Management & Analysis (3 Credits)
Typically offered Spring
The course aims to provide an understanding of big data and state-of-the-art technologies to manage and process them. General topics of this course include: big data ecosystems, parallel and streaming programming model, and spatial data processing. Hands-on labs and exercises in MapReduce, Hadoop, Spark, Hive, and Pig will be offered throughout the class to bolster the knowledge learned in each module.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8093 Data Visualization (3 Credits)
Typically offered Spring and Summer
Visualization and visual analytics systems help people explore and explain data by allowing the creation of both static and interactive visual representations. A basic premise of visualization is that visual information can be processed at a much higher rate than raw numbers and text. Well-designed visualizations substitute perception for cognition, freeing up limited cognitive/memory resources for higher-level problems. This course aims to provide a broad understanding of the principals and designs behind data visualization. General topics include state-of-the-art techniques in both information visualization and scientific visualization, and the design of interactive/web-based visualization systems. Hands on experience will be provided through popular frameworks such as matplotlib, VTK and D3.js.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8103 Data-Driven Methods for Policy Evaluation (3 Credits)
Typically offered occasionally
The growing use of data-centric technologies is transforming many aspects of public policy in the United States. These technologies affect the scale and nature of data that can be collected, enabling new approaches for evaluating policies both retrospectively and prospectively; for detecting discriminatory practices; and for auditing and designing "fair" algorithmic systems, among other applications. While modern computational and statistical methods offer the promise of increased efficiency, equity, and transparency, their use also raises complex legal, social, and ethical questions. In this course, we will discuss the use of such methods in a variety of applications, focusing on examples from criminal justice, and will examine the relationships between law, public policy, and data.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8113 Monitoring Cities (3 Credits)
Typically offered occasionally
The world's urban population is growing by nearly 60 million per year; equivalent to four cities like New York annually. Monitoring the chronological growth of key attributes of cities, as well as quantifying their current conditions presents a great potential for positive change. Through the acquisition of new data, there are immediate opportunities to influence the sustainable growth of small and medium size cities. There is also the potential for alleviating the extremes in Megacities, where conditions have reached a critical and unmanageable state. Looking at cities as interdependent networks of physical, natural and human systems, this course provides a perspective on how to monitor the function and wellness of these systems. Students obtain an understanding of needs assessment, planning, and technical approaches for instrumenting a city. This includes monitoring patterns of activity, mobility, energy, land use, physical and lifeline infrastructure, urban ecology, vegetation, atmosphere and air quality. The expected outcomes of this course is a comprehensive understanding of what can be instrumented and the monitoring architecture for acquiring and generating new data about cities.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8115 Large Scale Data Analysis II (1.5 Credits)
Typically offered Spring
The past decade has seen the increasing availability of very large scale data sets, arising from the rapid growth of transformative technologies such as the Internet and cellular telephones, along with the development of new and powerful computational methods to analyze such datasets. Such methods, developed in the closely related fields of machine learning, data mining, and artificial intelligence, provide a powerful set of tools for intelligent problem-solving and data-driven policy analysis. These methods have the potential to dramatically improve the public welfare by guiding policy decisions and interventions, and their incorporation into intelligent information systems will improve public services in domains ranging from medicine and public health to law enforcement and security. The LSDA course series will provide a basic introduction to large scale data analysis methods, focusing on four main problem paradigms (prediction, clustering, modeling, and detection). The first course (LSDA I) will focus on prediction (both classification and regression) and clustering (identifying underlying group structure in data), while the second course (LSDA II) will focus on probabilistic modeling using Bayesian networks and on anomaly and pattern detection. LSDA I is a prerequisite for LSDA II, as a number of concepts from classification and clustering will be used in the Bayesian networks and anomaly detection modules, and students are expected to understand these without the need for extensive review. In both LSDA I and LSDA II, students will learn how to translate policy questions into these paradigms, choose and apply the appropriate machine learning and data mining tools, and correctly interpret, evaluate, and apply the results for policy analysis and decision making. We will emphasize tools that can "scale up" to real-world policy problems involving reasoning in complex and uncertain environments, discovering new and useful patterns, and drawing inferences from large amounts of structured, high-dimensional, and multivariate data. No previous knowledge of machine learning or data mining is required, and no knowledge of computer programming is required. We will be using Weka, a freely available and easy-to-use machine learning and data mining toolkit, to analyze data in this course.
Grading: Grad Poly Graded
Repeatable for additional credit: No

CUSP-GX 8123 Disaster Risk Analysis and Urban Systems Resilience (3 Credits)

Typically offered Spring

This course offers ample coverage of urban risks to different natural hazards such as earthquakes, hurricanes, floods, and wildfires. The class will discuss fundamental concepts in understanding hazards, infrastructure vulnerability, risk, and disaster recovery. Additionally, the course will cover introductory topics on disaster risk modeling with rigorous statistical methods and large datasets. The class will review critical elements that can exacerbate risks such as climate change, rapid urban growth, and deteriorating and precarious infrastructure. The course will include guest speakers who inform policymaking on large-scale risk mitigation and novel technologies for disaster risk reduction. The class is designed for graduate students interested in risk and resilience for practice and research. Knowledge of undergrad-level statistics and probabilities and experience in data visualization in Python, Matlab, or R is required. The class will meet regularly for lectures and discussion of reading assignments on state-of-the-art quantitative and qualitative concepts of disaster risk and risk management. An open project in the field of disaster risk and resilience is a crucial component of the class.

Grading: Grad Poly Graded

Repeatable for additional credit: No

CUSP-GX 8133 Democracy and the City (3 Credits)

Typically offered occasionally

We live in a world beset with increasingly complex urban and global challenges where learning how to combine big data and collective intelligence is a must to create public value. Only by learning how to properly mix data analytics and the use of collaborative and participatory strategies will we be able to secure citizens' rights, expand the provision of public services and improve their quality. This course reviews big ideas, key debates, policies and innovative/disruptive tools around the combination of these two sources of knowledge that, properly blended, have the capacity to transform how we govern the city and the world. Following a Discovery-Design-Delivery approach, students will also learn how we can promote big data democratization, adding a bottom-up approach in the creation, capture, curation, analysis, visualization and data ethics, and will review how we can connect big data with justice, sustainability, livability, and resilience to secure citizens' socio-economic human rights and anticipate social problems like the ones derived to the aging population. Other questions that we will tackle will be how we can combine artificial and collective intelligence, the role that "global cities" can play in the global economic system and how we can help them to address the opportunities and challenges of the sharing and platform economy. In conclusion, reviewing good practices from around the world, the course purpose is twofold: (1) to enhance your sophistication in thinking about and analyzing the big data and collective intelligence blended practices, and (2) to hone your skills about how to work with public institutions, especially cities but also regional, state and federal governments, and putting them into practice developing practical collaborative and participatory management skills.

Grading: Grad Poly Graded

Repeatable for additional credit: No

CUSP-GX 8143 Internet-of-Things Security and Privacy: A Data-Driven Perspective (3 Credits)

Typically offered occasionally

Smart home IoT (Internet-of-Things) devices are gaining popularity in average consumer homes. These "smart" devices, such as cameras, plugs, TVs, dishwashers, etc, are also known to pose various security and privacy threats (e.g., your Alexa listening to you), but the opaque nature of these devices makes it difficult to discover security and privacy vulnerabilities. This course introduces basic and advanced topics on Internet-of-Things (IoT) security and privacy from a data-driven perspective. It starts with preliminaries on networking and Internet security, followed by security research based on a data-driven approach. Students will read peer-reviewed academic papers from multiple disciplines, ranging from computer science, psychology, and policy/law. Furthermore, students will engage in hands-on projects to independently investigate real-world security and privacy issues of IoT devices and/or propose solutions to fix these issues. Students for this class are expected to have networking knowledge, such as how TCP/IP works, how packets get forwarded, and how to run tcpdump. Otherwise, students are encouraged to take relevant Coursera courses on these topics before the semester begins and to seek the instructor's approval.

Grading: Grad Poly Graded

Repeatable for additional credit: No

CUSP-GX 8153 Complex Urban Systems (3 Credits)

Typically offered Spring

This course offers an introduction to the broad field of complex urban systems, with a focus on project-based learning and computer coding. Using only basic concepts in probability and linear algebra, the course will introduce methods and principles of complex systems applied to urban systems, including geography laws, scaling principles, and mobility patterns.

Grading: Grad Poly Graded

Repeatable for additional credit: No

CUSP-GX 9010 Urban Computing Skills Lab: Introduction to Programming for Solving City Challenges (0 Credits)

Typically offered not typically offered

The Masters program in Applied Urban Science and Informatics is a unique program that brings together people from diverse backgrounds and career paths who have found a passion for applying analytical skills to problem-solving in an urban context. Because of this wide variety of backgrounds, you may be entering into this program with little computer science background, or have less familiarity with urban challenges. This course is designed to develop programming skills and to gain familiarity with the techniques, concepts, and models of urban informatics computing. Students will learn to program in python through a series of online tutorials, and will be exposed to the leading thinking on urban challenges through readings and discussion. Weekly lectures will demonstrate how these skills can be used to construct analyses through detailed code reviews. Finally, students will have the opportunity to practice these skills as they build an analysis of an urban challenge using real data.

Grading: Grad Poly Pass/Fail

Repeatable for additional credit: No

CUSP-GX 9113 Special Topics in Urban Science & Informatics (3 Credits)
Typically offered occasionally
This special topic explores a specific perspective and research in urban science and informatics. Students are expected to participate actively through sessions.
Grading: Grad Poly Graded
Repeatable for additional credit: Yes