GC Digital Initiatives

Courses in Computation and Digital Cultures Across the Curriculum at The Graduate Center

Fall 2016

In Fall 2016, 17 courses focused on computational practices and digital cultures will be offered across The Graduate Center's doctoral, master's, and certificate programs. Topics covered in these courses range from theorizing digital humanities to computer programming to statistical analysis, and provide hands-on opportunities for GC students to develop their digital research skills.

The 17 courses are listed below in alphabetical order by program along with a brief description taken from their respective program websites. Interested students should contact individual programs if they have questions regarding course content/prerequisites or if permission is required.

For more information about the GC Digital Initiatives Program, please visit http://cuny.is/gcdi and http://cuny.is/gcdigitalfellows.

BIOL 78001 – Mathematical Biology (CRN: 32538)
****Instructor permission required. Associated lab: BIOL 78002 (CRN: 32539)****
Profs. Lisa Manne & Stephen Gosnell
DESCRIPTION: This course will serve to introduce the principles of experimental design and statistical analyses as applied to biological systems. The content will range from descriptive to inferential statistics and hypothesis testing. Considerable emphasis will be placed on the analysis of variance and its application to various experimental designs. Some attention will be given to non-parametric methods and randomization procedures.

The laboratory work consists of individual student projects and of introduction to computer programming.

CSc 70010 - Analysis of Algorithms (CRN: 32386)
****Students must have completed coursework at the undergraduate level in this area.****
Prof. Gabor T. Herman
DESCRIPTION: Analysis of algorithms involves characterizing the amount of resources consumed by algorithm, measured as a function of input length, and typically bounded in the worst case. The most common resources considered are running time and space used, but others may be considered as well, such as number of random bits used or number of blocks read from secondary storage. In algorithm design, we seek algorithms that have good worst-case resource requirements and other attractive qualities, such as optimality or approximation guarantees, good performance in practice, parallelizability, and simplicity.

This course covers the design and analysis of algorithms for a number of fundamental problems, such as sorting and order statistics, spanning trees, shortest paths, matching and max flow / min cut, max cut and max-SAT, knapsack, vertex cover and set cover, matrix multiplication (and integer multiplication), and linear programming. Common algorithm design techniques will be emphasized, including greedy, divide and conquer, iterative/gradient descent, and dynamic programming, as well as formulating problems as LPs and the use of randomness. Some efficient data structures will also be examined, primarily hash tables (and Bloom filters), but also varieties of heaps and binary search trees. Finally, we will briefly discuss Turing Machines and the halting problem, NP-Completeness (and P-Completeness), and reductions. Implementation projects might be assigned, applying algorithms to real-world applications.

CSc 72010 - Computer Networks (CRN: 32391)
****Students must have completed coursework at the undergraduate level in this area.****
Prof. Danyang Zhang
DESCRIPTION: The last two decades or so have witnessed the astonishing growth and evolution speed of computer networks and the tremendous impact they have made to our society and individuals in many aspects. Knowing how computer networks were established and how data is transmitted inside computer networks would be a fundamental expertise for graduate students majored in computer science.

This course is designed for graduate students in Computer Science programs who have knowledge in undergraduate level Computer Networks, Algorithms and some familiarity with probability theory. This course covers an in-depth review of fundamental principles of network architecture and protocols, introductions on advanced computer networks, and advanced principles of the design of computer networks. Specifically, we will review fundamental computer network architecture, principles of Circuit Switching and Packet Switching, the protocol stack, and essential design principles and network protocols of each network layer. Advanced topics in computer networks, such as Wireless and Mobiles networks and Network Security will be introduced. In addition, we will explore in-depth principles for common protocol design techniques.

CSc 74030 - Computer Vision/Image Processing (CRN: 32388)
**** Requires ability to program in C++, linear algebra, and probability and statistics.****
Prof. Ioannis Stamos
DESCRIPTION: Computer vision and image processing are important and fast evolving areas of computer science, and have been applied in many disciplines. This course will introduce students to the fascinating fields. Student will gain familiarity with both established and emergent methods, algorithms and architectures. This course will enable students to apply computer vision and image processing techniques to solve various real-world problems, and develop skills for research in the fields.

This course introduces fundamental concepts and techniques for image processing and computer vision. Topics to be covered include image formation, image filtering, edge detection and segmentation, morphological processing, registration, object recognition, object detection and tracking, 3D vision, and etc.

CSc 84030 - Big Data Management & Analysis (CRN: 32393)
****Students must have experience with parallel processing in the CUDA environment.****
Prof. Huy Vo
DESCRIPTION: Big data is sometimes defined as data that are too big to fit onto the analyst's computer. With storage and networking getting significant cheaper and faster, big data sets could easily reach the hands of data enthusiasts with just a few mouse clicks. These enthusiasts could be policy makers, government employees or managers, who would like to draw insights and (business) value from big data. Thus, it is crucial for big data to be made available to the non-expert users in such a way that they can process the data without the need of a supercomputing expert. The course aims to provide a broad understanding of big data and current technologies in managing and processing them with a focus on urban data sets.

An approach to make big data available to a wide audience target is to build big data programming frameworks that can deal with big data in as close a paradigm as the way it deals with "small data." Such a framework should be as simple as possible, even if not as efficient as custom-designed parallel solutions. Users should expect that if their code works within these frameworks for small data, it will also work for big data. The course will provide an overview of big data analytic lifecycle and how to use current techniques and frameworks to build big data analysis pipelines. This course will use Python as the main programming language; however, other languages may also be accepted where applicable, e.g. using Java for Hadoop.

CSc 84300 - Computational Biology (CRN: 32852)
****Prerequisites: Basic knowledge of Unix OS, statistics, and linear algebra. Programming skills are desired but not required.****
Prof. Lei Xie
DESCRIPTION: This course introduces the fundamental algorithms and applications of data mining, computational, and modeling techniques in biology and medicine. The focus will be on capability of formulating biological questions into computational problems, and hand-on skills in making use of software and databases to solve real-world problems. The goal is to provide students a holistic, quantitative, and multi-scale view of biological systems.

ENGL 89500 - Clouds (CRN: 32062)
Prof. Matthew Gold
DESCRIPTION: In *Mechanisms*, Matthew G. Kirschenbaum writes about the magnetic hard disk drive as an "example of what it means to consider storage media as a kind of writing machine." Though Kirschenbaum's work provides a "grammatology of the hard drive," increasingly, our text is consigned to other people's hard drives – otherwise known as "the cloud": our prose

typed into Google docs; our books downloaded from remote Kindle and iBook libraries; and our tweets, Facebook updates, and blog posts stored on remote, cloud-based servers. This is the public cloud. Behind that public cloud lies a mass of computational infrastructure and obfuscated text: our individual and collective search and purchase histories; our phone texts, email messages, and call logs; our media preferences and choices; our annotations, comments, faves, and likes -- all mined by "machine learning" algorithms, often in the service of both private corporate interests and governmental surveillance agencies. How do we make sense of the texts in and of our lives at a moment when our words are both inscribed on hard drives and consigned to the "cloud"? What new forms of control and surveillance do such cloud-based structures make possible, and what kinds of collectivities do they write into being? To what extent can we see such large-scale textual corpora as spaces for agency and for algorithmic exploration and play? Moving across histories of the book and of computational infrastructure to issues of text mining and deformance, this course will consider the problems, processes, and possibilities of the modern, text-based cloud.

Authors to be read include: Matthew G. Kirschenbaum, Simone Browne, Samir Chopra, Yochai Benkler, Benjamin H. Bratton, Frank Pasquale, Trebor Scholz, Gabriella Coleman, John Durham Peters, Tung-Hui Hu, Adrian Johns, Wendy Hui Kyong Chun, William Gibson, Adrian McKenzie, Jerome McGann, Evgeny Morozov, Alex Galloway, and Nicole Starosielski, among others.

EPSY 70500 - Statistics & Computer Programming I (CRN: 32038)
Prof. David Rindskopf
DESCRIPTION: Introduction to the basic principles underlying data exploration, description, and analysis, statistical inference and the use of computer packages for data analysis. 70500 and 70600 form an integrated sequence covering descriptive statistics, point and interval estimation, hypothesis testing, t-tests, analysis of variance, correlation, regression (including elementary matrix algebra), repeated measures designs, cross-classified data, and the use of computer packages for these analyses.

EPSY 83300 - The General Linear Model (CRN: 32041)
****Prerequisite: EPSY 70600.****
Prof. Jay Verkuilen
DESCRIPTION: This course presents a general statistical procedure (the General Linear Model) for analyzing relations between a set of dependent and independent variables. Problems such as experimental designs with unequal cell frequencies, analysis of covariance, and multivariate analyses with multiple dependent variables are considered within this framework.

ITCP 70010 - Interactive Media: History, Theory, and Practice (CRN: 32117)
****Open to all GC students but meeting with ITP Coordinator required.****
Profs. Stephen Brier & Ximena M. Gallardo

DESCRIPTION: This is the first core course in the Interactive Technology and Pedagogy certificate program. We will examine the economic, social, and intellectual history of technological change over time, as well as technology and digital media design and use. Our primary focus is on the mutual shaping of technology and academic teaching, learning and research—how people and technologies have shaped academic classroom and research interactions in the past, and how they are reshaping the university in the present. By examining the use and design of technologies inside and outside of the academy, we are, of course, also reflecting on what it means to be human in a world increasingly dominated and controlled by various technologies.

The course also explores the history and theory of digital media, including hypertext and multimedia, highlighting the theoretical and practical possibilities for research, reading, writing, presentation, interaction, and play. We are particularly interested in the ITP program in the possibilities that new, nonlinear, digital tools have opened up for teaching and research, including the emergence of the "Digital Humanities."

LING 78100 - Introduction to Computational Methods I (CRN: 32098)
****Limited seats available.****
Prof. Gita Martohardjono
DESCRIPTION: This is the first of a two-part course sequence to train students with a linguistics background in the core methodologies of computational linguistics. Successful completion of this two-course sequence will enable students to take graduate-level elective courses in computational linguistics; both courses offered by the Graduate Center's Linguistics Program, as well as courses offered by the Computer Science Program. This course [as the first part—Methods in Computational Linguistics I—of a two-part sequence] will introduce computer programming at a level that will allow students to begin building computer applications that address various computational linguistic tasks. No previous programming experience is required. The programming language we will use is Python. We begin by learning the syntax of Python and how to program generally; we then focus specifically on linguistic applications.

LING 79500 - Sociolinguistics of Computer Mediated Communication (CRN: 32087)
(Crosslisted with ANTH 78100 and SPAN 80100.)
Prof. Cecelia Cutler
DESCRIPTION: This course examines recent quantitative and qualitative research on language use, attitudes, ideologies, and practices in computer mediated communication (CMC) with a special focus on Spanish language data. It explores research on subcultures and fan communities, political activism and radicalization, diasporic communities, multilingual practices, creative orthography, language play, expressions of gender and transgender identities, and other topics of interest to students across various CMC platforms including Twitter, Facebook, online fora, microblogs, YouTube, blogs, and SMS/texting What's App, and Instagram.

MALS 75400 - Introduction to Digital Humanities (CRN: 32264)

(Crosslisted with IDS 81610.)
Profs. Stephen Brier & Lisa Rhody
DESCRIPTION: The dramatic growth of the Digital Humanities (DH) over the past half dozen years has helped scholars re-imagine the very nature and forms of academic research and teaching across a range of scholarly disciplines, encompassing the arts, the interpretive social sciences, and traditional humanities subject areas. This course will explore the history of the digital humanities, focusing especially on the diverse pioneering projects and core texts that ground this innovative methodological and conceptual approach to scholarly inquiry and teaching. It will also emphasize ongoing debates in the digital humanities, such as the problem of defining the digital humanities, the question of whether DH has (or needs) theoretical grounding, controversies over new models of peer review for digital scholarship, issues related to collaborative labor on digital projects, and the problematic questions surrounding research involving "big data." The course will also emphasize the ways in which DH has helped transform the nature of academic teaching and pedagogy in the contemporary university with its emphasis on collaborative, student-centered and digital learning environments and approaches. Along the way, we will discuss broad social, legal and ethical questions and concerns surrounding digital media and contemporary culture, including privacy, intellectual property, and open/public access to knowledge and scholarship. Students will be expected to participate actively in class discussions and online postings (including on blogs and wikis) and to research and write a final multimedia presentation on a key topic in the digital humanities. Students completing the course will gain broad knowledge about and understanding of the emerging role of the digital humanities across several academic disciplines and will begin to learn some of the fundamental skills used often in digital humanities projects.

Note: this course is part of an innovative "Digital Praxis Seminar," a two-semester long introduction to digital tools and methods that will be open to all students in the Graduate Center. The goal of the course is to introduce graduate students to various ways in which they can incorporate digital research into their work.

NURS 71100 - Applied Statistics I (CRN: 32575)
****Prerequisites: Graduate level statistics course within the last 5 years and NURS 70100.****
Prof. Eileen Gigliotti
DESCRIPTION: The focus of this first course in the two-semester statistics sequence will be on developing a conceptual understanding of the uses and interpretation of statistics involving the differences between and among populations (groups) including t-tests, one way ANOVA, multifactorial ANOVA, Analysis of Covariance (ANCOVA) and Repeated Measures ANOVA. Drawing on current nursing research, the case study method will be used to enhance the students' conceptual understanding by illustrating actual applications of particular statistical techniques.

PHYS 85200 - Big Data Analysis: Principles and Methods (CRN: 32550)

****Open to students in the sciences, math, computer science and economics. Other majors require instructor approval.****
Prof. Geva Patz
DESCRIPTION: Coming soon!

SOC 81900 - Advanced Methods of Demographic Analysis (CRN: 32216)
(Crosslisted with DCP 80100.)
Prof. Shiro Horiuchi
DESCRIPTION: In this course we study advanced methods of demographic analysis. They are widely used in research on mortality, fertility, nuptiality, migration, population composition, and other demographic processes, but many of them can also be applied to a broad range of topics in other areas of the social sciences and biomedical sciences. Those methods include event history analysis (nonparametric, semi-parametric and parametric versions; continuous and discrete time versions; fixed and time-dependent covariate versions), life table techniques (single-decrement, multiple-decrement and multi-state), decomposition analysis, age-period-cohort models, methods for analyzing multiple time trends (e.g., Lee-Carter model), Lexis map analysis, smoothing and non-parametric regression techniques, and mathematical models of population dynamics. Computer exercises are included.

SSW 85000 - Quantitative Methods for Policy Research (CRN: 32206)
(Crosslisted with CRJ 80200.)
****Prerequisite: Completion of an advanced statistics course. Class meets at the Silberman School of Social Work.****
Prof. Michael A. Lewis
DESCRIPTION: Public policies can be thought of as laws and regulations which authorize the creation of social interventions ostensibly intended to address various social problems. In this course, quantitative policy research refers to the use of quantitative methods in an attempt to answer questions related to policy issues, particularly those regarding cause and effect. More specifically, I will focus on tools developed by statisticians and econometricians that are used by social scientists, social work researchers, health researchers, and others interested in estimating causal effects, especially when randomized controlled experiments are neither ethical nor feasible.