MA in Computational Social Science

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• Magne Mogstad, Economics
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• Alessandra Voena, Economics
• Daniel Yurovsky, Psychology

Senior Lecturer
• Rick Evans

Lecturer
• Benjamin Soltoff

Preceptor
• Ging Cee Ng

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General Information

The Master of Arts in Computational Social Science is a two-year program of graduate study. It has a structured curriculum, with a total of 18 required and elective courses tailored to the disciplinary track a student follows. Students
submit an article-length MA thesis in their second year, after completing a three-quarter research commitment working directly with a member of our Executive or Affiliated Faculty.

The program aims to produce leading social scientists in each of our core social science fields – economics, sociology, political science, psychology, history, and anthropology – producing competitive PhD applicants, well-trained in computational approaches, who have mastered the research and analytical skills necessary to make important contributions.

Students receive close mentorship from the program’s Faculty Director, academic staff, and members of our Executive and Affiliated Faculty.

They receive full professional support from our Director of Career Services, with biweekly workshops, career planning, and employer recruitment.

Finally, all MA students may participate in an optional summer practicum between their first and second year, with internships drawn from academic and professional organizations. International students have three years of STEM work eligibility after they graduate.

Program Requirements and Course Work

All MA students complete the equivalent of 18 graduate seminars and write an article-length MA thesis.

The courses are selected with the advice of our academic staff, and follow different disciplinary tracks, tailored to the research commitments of each student.

In their first year, all students take a three course core in Perspectives: Perspectives on Computational Analysis, Perspectives on Computational Modeling, and Perspectives on Advanced Computational Topics.

Most take a three course sequence on Computer Science with Applications (with more advanced courses for students with prior exposure, and an optional sequence in Computational Neuroscience for psychology concentrators).

The remaining three courses vary, and depend on the student’s prior training and disciplinary path. Priority will go to any needed courses in statistics, linear algebra, or advanced math in particular disciplines (e.g. real analysis in economics). If those requirements are met, the student will take up to three social science electives in their area of research.

In their second year, all students complete a three course “research commitment,” working directly with a member of our Computation faculty, producing an MA thesis modeled on a professional journal article. They take three advanced courses in computational methods, tailored to their disciplinary interest. And they complete three social science electives, in their area of research.

If students desire, they can petition to replace any portion of the three quarter research commitment with social science electives or other courses in computational methods.

Outside of their coursework, all MA students are expected to attend our weekly Computation Workshop, where advanced scholars and invited guests present drafts of their research for critique and discussion.

Admission

MACSS applicants must meet the formal requirements of the Graduate Social Sciences Division.

All applicants must submit GRE scores, except for those applying for the joint BA/MA degree.

All financial aid is merit-based, and MACSS offers partial and full tuition scholarships at the time of admission.

Joint BA/MA applicants pay graduate tuition rates, and are eligible to receive the same aid they had in the College.

Applicants from non-English speaking countries must provide evidence of English proficiency by submitting scores from either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS).

Some non-native English speakers are exempt, if they have studied in an English language University. Please contact our Dean of Students Office with any questions: admissions@ssd.uchicago.edu

How to Apply

The Application for Admission and Financial Aid, with instructions and deadlines, is available online at: https://apply-ssd.uchicago.edu/apply/.

For additional information about our program, please contact E.G. Enbar, our Student Affairs Administrator, at 773-702-8312 or egenbar@uchicago.edu.

Please also visit our website: https://macss.uchicago.edu
MA Program in Computational Social Science Courses

MACS 30000. Perspectives on Computational Analysis. 100 Units.
Massive digital traces of human behavior and ubiquitous computation have both extended and altered classical social science inquiry. This course surveys successful social science applications of computational approaches to the representation of complex data, information visualization, and model construction and estimation. We will reexamine the scientific method in the social sciences in context of both theory development and testing, exploring how computation and digital data enables new answers to classic investigations, the posing of novel questions, and new ethical challenges and opportunities. Students will review fundamental research designs such as observational studies and experiments, statistical summaries, visualization of data, and how computational opportunities can enhance them. The focus of the course is on exploring the wide range of contemporary approaches to computational social science, with practical programming assignments to train with these approaches.

Instructor(s): Rick Evans and Benjamin Soltoff Terms Offered: Autumn
Note(s): MACSS students have priority. Others admitted with instructor consent.

MACS 30100. Perspectives on Computational Modeling. 100 Units.
Students are often well trained in the details of specific models relevant to their respective fields. This course presents a generic definition of a model in the social sciences as well as a taxonomy of the wide range of different types of models used. We then cover principles of model building, including static versus dynamic models, linear versus nonlinear, simple versus complicated, and identification versus overfitting. Major types of models implemented in this course include linear and nonlinear regression, machine learning (e.g., parametric, Bayesian and nonparametric), agent-based and structural models. We will also explore the wide range of computational strategies used to estimate models from data and make statistical and causal inference. Students will study both good examples and bad examples of modeling and estimation and will have the opportunity to build their own model in their field of interest.

Instructor(s): Rick Evans, Benjamin Soltoff Terms Offered: Winter
Prerequisite(s): MACS 30000. Economic Policy Analysis with Overlapping Generation Models. 100 Units.
Note(s): MACSS students have priority. Others admitted with instructor consent.

MACS 30200. Perspectives on Advanced Computational Topics. 100 Units.
This course focuses on scaling up computational approaches to social science analysis and modeling with big data in context of opportunities afforded by high performance and cloud computing. We will begin by exploring various data structures encountered in social science research, how to deal with large or complex data storage and streaming data, and how to factor considerations of computational complexity into their analyses. We will also study social science applications of parallel computing, both on stand-alone machines and in supercomputing environments, to carry out complex computations. Students will learn to carry out parallel I/O and parallel computation on their own machines and on a cluster. We will also address API construction and access, and explore cloud configurations for social science research designs. We will also help students construct web-based outward facing data, analysis and visualization portals. Students will efficiently gather, structure, perform and present analysis on large-scale social science data.

Instructor(s): Richard Evans, Benjamin Soltoff Terms Offered: Spring
Prerequisite(s): MACS 30000. Economic Policy Analysis with Overlapping Generation Models. 100 Units.
Note(s): MACSS students have priority. Others admitted with instructor consent.

MACS 30500. Computing for the Social Sciences. 100 Units.
This is an applied course for social scientists with little programming experience who wish to use computational analysis in their research. After completion of this course, students will be able to write basic programs that fulfill their own research needs. Major topics to be covered include data wrangling, data exploration, functional programming, statistical modeling, and reproducible research. Students will also learn how to parse text files, scrape data from other sources, create and query relational databases, implement parallel processes, and manage digital projects. Class meetings will be a combination of lecture and laboratory sessions, and students will complete weekly programming assignments as well as a final research project. Assignments will be completed primarily using the open-source R and Python programming languages and the version control software Git.

Instructor(s): Benjamin Soltoff Terms Offered: Autumn
Note(s): MACS students have priority. Others admitted with instructor consent.
Equivalent Course(s): SOCI 40176

MACS 40000. Economic Policy Analysis with Overlapping Generation Models. 100 Units.
This course will study economic policy questions ideally addressed by the overlapping generations (OG) dynamic general equilibrium framework. OG models represent a rich class of macroeconomic general equilibrium model that is extremely useful for answering questions in which inequality, demographics, and individual heterogeneity are important. OG models are used extensively by the Joint Committee on Taxation, Congressional Budget Office, and Department of the Treasury. This course will train students how to set up and solve OG models. The standard nonlinear global solution method for these models--time path iteration--is a fixed point method that is similar to but significantly different from value function iteration. This course will take students through progressively richer versions of the model, which will include endogenous labor supply, nontrivial demographics, bequests, stochastic income, multiple industries, non-balanced government budget constraint, and household tax structure.

Instructor(s): Rick Evans Terms Offered: Autumn
MACS 40200. Structural Estimation. 100 Units.
Structural estimation refers to the estimation of model parameters by taking a theoretical model directly to the data. (This is in contrast to reduced form estimation, which often entails estimating a linear model that is either explicitly or implicitly a simplified, linear version of a related theoretical model). This class will survey a range of structural models, then teach students estimation approaches including the generalized method of moments approach and maximum likelihood estimation. We will then examine the strengths and weaknesses of both approaches in a series of examples from the fields of economics, political science, and sociology. We will also learn the simulated method of moments approach. We will explore applications across the social sciences.
Instructor(s): Richard Evans Terms Offered: Winter
Prerequisite(s): MACSS students have priority. Others admitted with instructor consent.

MACS 40700. Data Visualization. 100 Units.
Social scientists frequently wish to convey information to a broader audience in a cohesive and interpretable manner. Visualizations are an excellent method to summarize information and report analysis and conclusions in a compelling format. This course introduces the theory and applications of data visualization. Students will learn techniques and methods for developing rich, informative and interactive, web-facing visualizations based on principles from graphic design and perceptual psychology. Students will practice these techniques on many types of social science data, including multivariate, temporal, geospatial, text, hierarchical, and network data. These techniques will be developed using a variety of software implementations such as R, ggplot2, D3, and Tableau.
Instructor(s): Benjamin Soltoff Terms Offered: Spring

MACS 54000. Introduction to Spatial Data Science. 100 Units.
Spatial data science consists of a collection of concepts and methods drawn from both statistics and computer science that deal with accessing, manipulating, visualizing, exploring and reasoning about geographical data. The course introduces the types of spatial data relevant in social science inquiry and reviews a range of methods to explore these data. Topics covered include formal spatial data structures, geovisualization and visual analytics, spatial autocorrelation, cluster detection, regionalization and spatial data mining. An important aspect of the course is to learn and apply open source software tools for the analysis of spatial data, such as R and GeoDa.
Instructor(s): L. Anselin Terms Offered: Autumn
Prerequisite(s): A multivariate statistics course; familiarity with GIS is helpful, but not necessary
Equivalent Course(s): SOCI 30253, GEOG 20500, SOCI 20253
Font Notice

This document should contain certain fonts with restrictive licenses. For this draft, substitutions were made using less legally restrictive fonts. Specifically:

- Times was used instead of Trajan.
- Times was used instead of Palatino.

The editor may contact Leepfrog for a draft with the correct fonts in place.