Certificate in Computational Social Science

Graduate Handbook

UNIVERSITY OF ARIZONA

Tucson, Arizona 2021-22

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https://css.arizona.edu

The requirements set forth in this handbook apply to students entering the graduate certificate computational social science program in fall of 2018 and thereafter. Students are responsible for knowing and following these requirements. If revisions are made throughout the year, students will be notified.

In addition, the Graduate College (grad.arizona.edu) sets policies applying to all graduate programs across the university. Likewise, the College of Social and Behavioral Sciences (sbs.arizona.edu), in which this certificate program is housed, sets policies pertaining to its units. Students should consult the websites of these divisions to familiarize themselves with general requirements and regulations.

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I.   Certificate Name and CIP Code

Graduate Certificate in Computational Social Science

CIP Code: 45.0102 Research Methodology and Quantitative Methods

II.   Certificate Description and Purpose

While there is no singular, consensus on the definition of computational social science (CSS), it can be broadly understood as using computational techniques to analyze social science data or create social simulations, whether that data be large scale data that requires high speed computing capacities (i.e., "big data"), data that is of more modest scale but requires computationally-intensive processes (i.e., analyzing sets of texts, sounds, social networks, sensors, or sensory touch data), data collected online through application programming interfaces, web scraping or direct intervention (e.g., online experiments), and data that is amenable to tools from machine learning or similar modalities, among other kinds of data. Understanding, deploying, and advancing these methods requires more advanced skills in data retrieval, management, and analysis as well as programming than is typically required in social science masters and PhD programs. Distinct from engineering disciplines, analyzing these data from a social science perspective also requires attention to the social origins and meaning of these data, the samples or structured populations from which data may be drawn, the reasonableness of extrapolation from these data to larger populations or other social settings, research ethics, and epistemology among other concerns.

Big Data and computational methods are not only useful for Big Science, Big Government, and Big Business, but are an integral part of social scientific inquiry. They are sophisticated, novel, and very exciting.

The faculty supporting this certificate unite for a common goal: to create an environment for social science graduate students to acquire theoretical knowledge and mastery of computational skills necessary for collecting, linking, processing, and analyzing large and complex data. Social scientists have distinct questions and needs that warrant unique training. Our endeavor involves connecting students to relevant research projects on campus, exploring with them the theoretical knowledge behind computational social science, helping them to begin independent projects requiring computational skills, and, perhaps in the future, connecting them with businesses, government agencies, and nonprofits that have an interest in and resources for computational social science.

The certificate entails taking four graduate level courses (12 credits) related to the theory, ethics, and methods of computational social science from various units in the College of Social and Behavioral Sciences (SBS). The certificate is noted on the student's official university transcript and can be listed as an educational credential on their Vita. The program hopes to connect students to faculty in different disciplinary traditions, host conferences and symposia, stimulate conversations among faculty, and build a community of computational social scientists.

III.   Learning Outcomes and Assessment

First, students need mastery of a computer language which enables them to utilize the computational tools available. This would include Python, R, or some other computer language appropriate for CSS research. They must demonstrate that they can use these tools to execute their research.

Second, students need to develop and demonstrate proficiency in at least one method of computationally-intensive data collection, extraction, or analysis. This would include mastery of machine learning, computational linguistics, network analysis, visualization data management, web scraping, agent based modeling, and advanced statistical modeling among other techniques.

Third, students need to understand CSS as a broad epistemology or approach to establishing credible knowledge, its history, and the ethical issues associated with CSS. They also need to be able to explain to non-experts the computational approaches they have learned and used in their research.

The achievement of these outcomes will be assessed by students' performance in the required course and three electives they must complete for the certificate.

IV.   Administration

The certificate is housed in the College of Social and Behavioral Sciences with courses provided by the Department of Communication, Department of Linguistics, School of Anthropology, School of Government and Public Policy, School of Information, School of Sociology, and Department of English.

The Director of the Certificate Program (DCP) reports directly to the Dean of the College of Social and Behavioral Sciences. They are responsible for developing and interpreting graduate program requirements and administering academic affairs including advising, monitoring curriculum, and evaluation of student progress. Currently the DCP is Professor Douglas Henry, School of Government and Public Policy (adhenry@arizona.edu).

The DCP works in consultation with the school's Faculty Advisory Committee (FAC). At the behest of the dean of SBS, decision-making regarding curriculum, admittance, and student petitions will be delegated to the faculty advisory committee made up of tenured and tenure eligible faculty in SBS who are currently doing research and/or teaching computational social science courses to graduate students. Appointments will be approved by the dean of SBS. Members of the FAC are listed in Appendix A.

Any exceptions to program requirements *must* be approved in writing by the DCP and, where warranted, the Dean of SBS and/or the Associate Dean of the Graduate College.

   a. The graduate coordinator is the main point of contact for routine administrative aspects of the graduate program (Ms. Stephanie Amado, samado@email.arizona.edu)

   b. Appeals process: Students may appeal any decision made by the DCP and/or the CSS Advisory Committee by requesting a review within 30 days of the decision. Requests

and supporting documentation should be submitted in writing to the DCP and copied to the dean's office and the graduate coordinator.

c. Most of the "paperwork" related to graduate program requirements and progress is administered electronically via the GradPath system. A couple of forms are internal and are available from staff. For further details on GradPath forms and procedures, see the "Tips for New Grads" handout (also available on the school's website) and the Graduate College's GradPath website (http://grad.arizona.edu/GradPath).

V.   Eligibility for the program

The student must be enrolled in a Ph.D., M.S., M.A., or professional master's degree program at the University of Arizona (but they need not be enrolled in SBS) and in good standing. The student should have a 3.5 or higher graduate GPA at the University of Arizona. Exceptions will be reviewed by the faculty advisory committee.

VI.   Requirements for the certificate

To successfully complete the certificate the student must complete 4 courses for a total of 12 credits, with a grade of 'B' or better in each course: one required three-credit course, plus three three-credit graduate level electives (5XX, 6XX) drawn from a list of courses approved by the certificate's faculty advisory committee (see Appendix B for listing of options). One of the three electives could be an independent study where the student would work on a project under the guidance of a faculty member from the advisory committee. At least two of the four courses must be outside the student's home unit to ensure breadth of exposure to different approaches. The required course will give an overview of CSS research, introduce relevant computing skills, discuss the theory and epistemology behind CSS, and explore ethical issues particular to CSS research.

VII.   Admissions

Students should go to the University of Arizona Graduate Admissions Application (GradApp) to submit their application (https://apply.grad.arizona.edu/users/login). The student also must submit a statement of purpose describing what they want from the certificate and a University of Arizona transcript. They also have to list the classes they tentatively plan on taking. For the application, the student's adviser or the DGS in his/her program needs to be one of the recommenders so that s/he can respond to a set of questions regarding the student's graduate status and potential, but no formal letter of recommendation is required. No course prerequisites or standardized tests are required for admission.

VIII.   Certificate outcomes

In the first three years of the certificate program each student successfully completing the coursework will be surveyed by the Director of the program about their satisfaction with the program and how it might be improved. We will also follow their career paths, being particularly interested in how the certificate in CSS gives them a competitive advantage in the academic and non-academic marketplaces. Data on career pathways will be gathered from SBS's ongoing Ph.D. placement tracking study (directed by Jane Zavisca, Associate Dean in SBS).

IX.   Frequently Asked Questions

    a. Will students be allowed to substitute required and/or elective courses at the advisor's discretion?

The student will be allowed to substitute one required or one elective course with the approval of the faculty advisory committee.

    a. What are the prerequisites or standardized tests required for admission?

The student should have a 3.5 or higher graduate GPA at the University of Arizona. Exceptions will be reviewed by the faculty advisory committee. No course prerequisites or standardized tests are required. Students do not need to know a programming language for admission.

    b. Is concurrent enrollment in a degree program allowed or required.

The student must be enrolled in a Ph.D., M.A., M.S., or professional degree program at the University of Arizona and in good standing.

    c. Can students be enrolled full-time (9 units) in the certificate in their first semester? What is the standard length of time to finish the certificate if students are enrolled full-time the first semester?

The student may enroll in classes during their first semester of graduate school. It is possible that students can finish the requirements for the certificate in twelve months, however, eighteen months may be more realistic. Per the Graduate College's rules students need to complete all coursework with a B or better within a four-year window.

    d. What is the maximum number of transfer units (courses taken at institutions other than the UA) that may be applied to the certificate?

The student may transfer one three-credit course from an institution other than the UA. The course will be reviewed by the faculty advisory committee.

    e. What provisions are included for student advising?

The Director of the certificate program will have primary responsibility for advising students with regards to the CSS certificate, however, because this is an inter-disciplinary certificate, other faculty can act as the adviser as well. We hope to match students with faculty from their home graduate program and with faculty from other units as well.

    f. If there are affiliated graduate programs, may the units earned for the certificate be applied to the degree program? If so, how many?

Yes, all twelve credits may be applied toward the student's graduate program of studies pending the home program's approval.

     g. May a student use any units taken in Graduate non-degree status (GNDS)? If so, how many?

In general, no. However, exceptional cases will be evaluated by the faculty advisory committee.

     X.   Model Program of Study

First semester	Second semester	Third semester
INFO 514 or PA572 (required)	Elective Elective	Elective

Appendix A   Members of the Faculty Advisory Committee

Steven Bethard, Associate Professor, Information, Ph.D.
Ronald Breiger, Professor, Sociology, Ph.D.
Jennifer Earl, Professor, Sociology, Ph.D.
Joseph Galaskiewicz, Professor, Sociology, Ph.D.
Michael Hammond, Professor, Linguistics, Ph.D.
Robert Henderson, Associate Professor, Linguistics, Ph.D.
Adam Douglas Henry, Professor, Government and Public Policy, Ph.D. (Director)
Francisco Javier Osorio Zago, Assistant Professor, Government and Public Policy, Ph.D.
Adriana Picoral, Assistant Professor, Information, Ph.D.
Steve Rains, Professor, Communication, Ph D.
Fernando Sanchez-Trigueros, Assistant Professor, Geography, Development and Environnent Ph.D
Yotam Shmargad, Assistant Professor, Government and Public Policy, Ph.D.

Appendix B   Courses

Required courses (choose only one):

INFO 514 Computational Social Science (3 credits) (TBA), or
PA 572 Digital Research in Politics and Policy (3 credits) (Y. Shmargad)

School of Information

Elective courses:
INFO 510 Bayesian Modeling and Inference (3 credits) (C. Morrison)
INFO 514 Computational Social Science (3 credits) (TBA)
INFO 516 Introduction to Human Computer Interaction (3 credits) (L. Bozgeyikli)
INFO 521 Introduction to Machine Learning (3 credits) (C. Morrison)
INFO 529 Applied Cyberinfrastructure Concepts (3 credits) (N. Merchant and E. Lyons)
INFO 523 Data Mining and Discovery (3 credits) (H. Cui)
INFO 550 Artificial Intelligence (3 credits) (C. Morrison)
INFO 555 Applied Natural Language Processing (3 credits) (S. Bethard)
INFO 557 Neural Networks (3 credits) (S. Bethard)
INFO 575 User Interface and Website Design (3 credits) (M. Fricke)

School of Sociology

Elective courses:
SOC 511 Formal Models for Cultural Analysis (3 credits) (R. Breiger) *
SOC 526 Methods for Social Network Analysis (3 credits) (R. Breiger) *
SOC 527 Social Networks (J. Galaskiewicz) *
SOC 552 Advanced Topics in Stratification (3 credits) (R. Breiger) *
SOC 561 Programming for the Social Sciences (3 credits) (J. Earl) *
SOC 596a Advanced Topics in Research: BD Big Data Techniques for Social Scientists (3 credits) (Unstaffed)*
SOC 596a Advanced Topics in Research: RM Advanced Topics in Research Methodology (3 credits) (E. Leahey) *

Department of Linguistics

Elective courses:
LING 508 Computational techniques for linguists (3 credits) (M. Hammond)
LING 529 Human Language Technology I (3 credits) (M. Hammond)
LING 531 Human Language Technology II (3 credits) (M. Hammond)
LING 538 Computational linguistics (3 credits) (S. Fong) *
LING 539 Statistical natural language processing (3 credits) (M. Surdeanu/Bethard)
LING 578 Speech technology (3 credits) (M. Hammond)
LING 581 Advanced computational linguistics (3 credits) (S. Fong) *
LING 583 Text retrieval and web search (3 credits) (M. Surdeanu)
LING 696b Seminar in phonology: "neural nets and machine learning in phonology and morphology" (3

credits) (M. Hammond)
LING 696g Topics in computational linguistics (3 credits) (S. Fong) *

Department of Communication

Elective courses:
COMM 640: Research Methodologies III (3 credits) (J. Bonito) *
COMM 696R: Advanced Communication Research Methods (Structural equation modeling) (3 credits) (J. Bonito) *
COMM 696R: Advanced Communication Research Methods (Data Management in R) (3 credits) (S. Rains)

School of Anthropology

Elective courses:
ANTH 595D: Special Topics in Biological Anthropology: R programming for data analysis and visualization (3 credits) (E. MacLean) *

School of Government and Public Policy

Elective courses:
PA 572: Digital Research in Politics and Policy (3 credits) (Y. Shmargad)
POL 610: Theory and Methods for the Analysis of Political Networks (3 credits) (A. D. Henry) *
POL 684: Causal Inference (3 credits) (L. Bakkensen) *
POL 688: Digital Traces in Political and Social Research (3 credits) (Y. Shmargad)

Department of English

Elective courses:
ENGL/SLAT 596o: Corpus Linguistics (S. Staples)

*With the consent of the instructor (please contact the instructor before registering)

School of Geography
GEOG 557: Statistical Techniques in Geography, Regional Development and Planning
GIST 601B: Remote Sensing