

# DATA SCIENCE, CERTIFICATE

Students in the data science certificate will develop abilities such as data management, reproducibility, modeling strategies, and ethical considerations of data science to be paired with their knowledge gained from their major or domain area. The certificate is a great fit for students who like programming, want to learn data analysis, and seek to be high-end users of data science tools in domain areas. Data science is one of the fastest growing career sectors in Wisconsin and across the nation.

By its very nature, the field of data science is one that teaches novel and cutting-edge ways to engage in the “continual sifting and winnowing by which alone the truth can be found.”

## HOW TO GET IN

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Students are eligible to declare the certificate at any point in their studies, however they should declare it as early as possible to plan the required coursework. See the departmental website (<https://stat.wisc.edu/data-science-certificate/>) for information about how to declare.

Students declared in the Data Science major or the Certificate in Engineering Data Analytics are not eligible to declare the Certificate in Data Science.

## REQUIREMENTS

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The certificate requires a minimum of 16 credits.

| Code  | Title  | Credits      |
|---|--|--------------|
| <b>Foundation Courses</b>   |  | <b>10-12</b> |
| <i>Complete two programming courses from</i>  |  | 7-8          |
| COMP SCI 220  | Data Science Programming I <sup>1</sup>                                    |              |
|   | or COMP SCI 320 Data Science Programming II                                |              |
| STAT 240  | Data Science Modeling I  |              |
| E C E 204   | Data Science & Engineering   |              |
| <i>Complete one ethics course from</i>  |  | 3-4          |
| L I S 461   | Data and Algorithms: Ethics and Policy (4-credit Communication B optional) |              |
|   | or E C E/<br>I SY E 570 Ethics of Data for Engineers                       |              |
| <b>Elective Courses</b>   |  | <b>6</b>     |
| Complete a minimum of 6 credits of electives, including at least 3 credits from the Fundamental Electives list. |  |              |
| <i>Fundamental Electives</i>  |  | 3-6          |
| BIOCORE 382   | Evolution, Ecology, and Genetics Laboratory                                |              |
| BIOCORE 384   | Cellular Biology Laboratory  |              |
| BIOCORE 486   | Principles of Physiology Laboratory  |              |

|                               |  |     |
|-------------------------------|--|-----|
| COMP SCI 320                  | Data Science Programming II <sup>1</sup>                               |     |
| COMP SCI/E C E/<br>M E 532    | Matrix Methods in Machine Learning                                     |     |
| COMP SCI 544                  | Introduction to Big Data Systems                                       |     |
| COMP SCI 565                  | Introduction to Data Visualization                                     |     |
| COMP SCI/<br>B M I 576        | Introduction to Bioinformatics   |     |
| ECON 315                      | Data Visualization for Economists                                      |     |
| ECON 400                      | Introduction to Applied Econometrics                                   |     |
| ECON 410                      | Introductory Econometrics  |     |
| ECON 460                      | Economic Forecasting   |     |
| ECON 570                      | Fundamentals of Data Analytics for Economists                          |     |
| ECON 695                      | Topics in Economic Data Analysis                                       |     |
| ED PSYCH 551                  | Quantitative Ethnography   |     |
| FINANCE 310                   | Data Analytics for Finance   |     |
| GEN BUS 656                   | Machine Learning for Business Analytics                                |     |
| GEOG 378                      | Introduction to Geocomputing   |     |
| GEOG 573                      | Advanced Geocomputing and Geospatial Big Data Analytics                |     |
| GEOG 574                      | Geospatial Database Design and Development                             |     |
| GEOG 579                      | GIS and Spatial Analysis   |     |
| I SY E 412                    | Fundamentals of Industrial Data Analytics                              |     |
| I SY E 521                    | Machine Learning in Action for Industrial Engineers                    |     |
| MATH 444                      | Graphs and Networks in Data Science                                    |     |
| MATH 535                      | Mathematical Methods in Data Science                                   |     |
| PHYSICS 361                   | Machine Learning in Physics  |     |
| SOC 362                       | Statistics for Sociologists III  |     |
| SOIL SCI 585                  | Using R for Soil and Environmental Sciences                            |     |
| STAT 340                      | Data Science Modeling II   |     |
| STAT 405                      | Data Science Computing Project   |     |
| STAT 436                      | Statistical Data Visualization   |     |
| STAT/<br>COMP SCI 471         | Introduction to Computational Statistics                               |     |
| <i>Domain Electives</i>       |  | 0-3 |
| A A E/ECON 421                | Economic Decision Analysis   |     |
| BIOCHEM 570                   | Computational Modeling of Biological Systems                           |     |
| COMP SCI/E C E/<br>I SY E 524 | Introduction to Optimization   |     |
| GEN BUS 307                   | Business Analytics II  |     |
| INFO SYS 322                  | Introduction to Databases  |     |
| L I S 440                     | Navigating the Data Revolution: Concepts of Data & Information Science |     |
| LSC 460                       | Social Media Analytics   |     |

|                     |  |
|---------------------|--|
| LSC 660             | Data Analysis in Communications Research           |
| SOC 351             | Introduction to Survey Methods for Social Research |
| SOC/<br>C&E SOC 618 | Social Network Analysis                            |

## RESIDENCE AND QUALITY OF WORK

- Minimum 2.000 GPA on all certificate courses
- At least 9 credits must be taken in residence at UW-Madison

## FOOTNOTES

<sup>1</sup> COMP SCI 320 may count toward either the Foundation Courses or Fundamental Electives requirement, but not both.

## CERTIFICATE COMPLETION REQUIREMENT

This undergraduate certificate must be completed concurrently with the student's undergraduate degree. Students cannot delay degree completion to complete the certificate.

## LEARNING OUTCOMES

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1. Apply tools and processes necessary for data management and reproducibility.
2. Produce meaning from data employing modeling strategies.
3. Learn best practices related to data science concepts and methods.
4. Articulate policy, privacy, security and ethical considerations in data science projects.

## ADVISING AND CAREERS

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#### LOOKING FOR DATA SCIENCE ADVISING?

Students who are interested in data science academic advising should check out the advising information on our website (<https://stat.wisc.edu/data-science-certificate/>) or send an email to [dscert@stat.wisc.edu](mailto:dscert@stat.wisc.edu).

#### WHAT DO DATA SCIENTISTS DO?

Data Scientists are trained to manage, process, model, gain meaning and knowledge, and present data. These skills can be employed in a wide variety of different sectors of employment. Examples of interests of our students include finance, banking, sports analytics, marketing, retail, humanities, psychology, biosciences, healthcare, and consulting, just to name a few. Students are encouraged to combine data science with majors, certificates, and courses from differing areas to best be able to apply their data science in the area of their choosing.

Data science is one of the fastest growing area of jobs in the U.S. and in Wisconsin. All of the major job search engines regularly list thousands of jobs, for example, in 2018 Data Scientist was the #1 job on the web site Glassdoor with over 25,000 jobs, Monster.com listed over 12,000 jobs

in data science nationally, and Indeed.com had over 1,000 jobs for data analysts just in the state of Wisconsin.

Additionally, the Occupational Outlook Handbook (OOH) from the Bureau of Labor Statistics shows the job growth outlook from 2016-26 for Mathematicians and Statisticians to be 33% (much faster than average) and for Computer and Information Research Scientists to be 19% (much faster than average).

Some students may want to continue to develop additional advanced data science skills through graduate education.

## L&S CAREER RESOURCES

Every L&S major opens a world of possibilities. SuccessWorks (<https://successworks.wisc.edu/>) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (<https://careers.ls.wisc.edu/>)
- Set up a career advising appointment (<https://successworks.wisc.edu/make-an-appointment/>)
- Enroll in a Career Course (<https://successworks.wisc.edu/career-courses/>) - a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (<https://successworks.wisc.edu/finding-a-job-or-internship/>)
  - INTER-LS 260 Internship in the Liberal Arts and Sciences
- Activate your Handshake account (<https://successworks.wisc.edu/handshake/>) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students' lives (<https://successworks.wisc.edu/about/mission/>)

## PEOPLE

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#### ADVISING STAFF

Information regarding the Data Science advisors and how to make appointment can be found on the program page (<https://stat.wisc.edu/data-science-certificate/>).

#### DATA SCIENCE PROGRAM COMMITTEE

- Tyler Caraza-Harter (Computer Sciences)
- Michael Ferris (Computer Sciences)
- B. Ian Hutchins (iSchool)
- Bret Larget, Program Director (Statistics), committee chair

- Nan Chen (Mathematics)
- Sara Rodock (Statistics), advising representative