Data Science

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The volume, rate, and importance of data is growing exponentially, with more data being created in the past two years than in all history combined. At the University of Oregon we're bringing our strengths as a liberal arts university to the field – to not only ask what can we do with data – but what should we do.

As a data science major at the UO, you will learn key computational, statistical, and inferential data science skills side-by-side with applied knowledge in one of 10 different areas: accounting analytics, biology, earth science, economics, geography, linguistics, marketing analytics, music technology, physics, and sociology. Our unique interdisciplinary program teaches you how to extract knowledge and insight from data, empowering you to make decisions earlier, faster, better. When you graduate, your understanding of applied data science techniques, framed within the liberal arts, will help launch you directly into the workforce.

Students may earn a bachelor of arts (BA) or a bachelor of science (BS) degree.

Program Learning Outcomes

Upon successful completion of this program, students will be able to:

- Demonstrate the ability to assess data set quality, identifying and rectifying potential errors in such a way so as to lead to statistically meaningful derived information.
- Visualize complex data sets using descriptive statistics and graphs.
- Demonstrate understanding of basic regression, optimization, prediction, simulation, and visualization methods.
- Use critical thinking skills to translate substantive questions into well-defined statistical or probability problems and choose the appropriate graphical or numerical descriptive and/or inferential statistical techniques for a given problem, leading to actionable, valid, and meaningful conclusions.
- Develop successful strategies for formulating and testing hypotheses about data.
- Demonstrate an understanding of ethical, legal, societal, and economic concerns.
- Apply fundamental concepts of data science (data management, statistical prediction and inference, experimental design, etc.) to applications specific to the chosen specialization domain.

Data Science Geography Concentration Program Learning Outcomes

Upon successful completion of this program, students will be able to:

- Exhibit a general understanding of the geographic and mathematical foundations of spatial data science and technologies.
- Demonstrate knowledge of the geographic context of technology infrastructure, geographic data needs, and technology interface design and therefore have the potential to contribute to the development of geospatial data and technologies.
- Understand the societal implications of geospatial data and technologies, including issues surrounding privacy and security of individual-level data containing locational information, the types of inequalities that certain geospatial technologies produce, and the role that geospatial technologies play in humanitarian crises.
- Utilize geospatial data and technologies for collecting data, employ analytical and visualization methods for interpreting such data, and communicate effectively to a range of audiences.

Data Science Major Requirements

The data science curriculum combines general principles with domain-specific application. The curriculum is sub-divided into the following categories with the corresponding requirements:

Code	Title	Credits
Data Science Core Courses		
DSCI 101	Foundations of Data Science I	4
DSCI 102	Foundations of Data Science II	4
DSCI 311	Principles and Techniques of Data Science	4
Data Science Capstone Project		4
Foundations in Mathematics and Computing		
CS 210 & CS 211 & CS 212	Computer Science I and Computer Science II and Computer Science III	12
MATH 251 & MATH 252	Calculus I and Calculus II	8
MATH 341 & MATH 342	Elementary Linear Algebra and Elementary Linear Algebra	8
Probability		
DSCI/MATH 345M	Probability and Statistics for Data Science	4
Modeling, Learning and Decision Making		
DSCI/CS 372M	Machine Learning for Data Science	4
Ethics Course		
PHIL 223	Data Ethics	4
Computational and Inferential Depth		
Select three courses from the list below:		12
CS 314	Computer Organization	
CS 322	Introduction to Software Engineering	
CS 330	C/C++ and Unix	
CS 333	Applied Cryptography	
CS 415	Operating Systems	
CS 432	Introduction to Networks	
MATH 253	Calculus III	
MATH 307	Introduction to Proof	
MATH 461	Introduction to Mathematical Methods of Statistics I	
MATH 462	Introduction to Mathematical Methods of Statistics II	
MATH 463	Mathematical Methods of Regression Analysis and Analysis of Variance	
MATH 458	Introduction to Mathematical Cryptography	

Domain Emphasis	**22-28**
Total Credits	**90-96**

Domain Emphasis

The domain emphasis consists of completing 2-3 courses (8-12 credits) in the domain core, followed by a minimum of 4 courses (16 credits) of domain specialization. For each domain emphasis, a curated list of courses has been developed for both the core and specialization component. Please see the Concentrations tab (http://catalog.uoregon.edu/archive/2023-2024/arts-sciences/natural-sciences/data-sci/#concentrationstext) for a detailed list of courses that satisfy each available domain emphasis.

An essential aspect of the degree in data science is that data science majors develop critical competencies in a domain emphasis of their choosing. The domain emphasis consists of completing 2-3 courses (8-12 credits) in the domain core, followed by a minimum of 3 courses (12 credits) of domain specialization. For each domain emphasis, a curated list of courses has been developed for both the core and specialization component.

Currently, domain emphases have been established for biology, geography, accounting analytics, marketing analytics, and linguistics. The curated list of domain core and domain specialization courses for each domain is outlined below.

- Accounting Analytics (p. 2)
- Biology (p. 2)
- Cultural Analytics (p. 3)
- Earth Sciences (p. 3)
- Economics (p. 3)
- Geography (p. 3)
- Linguistics (p. 3)
- Marketing Analytics (p. 4)
- Music Technology (p. 4)
- Physics (p. 4)
- Sociology (p. 4)

Data Science Domain - Accounting Analytics

Data has proliferated in business as organizations generate large volumes of information within their day to day operations while increasingly having access to externally created information as well.

Data science applied to accounting data can help organizations understand the implications for decision-making and provide better insights. You might delve into company sales data, purchasing data, contracts, or company disclosures to help solve a variety of business problems.

In the data science domain area of accounting analytics, you will learn to search for relationships between different variables and outcomes they influence, driving business decisions and informing success.

Code	Title	Credits
Core Courses:		
BA 101	Introduction to Business	4
BA 215	Accounting: Language of Business Decisions	4
EC 201	Introduction to Economic Analysis: Microeconomics	4
Required		
BA 240	Spreadsheet Analysis and Visualization	4
ACTG 350	Intermediate Accounting I	4
Take two out the following three		**8**
ACTG 410	Experimental Course: [Topic] (Accounting Data and Analytics)	
ACTG 410	Experimental Course: [Topic] (Accounting Data and Analytics Capstone)	
OBA 410	Experimental Course: [Topic] (Predictive Analytics)	
Total Credits		**28**

Data Science Domain - Biology

Recent technological breakthroughs in DNA sequencing mean that scientists can characterize an organism's entire genome in a matter of days. But a great challenge remains in translating that genomic sequence — nature's data set — into biology.

That translation is fundamentally changing how we study biology.

In the data science domain area of biology, you will find yourself on the cutting edge of the field, working in the acquisition, analysis, and interpretation of data and how it applies to gene function, disease, microbial ecology, and the assembly and characterization of new genomes.

Code	Title	Credits
Core Courses:		10
BI 211	General Biology I: Cells	
BI 212	General Biology II: Organisms	
BI 213	General Biology III: Ecology and Evolution	
Select four of the following		16
BI 320	Molecular Genetics	
BI 360	Neurobiology	
BI 370	Ecology	
BI 399	Special Studies: [Topic] (Computational Genomics)	
BI 399	Special Studies: [Topic] (Modeling in Biology: Deterministic Models)	
BI 410	Experimental Course: [Topic] (Data Management and Visualization)	
BI 410	Experimental Course: [Topic] (Modeling in Biology: Stochastic Models)	
BI 410	Experimental Course: [Topic] (Neural Data Analysis)	
BI 471	Population Ecology	
DSCI 411	Capstone Project	
Total Credits		**26**

Data Science Domain - Cultural Analytics

Code	Title	Credits
Core Courses - choose 3		**12**
COLT 301	Approaches to Comparative Literature	
COLT 305	Cultural Studies	
HUM 300	Themes in the Humanities	
ENG 303	Foundations of the English Major: Text	
ENVS 203	Introduction to Environmental Studies: Humanities	
FLR 250	Introduction to Folklore	
Upper division - required		**4**
LIB/DSCI 350M		
Electives - choose 3		**12**
ENG 250	Literature and Digital Culture	
ENG 470	Technologies and Texts Capstone	
ENG/CINE 486M	New Media and Digital Culture: [Topic]	
FLR 495	Folklore Fieldwork	
J 429	Media Technologies and Society: [Topic]	
PHIL 123	Internet, Society, and Philosophy	
PHIL 423	Technology Ethics: [Topic]	
Total credits		**28**

Data Science Domain - Earth Sciences

Code	Title	Credits
Core Courses:		
ERTH 202	Earth's Surface and Environment	4
PHYS 201	General Physics	4
or PHYS 251	Foundations of Physics I	
ERTH 315	Earth Physics	4
Choose four of the following:		15-16
ERTH 353	Geologic Hazards	
ERTH 415	Field Geophysics	
ERTH 438	Geobiology	
ERTH 441	Hillslope Geomorphology	
ERTH 453	Tectonics	
ERTH 454	Fluid Dynamics	
ERTH 455	Mechanical Earth	
ERTH 467	Fault Mechanics	
Data Science Capstone Course		
Total Credits		**27-28**

Data Science Domain - Economics

Code	Title	Credits
Core Courses:		
EC 201	Introduction to Economic Analysis: Microeconomics	4
EC 311	Intermediate Microeconomic Theory	4
EC 320	Introduction to Econometrics I	4
EC 421	Introduction to Econometrics II	4
Choose three from the following:		12
EC 422	Economic Forecasting	
EC 428	Behavioral and Experimental Economics	
EC 434	Environmental Economics	
EC 443	Health Economics	
EC 451	Issues in Labor Economics	
EC 460	Theories of Industrial Organization	
EC 482	Economics of Globalization	
EC 490	Economic Growth and Development	
Total Credits		**28**

Data Science Domain - Geography

Spatial data is integrated into our everyday lives and employed in a range of professions. We are all integrated into a complex web of movement, place, and discovery, whether we're navigating across town or interpreting maps of election results.

UO geographers use spatial data technologies to focus on remote sensing of the changing environment, climate-change analysis, web-mapping, cartography and data visualization, spatial cognition, and spatial patterns in public health.

In the data science domain area of geography, you will be studying how spatial data can revolutionize business, nonprofit, and government worlds.

Code	Title	Credits
Core Courses:		
GEOG 181	Our Digital Earth	4
GEOG 281	The World and Big Data	4
GEOG 481	GIScience I	4
Select four of the following		16
GEOG 482	GIScience II	
GEOG 485	Remote Sensing I	
GEOG 486	Remote Sensing II	
GEOG 490	GIScience: [Topic]	
GEOG 491	Advanced Geographic Information Systems	
GEOG 493	Advanced Cartography	
GEOG 498	Geospatial Project Design	
DSCI 411	Capstone Project	
Total Credits		**28**

Data Science Domain - Linguistics

Usage-based linguistics studies language as a dynamic, constantly changing system. Much of this work involves working with large collections of text or speech – referred to as "corpora." Examples of readily available real-world corpora include Amazon product reviews and collections of Twitter messages.

Linguists use corpora to help identify patterns and structures in language, providing insights into how we both acquire and lose language skills, how language use varies across people and contexts, and how real-life speech and language evolve.

In the data science domain area of linguistics, you will learn methods to identify linguistic structures within corpora, gleaning new insights

while using the best and latest practices in the field. These methods will allow you to answer basic science questions as well as questions that are of interest to marketing firms, political consulting groups, or other commercial enterprises. So, for example, you can use the knowledge you acquire in the linguistics domain to explore how the use of a word like “cool” has changed over time (a basic science question) or to identify linguistic strategies associated with leading positive product reviews for different product types (a marketing question).

Code	Title	Credits
Core Courses:		8
LING 301	Introduction to Linguistics Analysis	
LING 302	Introduction to Linguistic Behavior	
Electives:		16
LING 435	Morphology and Syntax	
LING 451	Functional Syntax I	
LING 493	Corpus Linguistics	
Data Science Capstone Course		
Total Credits		**24**

Data Science Domain - Marketing Analytics

Marketing analytics is the practice of measuring, managing, and analyzing marketing performance to maximize effectiveness and optimize return on investment. Data science applied to marketing data can help a business predict consumer behavior, improve decision-making, and gauge the success of marketing investments.

For example, machine learning and statistical techniques can be used to classify data and detect patterns that might predict a campaign’s success.

In the data science domain area of marketing analytics, you will learn how to see the future, through the lens of both existing and new methods of predictive analytics.

Code	Title	Credits
Core Courses:		
BA 101	Introduction to Business	4
BA 215	Accounting: Language of Business Decisions	4
EC 201	Introduction to Economic Analysis: Microeconomics	4
Required		
BA 240	Spreadsheet Analysis and Visualization	4
BA 317	Marketing: Creating Value for Customers	4
MKTG 390	Marketing Research	4
Pick one of the following:		4
MKTG 415	Marketing Analytics	
OBA 410	Experimental Course: [Topic]	
Total Credits		**28**

Data Science Domain - Music Technology

Code	Title	Credits
Core Courses		
MUS 227	Elements of Electronic Music	4
MUS 447	Digital Audio and Sound Design (Core)	4
MUS 470	History of Electroacoustic Music	3
Upper division - required		
MUS 448	Interactive Media Performance	3
MUS 479	Data Sonification	4
Upper division - choose 2		6-8
MUS 360	Hip-Hop Music: History, Culture, Aesthetics (Elective)	
MUS 445	Electronic Composition	
MUS 476	Digital Audio Workstation Techniques I	
MUS 483	Audio Effects Theory and Design	
Total Credits		**24-26**

Data Science Domain - Physics

Code	Title	Credits
Core Courses:		
PHYS 251	Foundations of Physics I	4
PHYS 253	Foundations of Physics I	4
PHYS 290	Foundations of Physics Laboratory	1
PHYS 391	Physics Experimentation Data Analysis Laboratory	4
Choose three of the following:		11-12
PHYS 432	Digital Electronics	
PHYS 481	Design of Experiments	
PHYS 491	Research Project I	
Data Science Capstone Project		
Total Credits		**23-25**

Data Science Domain - Sociology

Code	Title	Credits
Core Courses:		
SOC 204	Introduction to Sociology	4
SOC 310	Social Theory	4
SOC 311	Research Methods	4
SOC 412	Sociological Research Methods	4
SOC 413	Sociological Research Methods	4
Choose two from the following:		8
SOC 370	Urban Sociology	
SOC 380	Introduction: Deviance, Control, and Crime	
SOC 416	Issues in Environmental Sociology [Topic]	
SOC 442	Issues in Urban Sociology: [Topic]	
SOC 445	Sociology of Race and Ethnicity: [Topic]	
SOC 451	Social Stratification	
SOC 465	Political Sociology	

SOC 467	Economic Sociology	
Total Credits		**28**