DATA SCIENCE (CAS)

Description

The interdisciplinary data science major prepares students with skill and competency in data analysis and interpretation, algorithm design and implementation, and helps them develop aptitudes for interdisciplinary problem-solving. Thus, this program enables students to take advantage of career and employment opportunities across diverse fields involving data-rich, data-driven systems and applications. Ultimately, this will help address the increasing societal and economic need for a qualified workforce in today's digital age.

The data science major is available through the College of Art and Sciences, the College of Engineering, and the College of Agricultural Sciences and Natural Resources. A shared set of core requirements exists in each college combining foundational knowledge in Computer Science, Mathematics, and Statistics. Beyond the core requirements, the major has common set of focus areas for students to deepen their knowledge in two areas of data science like Artificial Intelligence, Data Pipeline, Mathematical Modeling, Statistical Modeling, Software Development, and Applied Computing. However, each college offers a unique approach within the overall degree. The College of Arts and Sciences data science majors will have the opportunity to pursue the major as part of an overall liberal arts curriculum characterized by both focus and range. Due to the flexible and customizable structure of the degrees, the major will pair well with related minors or even a second major.

Learning Outcomes

The primary student learning outcomes of the interdisciplinary data science major are:

1. Foundational knowledge and expertise in the analysis of large-scale data sources from the interdisciplinary perspectives of applied computer science, data modeling, mathematics, and statistics.
2. Foundational knowledge and expertise in the application of computing, informatics, and modeling to solve multidisciplinary problems.
3. Abilities and professional skills to solve multidisciplinary data science problems as a member of an interdisciplinary team.
4. Familiarity with ethical challenges in data science, including ethical collection of data, responsible use of data and algorithmic bias.

Academic and Career Advising

Academic and Career Advising Center

Not sure where to go or who to ask? The Advising Center team in 107 Oldfather Hall can help. The Academic and Career Advising Center is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representatives.

CAS Career Coaches are available by appointment (in-person or Zoom) and located in the CAS Academic and Career Advising Center, 107 Oldfather Hall. They help students explore majors and minors, gain experience, and develop a plan for life after graduation.

Assigned Academic Advisors

Academic advisors are critical resources dedicated to students' academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline specific expertise. They are available for appointments (in-person or Zoom) and through weekly virtual drop-ins. Assigned advisors are listed in MyRED (https://its.unl.edu/myunl/) and their offices may be located in or near the department of the major for which they advise.

Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, visit https://cas.unl.edu/major-advisors (https://cas.unl.edu/major-advisors/), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, casadvising@unl.edu.

Career Coaching

The College believes that **Academics + Experience = Opportunities** and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value. Graduates are prepared to effectively contribute professionally and personally with a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather Hall, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

ACE Requirements

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE (http://ace.unl.edu) website (http://ace.unl.edu) for the most current list of certified courses.

ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.

ACE 2: Demonstrate competence in communication skills.

ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

College Degree Requirements

College Distribution Requirements

The College of Arts and Sciences distribution requirements are designed to ensure a range of courses across disciplines within the College. Students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Internship (395 or 495), independent study or readings (396 or 496), research (398 or 498), and thesis (399, 399H, 499, or 499H) will not satisfy distribution requirements.
- Other courses with a 9 in the middle number (ex. PSYC 292) will not satisfy distribution requirements unless approved by an advisor.
- Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the lead department.

CDR: Written Communication

Select from courses approved for ACE outcome 1.

CDR: Natural, Physical, and Mathematical Sciences [1]

Select a course from ASTR, BIOS, CHEM, GEOL, LIFE, METR, MATH, PHYS, or ANTH 242, GEOG 155, GEOG 281, POLS 250, or PSYC 273.

CDR: Laboratory [2]

Laboratory courses may be embedded in a 4-5 credit course used in CDR Natural, Physical, and Mathematical Science (example GEOG 155), or stand alone (example LIFE 120L).

CDR: Humanities [3]

Select a course from ARAB, CHIN, CLAS, CZEC, ENGL, FILM, FREN, GERM, GREK, HIST, JAPN, LATN, PHIL, RELG, RUSS, or SPAN.

CDR: Social Science [4]

Select a course from ANTH, COMM, GEOG, NSST, POLS, PSYC, or SOCI.

CDR: Human Diversity in U.S. Communities

Select from the following approved courses also listed in your degree audit: ANTH 130, ANTH 412, ANTH 447, ANTH 473, ARAB/RELG 313, COMM 311, COMM 315, COMM/ETHN 335, COMM 364, COMM/ETHN 365, COMM 465, ENGL/WMNS 212, ENGL/ETHN 245N, ENGL/WMNS 312, ENGL/ETHN 345D, ENGL/ETHN/WMNS 345N, ENGL/ETHN 346, ENGL 376, ENGL 380, ENGL/ETHN 445, ETHN 100, ETHN 201, ETHN 202, ETHN 204, ETHN 484, FILM/ETHN 344, GEOG 271, GEOG 403, GLST/ANTH/MODL 214, GLST 350, HIST/ETHN/WMNS 115, HIST/ETHN 234, HIST/ETHN 246, HIST 251, HIST/ETHN 340, HIST 351/ETHN 341, HIST/ETHN/WMNS 356, HIST/ETHN 357, HIST/WMNS 402, HRHA 350, MODL 260, PHIL 105, PHIL 106, PHIL/WMNS 218, PHIL 323, PHIL 325, POLS/ETHN 333, POLS/WMNS 338, POLS 340, POLS 347, POLS 433, PSYC/ETHN 310, PSYC 330, PSYC/WMNS 421, PSYC/ETHN 425, RELG/HIST 134, RELG/ETHN/HIST 226, RELG/HIST 227, SOCI 101, SOCI 180, SOCI/WMNS 200, SOCI/ETHN 217, SPAN 206, SPAN 486, WMNS 101, WMNS 201, WMNS 202, WMNS 210

CDR: Language

BA Students [5]

Fulfilled by the completion of the 4th level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

BS Students [6]

Fulfilled by the completion of the 2nd level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

1 *Excluded courses:* BIOC 101, BIOS 100, BIOS 180, CHEM 101, MBIO 101, PHYS 201, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, *and MATH subject area credit at the 100 level or below.*

2 ANTH 242L, ASTR 224, BIOS 101L, BIOS 110L, BIOS 111, BIOS 116, BIOS 213L, BIOS 214, CHEM 105L, CHEM 106L, CHEM 109L, CHEM 110L, CHEM 113L, GEOG 155, GEOL 101, GEOL 103, LIFE 120L, LIFE 121L, METR 100, PHYS 141, PHYS 142, PHYS 153, PHYS 221, *or* PHYS 222.

3 *ARAB, CHIN, CZEC, FREN, GERM, GREK, JAPN, LATN, and SPAN courses must be numbered 300 or above. ENGL courses must be* ENGL 170, ENGL 180, *or ENGL 200 level and above. Excluded courses:* CLAS 116, ENGL 254, ENGL 300, ENGL 354, SPAN 300A, SPAN 303, *and* SPAN 304.

4 *Excluded courses:* ANTH 242/ANTH 242L, GEOG 155, GIST 111, GIST 311, POLS 101, POLS 250, PSYC 100, PSYC 273.

5 ARAB 202, CHIN 202, CZEC 202, FREN 202 *or* FREN 210, GERM 202, GREK 301 *and* GREK 302, JAPN 201 *and* JAPN 202, LATN 301 *and* LATN 302, SPAN 202 *or* SPAN 210 *or* SPAN 300A *or* SLPA 202.

[6] ARAB 102, CHIN 102, CZEC 102, FREN 102, GERM 102, GREK 102 *or* GREK 151, JAPN 102, LATN 102, SPAN 102 *or* SPAN 110 *or* SPAN 300A, *or* SLPA 102.

Language Requirement

The University of Nebraska–Lincoln and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The University of Nebraska–Lincoln entrance requirement is successful completion of two levels of the same world language, and the College of Arts and Sciences degree requirement (CDR: Language) is proficiency through 4 levels for BA students, or 2 levels for BS students. Levels are defined as years in High School, or semesters in college as documented on an official transcript.

Students who believe they are proficient in a language, but who do not have academic records of that proficiency, should consult with their academic advisor to explore alternative assessments which may include a proficiency examination by a UNL faculty member for languages taught at UNL, or through an approved private service for languages not taught at UNL (expenses for this service would be the student's responsibility.)

Experiential Learning Requirement

All undergraduates in the College of Arts and Sciences must complete an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning. Students should consult their assigned Academic Advisor and Career Coach for assistance identifying experiential learning opportunities relevant to their academic program, interests and goals.

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences from disciplines within the College of Arts and Sciences or required in its majors: ACTS, ASTR, BIOC, BIOS, CHEM, CSCE, GEOL, LIFE, MBIO, METR, MATH, PHYS, STAT or ANTH 242 , ANTH 242L, ANTH 341, ANTH 385, ANTH 386, ANTH 389, ANTH 416, ANTH 422, ANTH 430, ANTH 442, ANTH 443, ANTH 444, ANTH 448, ANTH 473, ANTH 484, ANTH 487D, ENVR 201, GEOG 155, GEOG 217, GEOG 281, GEOG 308, GEOG 317, GEOG 408, GEOG 417, GEOG 418, GEOG 419, GEOG 421, GEOG 422, GEOG 425, GEOG 427, GEOG 432, GEOG 444, GEOG 461, GEOG 467, PHIL 211, POLS 250, PSYC 273, PSYC 368, PSYC 370, PSYC 450, PSYC 451, PSYC 456, PSYC 458,PSYC 460, PSYC 461, PSYC 463, PSYC 464, or PSYC 465.

Excluded courses include: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, MBIO 101, PHYS 201 as well as any course numbered 395, 495, 399, 399H, 499, or 499H. MATH subject area credit at the 100 level or below is also excluded.

Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the College of Arts and Sciences. See your assigned academic advisor to start the approval process.

Minimum Hours Required for Graduation

A minimum of 120 semester hours of credit is required for graduation from the College of Arts and Sciences. A cumulative grade point average of at least 2.0 is required.

Grade Rules

Restrictions on C- and D Grades

The College will accept no more than 15 semester hours of C- and D grades from other domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No University of Nebraska–Lincoln C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by the College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege

University policy for the Pass/No Pass (P/N) privilege:

- Neither the P nor the N grade factor into your GPA.
- 'P' is interpreted to mean a grade of C or above. A grade of C- or lower results in a "N'.
- A change to or from a Pass/No Pass may be made until mid-term (1/2 of the course - see the academic calendar for specific dates per term).
- The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University policy governing the grading options.
- Changing to or from the Pass/No Pass grading option requires using MyRED, or processing a Schedule Adjustment Form.
- For undergraduates, the University maximum of 24 'Pass' credit hours and/or college and department limits will apply. These limits do not include courses offered on a 'Pass/No Pass' basis only. Consult your advisor or the Undergraduate Catalog (https://catalog.unl.edu/undergraduate/) for restrictions on the number of 'Pass' hours you can apply toward your degree.
- The 'Pass/No Pass' grading option cannot be used for the removal of 'C-', 'D+', 'D', 'D-', or 'F' grade factors.
  NOTE: See Course Repeats *(*https://registrar.unl.edu/academic-standards/course-repeats/*)*

College of Arts and Sciences policy on the Pass/No Pass (P/N) privilege:

- Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences majors and minors do not permit any courses graded Pass/No Pass to apply, or limit them to no more than 6 hours. Students should refer to the major section of the catalog for clarification.
- Departments may specify that certain courses of theirs can be taken on a P/N-only or on a graded-only basis.

Grading Appeals

A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk with the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor's department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean's Office, 1223 Oldfather Hall.

Course Level Requirements

Courses Numbered at the 300 or 400 Level

Thirty (30) of the 120 semester hours of credit must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 hours (1/2) must be completed in residence at the University of Nebraska–Lincoln.

Residency Requirement

The term "Residency" refers to courses taken at UNL. Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska–Lincoln. Students must complete at least 18 hours of their major coursework, and 15 of the 30 hours required at the 300 or 400 level, at UNL.

Catalog to Use

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991, the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Transfer Students: Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska-Lincoln within 1 calendar year from their last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the time frame allowable for that catalog year.

Major Requirements

The interdisciplinary data science major includes a set of core requirements, professional experience, and a selection of fifteen (15) hours from two focus areas of interest.

Core Requirements

Computer Science		
CSCE 155T	Computer Science I: Informatics Focus	3-4
or CSCE 155A	Computer Science I	
or CSCE 155E	Computer Science I: Systems Engineering Focus	
or CSCE 155H	Honors: Computer Science I	
or CSCE 155N	Computer Science I: Engineering and Science Focus	
or RAIK 183H	Honors: Computer Problem Solving Essentials	
CSCE 311	Data Structures and Algorithms for Informatics	3-4
or CSCE 310	Data Structures and Algorithms	
or RAIK 283H	Honors: Software Engineering III	
CSCE 320	Data Analysis	3
or RAIK 370H	Honors: Data and Models II: Data Science Fundamentals	
Credit Hours Subtotal:		9-11
Mathematics		
MATH 104	Applied Calculus	3-5
or MATH 106	Calculus I	
MATH 203	Contemporary Mathematics	3-4
or MATH 107	Calculus II	
MATH 315	Linear Algebra for Data Science	3
or MATH 314	Linear Algebra	
Credit Hours Subtotal:		9-12
Statistics		
Select one of the following:		6
Choice A		
STAT 218	Introduction to Statistics	
or STAT 380 RAIK 270H	Statistics and Applications	
STAT 318	Introduction to Statistics II	
Choice B		
STAT 101	Introduction to Data	
STAT 102	Principles of Statistical Analysis	
Credit Hours Subtotal:		6
Total Credit Hours		**24-29**

Specific Major Requirements

Professional Experience		
MATH 435	Math in the City	3
or RAIK 402H	Honors: RAIK Design Studio II	
Credit Hours Subtotal:		3
Focus Area Courses		
Select at least 15 hours from two of the following focus areas, with 9 credit hours in one focus area and 6 credit hours in another focus area.		15
Applied Computing: Journalism and Humanities		
ADPR 358	UX/UI Design	
JOUR 307	Data Journalism	
JOUR 407	Data Visualization	
SPMC 350	Sports Data Visualization and Analytics	
Applied Computing: Natural Resources		
AECN 401	Advanced Farm Management and Linear Programming	
AECN 436	Commodity Price Forecasting	
NRES 218	Introduction to Geospatial Technologies	
NRES 415	GIS for Agriculture and Natural Resources	
NRES 418 / GEOG 418	Introduction to Remote Sensing	
PLAS 420	Bioinformatics Applications in Agriculture	
PLAS 431 / AGEN 431 / AGST 431	Site-specific Crop Management	
Applied Computing: Sociology		
SOCI 333	Applied Research in Public Opinion	
SOCI 362	Ethics and the Responsible Conduct of Research	

SOCI 407	Strategies of Social Research: Qualitative Methods
SOCI 465	Survey Design and Analysis
Artificial Intelligence	
CSCE 421	Foundations of Constraint Processing
CSCE 472	Digital Image Processing
CSCE 473	Computer Vision
CSCE 474	Introduction to Data Mining
CSCE 475	Multiagent Systems
CSCE 476	Introduction to Artificial Intelligence
CSCE 478	Introduction to Machine Learning
CSCE 479	Introduction to Deep Learning
Data Pipeline	
CSCE 411	Data Modeling for Systems Development
CSCE 413	Database Systems
CSCE 436	Advanced Embedded Systems
CSCE 438	Internet of Things
CSCE 458	Molecular and Nanoscale Communication
CSCE 463	Data and Network Security
CSCE 465	Wireless Communication Networks
STAT 251	Statistical Computing I: Data Wrangling
STAT 351	Statistical Computing II: Data Management and Visualization
Mathematical Modeling	
MATH 208	Calculus III (Mathematical Modeling)
MATH 221	Differential Equations
MATH 415	Theory of Linear Transformations
MATH 424	Introduction to Partial Differential Equations
MATH 428	Principles of Operations Research
MATH 433	Nonlinear Optimization
MATH 432	Mathematics of Machine Learning
MATH 440	Numerical Analysis I
MATH 447	Numerical Methods for Applied Math
MATH 450	Combinatorics
MATH 452	Graph Theory
MATH 471	Introduction to Topology
MATH 487	Probability Theory
MATH 489	Stochastic Processes
Software Development	
SOFT 261	Software Engineering IV
CSCE 361	Software Engineering
CSCE 378	Human-Computer Interaction
CSCE 412	Data Visualization
CSCE 460	Software Engineering for Robotics
CSCE 461	Advanced Topics in Software Engineering
CSCE 464	Internet Systems and Programming
CSCE 466	Software Design and Architecture
CSCE 467	Testing, Verification and Analysis
CSCE 468	Requirements Elicitation, Modeling and Analysis
RAIK 284H	Software Engineering IV
RAIK 403H	Honors: RAIK Design Studio III
RAIK 404H	Honors: RAIK Design Studio IV
RAIK 405H	Honors: RAIK Research Studio I
RAIK 406H	Honors: RAIK Research Studio II
RAIK 453H	Honors: User Interfaces
Statistical Modeling	
PLAS 420	Bioinformatics Applications in Agriculture
SOCI 465	Survey Design and Analysis
STAT 212	Principles of Study Design
STAT 301	Mathematical Statistics and Modeling I
STAT 302	Mathematical Statistics and Modeling II
STAT 325	Statistical Collaboration I
STAT 412	Advanced Statistical Design
STAT 414	Introduction to Survey Sampling
STAT 432	Introduction to Spatial Statistics
STAT 443	Statistical Analysis of Genomics Data
STAT 450	Introduction to Regression Analysis
STAT 462	Introduction to Mathematical Statistics I: Distribution Theory
STAT 463	Introduction to Mathematical Statistics II: Statistical Inference
STAT 464	Model Selection and Prediction
STAT 474	Introduction to Nonparametric Statistics
STAT 475	Introduction to Categorical Data Analysis
STAT 478	Introduction to Time Series Analysis
STAT 486	Introduction to Bayesian Analysis
Credit Hours Subtotal:	15

Additional Major Requirements

Grade Rules

C- and D Grades

A grade of C or above is required for all courses in the major.

Pass/No Pass

No course taken Pass/No Pass will be counted toward the major, unless offered exclusively with a grade option of Pass/No Pass.