

# PROGRAM IN DATA SCIENCE AND ANALYTICS

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## General Information

Data Science and Analytics is the development of analytical models and methods to extract new knowledge from vast, complex data. Organizations large and small employ data scientists to determine profitable lines of business, characterize customers, evaluate and predict risks, improve operational efficiencies, predict system performance and perform complex simulations. Graduates in Data Science and Analytics will have the skills to design and build tools to extract, assimilate and analyze data, and the systems understanding to predict and enhance future performance for enterprises across all domains of the private and public sectors.

## Undergraduate

### Undergraduate Certificate

The Certificate in Data Science and Analytics will provide students with data science concepts and knowledge in a formal, stand-alone certificate format. The courses for this program are developed specifically for this certificate for undergraduate students enrolled in degree programs within Gallogly College of Engineering or the Mewbourne College of Earth and Energy. This certificate is intended to provide the level of data literacy required by the companies that recruit engineering and geoscience majors at the University of Oklahoma. Modern organizations are driven by the insights derived through extracting and analyzing the large quantities of data generated within and outside their organization. In order to accomplish this, employees must have a fair degree of understanding of data management, technology, and analytics. Hence, engineering students must acquire these skills so that they can help their organizations create analytical and statistical value.

Please contact the College's Williams Student Services Center (WSSC) for information about adding the certificate, or for guidance on course selection. The WSSC is located in 112 Felgar Hall | (405) 325-4096 | coewssc@ou.edu

## Graduate

### Master of Science

The Data Science and Analytics, Master of Science program merges expertise and knowledge from the Schools of Computer Science and Industrial and Systems Engineering. Students will develop a strong foundation in the theory and application of data science, including machine learning, optimization modeling, and artificial intelligence, that will give them the skills to harness big data.

### Graduate Certificate

Through the Graduate Certificate in Data Science and Analytics students will build their data science and analytics skill set to enhance their current position or to allow them to seek new positions in the field.

## Doctor of Philosophy

The Data Science and Analytics, Doctor of Philosophy program will allow students to examine more deeply the fundamentals, theory, and application of Algorithmic, Systems, and Statistically thinking to extract knowledge from data that arises in various application domains. The graduates of the program will be prepared to engage in creative research and development in academia or industry.

## Student Resources

The DSA Office is here for our students from application to graduation.

The information on this page will help orientate our new students by providing links to student groups, campus offices and contact information. While also providing current students all the information and forms they need for enrollment through to graduation. In addition to our credit-based offerings, OU DSAI provides non-degree learning and development opportunities and certifications for working professionals, and collaborative engagement with industry partners. For more information, visit our Industry Engagement page.

Guidance can be found via: Felgar Hall, Room 213 | (405) 325-6417 | datascience@ou.edu

## Courses

### DSA 3013 Machine Learning for Data Science 3 Credit Hours

Prerequisite: CS 1213 or CS 1313 or CS 1321 or CS 1323 or CS 1324, and departmental permission. Machine Learning for Data Science provides a broad overview of widely accepted and state-of-the-art machine learning approaches to automatically extract information from a variety of data types. This course will include conceptual background on data, methods, and application approaches; coverage of issues of data security, privacy, and ethics related to machine learning; and practical, hands-on exercises. (Irreg.)

### DSA 3023 Big Data Engineering 3 Credit Hours

Prerequisite: DSA 3013, and CS 1213 or CS 1313 or CS 1321 or CS 1323 or CS 1324, and departmental permission. Students in this course will develop basic ability to design, build, and implement data pipeline systems to allow efficient access to data and databases. Several topics will be covered including data wrangling, data ingestion, and storage engines. Cloud based systems for data processing and distributed computing will also be discussed. (Irreg.)

### DSA 4003 Applied Data Science 3 Credit Hours

Prerequisite: DSA 3013 and DSA 3023, and CS 1213 or CS 1313 or CS 1321 or CS 1323 or CS 1324; and departmental permission. In this course you will complete multiple larger-scale team projects on real-world complex data sets. The projects will allow you to develop and continue to refine your skills in problem identification, data visualization, data wrangling, data organization, machine learning, communication, and presentation. (Irreg.)

### DSA G4413 Algorithm Analysis 3 Credit Hours

(Crosslisted with C S 4413) Prerequisites: C S 2413 and C S 2813; or MATH 2513; or DSA 5005; and departmental permission. Design and analysis of algorithms and measurement of their complexity. This course introduces various algorithm design strategies--divide and conquer, greedy principle and dynamic programming--to solve a variety of problems using algorithms of various types: deterministic and randomized, serial and parallel, centralized and decentralized, and program based and circuit based. (F)

- DSA G4513 Database Management Systems 3 Credit Hours**  
(Crosslisted with C S 4513) Prerequisites: C S 2413 and C S 2813; or MATH 2513; or DSA 5005; and departmental permission. The design and implementation of a DBMS including data models, query languages, entity-relationship diagrams, functional dependencies, normalization, storage structures, access methods, query processing, security and transaction management, and applications. The impact of databases on individuals, organizations, and society, and legal and professional responsibilities including security and privacy will be discussed. A commercial DBMS is used. Students practice written communication skills. (F)
- DSA 5001 Data Analytics and Media 1 Credit Hour**  
Prerequisites: Departmental permission; graduate standing. This course covers the application of data analytics to the media environment. Students will learn the application and usage of data analytics in media and its effectiveness; and how data analytics provides research tools to collect audiences' opinion on political, social, public issues, and consumers' responses to the brand. (Irreg.)
- DSA 5005 Computing Structures 5 Credit Hours**  
(Crosslisted with C S 5005) Prerequisite: CS 2334, MATH 1914 or MATH 1823 or with permission of graduate liaison. This course has three parts: discrete mathematics, object-oriented programming in C++, and data structures in C++. As part of the discrete mathematics students will be introduced to combinatorics, logic, relations, functions, computational complexity, automata, and graph theory. Students will be introduced to the fundamentals of object-oriented programming and learn to design, build, and analyze data structures using object-oriented principles and techniques. Credit hours earned for this course cannot be used to fulfill degree requirements for the B.S., M.S. or Ph.D. programs in computer science. (Irreg.)
- DSA 5011 Introduction to R 1 Credit Hour**  
Prerequisites: departmental permission; graduate standing. R is a free open source statistical programming language used by professionals in every field and industry. This introductory course aims to provide students with the fundamentals of R and R Studio. Instead of passively watching videos, students will apply R to solve real data problems while receiving instant and personalized feedback that guides them to the correct solution. (Irreg.)
- DSA 5013 Fundamentals of Engineering Statistical Analysis 3 Credit Hours**  
(Crosslisted with ISE 5013) Prerequisite: graduate standing. Introduction to probability, expectation, discrete and continuous distributions, sampling and descriptive statistics, parameter estimation, and statistical tests to aid decision making. The student will learn analysis techniques for verification of systems parameters. (F, Sp)
- DSA 5021 Data Analytics Applied to Meteorology Data 1 Credit Hour**  
Prerequisites: departmental permission; graduate standing. This course focuses on meteorology data that is stored regularly in space and time, so-called gridded data. For example, satellite or forecast data that is stored in a specific latitude-longitude grid, and available at uniform increments in time. Analysis of gridded data is abetted by programming in Python, offering an array syntax that exploits the uniformity of data. (Irreg.)
- DSA 5031 Econometrics for DSA 1 Credit Hour**  
Prerequisite: Graduate standing and departmental permission. The main goal of this course is to learn a set of econometrics tools that can be applied in empirical research related to economic issues. The course will emphasize applying different estimation techniques, or quasi-experimental methods, to establish causal relationships in observational data. (Irreg.)
- DSA 5041 Advanced R 1 Credit Hour**  
Prerequisite: Graduate standing in DSA/C S/ISE and DSA 5011, or departmental permission. R is a free open source statistical programming language used by professionals in every field and industry. This course will provide students with detailed knowledge of R and R Studio. Instead of passively watching videos, students will apply R to solve real data problems while receiving instant and personalized feedback that guides them. (Irreg.)
- DSA 5051 Data Visualization 1 Credit Hour**  
Prerequisite: Graduate standing in DSA/C S/ISE and departmental permission; DSA 5103 and DSA 4513 recommended. Aspiring data scientists need to be able to communicate the stories of data to communities of interest. This usually requires the depiction of data in visualizations. The course combines an overview of best practices for visualizations with practical knowledge, including the use of Tableau and how to gather user requirements. (Irreg.)
- DSA 5061 Python for Data Science and Analytics 1 Credit Hour**  
Prerequisite: Graduate standing, C S 1313 or C S 1323, and departmental permission. This course introduces core programming basics, including data types, control structures, and algorithm development with functions via the Python programming language for students without prior programming experience. The course discusses the fundamental principles of Object-Oriented Programming and their application in data science and analytics. (Irreg.)
- DSA 5103 Intelligent Data Analytics 3 Credit Hours**  
(Crosslisted with ISE 5103) Prerequisite: graduate standing or permission of instructor; ISE 3293 or ISE 5013; CS 1313 or CS 1323. In our society, data is rapidly increasing in volume, velocity, and variety. At the same time computing power and the sophistication of data analysis techniques are increasing. However, even with the expanding capabilities, businesses and organizations often find themselves "data rich, but information poor." Intelligent Data Analysis is a holistic approach to addressing real-world data intensive problems that integrates human intuition with data analysis tools to best draw out meaningful insights. To this end, the course has four underlying themes: defining the Problem, understanding and coping with Data, selecting and using appropriate Analytical Tools, and discovering and communicating the Insight. Techniques covered include data cleansing and pre-processing, exploratory analysis and visualization, dimension reduction, linear and logistic regression, decision trees, and clustering. This course will introduce students to a powerful open source statistical programming language (R) and include extensive hands-on data analysis and team projects. (F)
- DSA 5113 Advanced Analytics and Metaheuristics 3 Credit Hours**  
(Crosslisted with ISE 5113) Prerequisite: ISE 5013, graduate standing or permission of Instructor. Explores advanced techniques for addressing complex optimization problems. Focus is on formulating mathematical models and developing problem solving strategies using methods in the context of Data Science and Analytics. Topics include continuous and combinatorial optimization with an emphasis on both traditional and modern heuristic techniques. (Sp)

**DSA 5133 Energy Analytics 3 Credit Hours**

(Crosslisted with ISE 5133) Prerequisite: Graduate standing or permission of instructor. In today's data-driven world, the ability to extract knowledge and create successful future energy projections is critical for the energy sectors. In this regard, data science body of knowledge promises a strong set of analytical tools that can be used for demand/supply forecasting and price prediction. This course aims at teaching the students the fundamentals of data analysis and interpretation. (F)

**DSA 5203 Time Series Analysis 3 Credit Hours**

Prerequisite: DSA/ISE/C S graduate standing or Departmental permission. This course will cover data mining and time series analysis. Modules include: statistical estimation, transformations and decomposition of time series, quantifying correlation structure in standard models, forecasting methods, linear least squares method, and volatility models. Students will utilize MATLAB Time Series Tool Box and open source programs in R. (Irreg.)

**DSA 5303 Financial Engineering Analytics 3 Credit Hours**

Prerequisite: departmental permission or DSA/ISE/C S graduate standing. Course focuses on use of optimization and stochastic models to solve portfolio optimization problems; price derivative securities including energy and weather derivatives; and applications of financial engineering, including algorithmic trading, financial networks, pricing of real options, and the use of machine learning in pricing. Data driven models and big data mining in financial engineering will be also discussed. (Irreg.)

**DSA 5403 Bayesian Statistics 3 Credit Hours**

Prerequisite: Departmental permission or DSA graduate standing. Course topics are models, probability, Bayes' Rule and R; inference to a binomial probability; and the generalized linear model. (Irreg.)

**DSA 5503 Healthcare Analytics 3 Credit Hours**

(Crosslisted with ISE 5503) Prerequisite: Graduate standing and ISE 3293 or ISE/DSA 5013. This course gives an overview of the primary concepts and methods towards developing artificial intelligence (AI)-enabled healthcare systems. We will focus on foundational methods in machine learning and data analytics for prediction and pattern recognition, and apply them to specific areas in medicine and healthcare including, but not limited to, disease diagnosis, patient treatments and their outcomes prediction. (Sp)

**DSA 5703 Machine Learning Practice 3 Credit Hours**

(Crosslisted with C S 5703) Prerequisite: Graduate standing; C S 4013/5013, C S 5593, or ISE/DSA 5103; or permission of instructor. Machine learning is the data-driven process of constructing mathematical models that can be predictive of data observed in the future. In this course, we will study the use of a range of supervised, semi-supervised and unsupervised methods to solve both classification and regression problems. (F)

**DSA 5900 Professional Practice 1-4 Credit Hours**

1 to 4 hours. Prerequisite: Completed or concurrent enrollment in DSA 5103, DSA 5113, DSA 4413, and DSA 4513. Graduate standing and departmental permission. May be repeated; maximum credit four hours. Participation in a professional experience with an approved project sponsor and topic. A written report detailing the responsibilities and results of the experience is required upon completion along with an oral presentation. (F, Sp, Su)

**DSA 5970 Special Topics/Seminar 1-3 Credit Hours**

1 to 3 hours. Prerequisite: permission of instructor. May be repeated with a change of subject matter; maximum credit 12 hours. Selected topics of current research interest not covered by regularly scheduled coursework. (F, Sp, Su) (Irreg.)

**DSA 5980 Research for Master's Thesis 2-9 Credit Hours**

2 to 9 hours. Prerequisite: Graduate standing and departmental permission. Variable enrollment, two to nine hours; maximum credit applicable toward degree, six hours. (F, Sp, Su)

**DSA 5990 Independent Study 1-3 Credit Hours**

1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

**DSA 6980 Research for Doctoral Dissertation 2-16 Credit Hours**

2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

**Faculty**

Last Name	First/Middle Name	Middle init.	OU Service start	Title(s), date(s) appointed	Degrees Earned, Schools, Dates Completed
Barker	Kash		2011	PROFESSOR OF INDUSTRIAL AND SYSTEMS ENGINEERING, 2021; DAVID L. BOREN PROFESSOR, 2020; PROFESSOR DATA SCIENCE AND ANALYTICS	PhD, Univ of Virginia, 2008; MS, Univ of Oklahoma, 2004; BS, Univ of Oklahoma, 2002
Beattie	Matt			Adjunct Professor	PhD, University of Oklahoma
Dhall	Sundarshan			Professor Emeritus	Ph.D., Computer Science, Univ of Illinois; MS, Mathematics, Univ of Illinois; MA, Delhi Univ, Delhi, India
Diochnos	Dimitrios			Assistant Professor	PhD, Univ of Illinois at Chicago MS, Univ of Athens BS, Univ of Athen
Ebert	David			Professor of Electrical and Computer Engineering and the Director of the Data Institute for Societal Challenges.	PhD, Computer Science, The Ohio State Univ; MS, Computer Science, The Ohio State Univ; BS, Computer Science, The Ohio State Univ
Fagg	Andrew			Presidential Associates Presidential Professor and Associate Professor of Computer Science and Bioengineering	Postdoctoral Research Associate, Univ of Massachusetts Amherst; PhD, Univ of Southern California; MS, Univ of Southern California; BS, Carnegie Mellon Univ
Fiedler	Brian			Professor Emeritus. Meteorology	B.S., Physics, M.I.T., 1978 Ph.D., Astro-Geophysics, Univ of Colorado, 1982
Ghosh	Pallab			Associate Professor of Economics	Ph.D., Syracuse University, 2014

Gonzalez	Andres			Assistant Professor. Industrial and Systems Engineering.	Ph.D., Civil Engineering, Rice Univ; Ph.D., Engineering, Universidad de los Andes; Six Sigma Black-Belt, Arizona State Univ; M.Eng., Industrial Engineering, Universidad de los Andes; B.Sc. Physics, Universidad de los Andes
Kirstetter	Pierre			Associate Professor. School of Meteorology	PhD, 2008, Meteorology, Grenoble Alps Univ, Grenoble, France; MSc, 2005, Environmental Sciences, Grenoble Alps Univ, France; M.Eng, 2004, Civil Engineering and Environmental Science, Grenoble Institute of Technology, France
Gruenwald	Gia Loi	L	1991	SAMUEL ROBERTS NOBLE PRESIDENTIAL PROFESSOR OF COMPUTER SCIENCE, 2002; DAVID W. FRANKE PROFESSOR OF COMPUTER SCIENCE, 2006	PhD, Southern Methodist Univ, 1990; MS, Univ of Houston, 1983; BS, Univ of Saigon, 1978
Habibi	Golnaz			Assistant Professor in Computer Science.	PhD, Computer Science, Rice Univ, Houston, TX; MS, Electrical and Control Engineering, Tarbiat Modares Univ, Tehran; BS, Electrical and Control Engineering, K.N. Toosi Univ, Tehran
Kumar	Naveen			Assistant Professor in Management Information Systems	PhD, Industrial Engineering, Univ of Washington, Seattle (2006); Graduate Certificate Holder (2004), Global Trade, Transportation & Logistics (GTTL), Univ of Washington, Seattle; MS, Industrial Engineering, Univ of Washington, Seattle (2003); MS, Industrial Engineering, Univ of Tennessee, Knoxville (2002)
Hemmati	Soheil	M	2023	Assistant Professor of Industrial and Systems Engineering	Ph.D Industrial and Systems Engineering, University of Florida, M.S. Industrial Engineering, Sharif University of Technology, B.S. Industrial Engineering, Sharif University of Technology
Kyprioti	Aikaterini	P	2022	Assistant Professor, School of Civil Engineering and Environmental Science	Ph.D. Unvierstiy of Notre Dame; M.S. University of Notre Dame; B.S. Aristotle University of Thessaloniki, Greece
Hougen	Dean		2001	ASSOCIATE PROFESSOR OF COMPUTER SCIENCE, 2007; INTERIM DIRECTOR OF COMPUTER SCIENCE, 2022	PhD, Univ of Minnesota, 1998; BS, Univ of Minnesota, 1988
LakshmiVaralS				Professor Emeritus	PhD, Electrical Engineering, Indian Institute of Science; ME, Applied Electronics and Servos, Indian Institute of Science; BE, Electrical Technology, Indian Institute of Science; BS, Physics, Univ of Madras
KhanmohamSina				Assistant Professor in Computer Science	PhD, Systems Science, State Univ of New York at Binghamton; MSc, Manufacturing Management, Univ of Hertfordshire; BSc, Computer Science, University of Tabriz
Lan	Chao			Assistant Professor in Computer Science.	PhD, Computer Science, Univ of Kansas MS, Nanjing Univ of Posts and Telecommunication, China BS, Nanjing Univ of Posts and Telecommunication, China
Li	Yifu			Assistant Professor	Ph.D., Industrial and Systems Engineering, Virginia Tech; B.S., Industrial and Systems Engineering, Virginia Tech

Maiti	Anindya		Assistant Professor in Computer Science	PhD in Electrical Engineering and Computer Science, Wichita State Univ; MS in Electrical Engineering, Wichita State Univ; BTech in Computer Science, Vellore Institute of Tech
Malhotra	Pankhuri		Affiliated DSA Faculty, Assistant Professor of Marketing	Ph.D Information Systems, University of Illinois; MSC Business Analytics and Operations Research, University of Manchester; BSC Physics University of Delhi, Mrianda House
Moussa	Marmar	2023	Assistant Professor Computer Science and Engineering	PhD. Computer Science and Engineering, University of Connecticut; M.S. Computer Science and Engineering, University of Connecticut; M.S. Computer Science and Engineering, Alexandria University; B.S. Computer Science, Alexandria University
Mudduluru	Sanjana	2023	Assistant Professor, Computer Science	PhD. Computer Science, University of Oklahoma; M.S. Computer Science, University of Oklahoma; BTech, Jawaharlal Nehru Technological University
Nicholson	Charles	2013	DIRECTOR OF DATA SCIENCE AND ANALYTICS INSTITUTE, 2023; ASSOCIATE PROFESSOR OF INDUSTRIAL AND SYSTEMS ENGINEERING, 2019; ASSOCIATE PROFESSOR DATA SCIENCE AND ANALYTICS	PhD, Southern Methodist Univ, 2010; MS, Univ of North Texas, 2002; BS, Univ of North Texas, 1999
Pan	Chongle		Associate Professor of Computer Science and Microbiology	PhD, Univ of Tennessee, Knoxville; BS, East China Normal Univ
Park	Ji Hwan		Assistant Professor, School of Computer Science	PhD, Computer Science, Stony Brook Univ, Stony Brook, NY; MS, Digital Media, KAIST, Daejeon, South Korea; BS, Computer Engineering, Hongik Univ, Seoul, South Korea
Pei	Jin-Song	2002	Associate Professor, Civil Engineering & Environmental Science	Ph.D. Columbia University, New York; MS Engineering, Nanyang Technological University Singapore; BS Engineering Xi'an Jiaotong University, Xi'an, China
Radhakrishna	Bridhar	1990	PROFESSOR OF COMPUTER SCIENCE, 2002; INTERIM ASSOCIATE DEAN FOR PARTNERSHIPS, 2022	PhD, Louisiana State Univ, 1990; MS, Louisiana State Univ, 1987; MLIS, Louisiana State Univ, 1986; BS, Univ of South Alabama, 1985; BSC, Univ of Madras, 1983
Razzaghi	Talayeh		ASSISTANT PROFESSOR	PhD, Univ of Central Florida; MS, Sharif Univ of Technology, Iran; BS, Univ of Tehran, Iran
Roh	Byeong-Min	2022	Assistant Professor, Mechanical Engineering	PhD. Mechanical Engineering, The Pennsylvania State University; M.S. Mechanical Engineering, The Pennsylvania State University; M.S. Industrial Engineering, The Pennsylvania State University; B.S. Manufacturing Systems & Design Engineering, Northumbria University at Newcastle, UK; B.S. Manufacturing Systems & Design Engineering, Seoul National University of Science and Technology
Shehab	Randa	1997	PROFESSOR OF INDUSTRIAL AND SYSTEMS ENGINEERING, 2009; ADJUNCT PROFESSOR OF WOMEN'S AND GENDER STUDIES, 2013; NETTIE VINCENT BOGGS PROFESSOR OF ENGINEERING, 2014; CO-DIRECTOR DATA SCIENCE AND ANALYTICS	PhD, Univ of Oklahoma, 1995; MS, Univ of Oklahoma, 1993; BS, Univ of Oklahoma, 1989
Stewart	Wayne		Lecturer, Mathematics	PhD, University of Auckland, 2007

Trafalis	Theodore B	1991	PROFESSOR OF INDUSTRIAL AND SYSTEMS ENGINEERING, 2002; ADJUNCT PROFESSOR OF METEOROLOGY, 2008; PROFESSOR DATA SCIENCE AND ANALYTICS	PhD, Purdue Univ, 1989; MS, Purdue Univ, 1984; BS, Athens, 1982
Veras	Richard	2021	Assistant Professor, Electrical and Computer Engineering	Ph.D Electrical and Computer Engineering, Carnegie Mellon University; M.S. Electrical and Computer Engineering, Carnegie Mellon University; B.S. Mathematics, The University of Texas at Austin; B.S. Computer Science, The University of Texas at Austin
Yoon	Doyle	2003	ASSOCIATE PROFESSOR OF JOURNALISM AND MASS COMMUNICATION, 2009; ASSOCIATE PROFESSOR DATA SCIENCE AND ANALYTICS, 2017; GRADUATE DIRECTOR, 2023	PhD, Univ of Missouri, 2003; MA, Univ of Missouri, 1999; BA, Sogang Univ, 1989
Zamani Esfahlani	Farnaz	2023	Assistant Professor, Biomedical Engineering	Ph.D Systems Science, State University of New York at Binghamton; M.S. Biomedical Engineering, State University of New York at Binghamton; B.A. Clinical Psychology, University of Tabriz