DATA SCIENCE ONLINE (DTSA)

Courses

The following courses are only available through CU Boulder on Coursera program offerings. Please refer to the Online Programs (https://catalog.colorado.edu/online/) section of the catalog for more information.

DTSA 5001 (1) Probability Theory: Foundation for Data Science
Probability Theory covers the foundations of probability and its relationship to statistics and data science. Calculate a probability, independent and dependent outcomes, and conditional events. Understand discrete and continuous random variables and see how this fits with data collection. Learn Gaussian (normal) random variables and the Central Limit Theorem and understand it¿s fundamental importance for statistics and data science.
Grading Basis: Letter Grade

DTSA 5002 (1) Statistical Inference for Estimation in Data Science
Introduction to statistical inference, sampling distributions, and confidence intervals. Learn how to define and construct good estimators, method of moments estimation, maximum likelihood estimation, and methods of constructing confidence intervals that will extend to more general settings.
Grading Basis: Letter Grade

DTSA 5003 (1) Hypothesis Testing for Data Science
This course will focus on theory and implementation of hypothesis testing, especially as it relates to applications in data science. Students will learn to use hypothesis tests to make informed decisions from data. Special attention will be given to the general logic of hypothesis testing, error and error rates, power, simulation, and the correct computation and interpretation of p-values. Attention will also be given to the misuse of testing concepts, especially p-values, and the ethical implications of such misuse.
Grading Basis: Letter Grade

DTSA 5011 (1) Modern Regression Analysis in R
Modern Regression Analysis in R provides foundational statistical modeling tools for data science. Introduction to methods, theory, and applications of linear statistical models, covering the topics of parameter estimation, residual diagnostics, goodness of fit, and various strategies for variable selection and model comparison. Attention will also be given to the misuse of statistical models and ethical implications of such misuse.
Grading Basis: Letter Grade

DTSA 5012 (1) ANOVA and Experimental Design
Introduction to the analysis of variance (ANOVA), analysis of covariance (ANCOVA), and experimental design. ANOVA and ANCOVA, presented as a type of linear regression model, provide mathematical basis for designing experiments for data science applications. Emphasis placed on important design-related concepts, such as randomization, blocking, factorial design, and causality. Attention will also be given to ethical issues raised in experimentation.
Grading Basis: Letter Grade

DTSA 5013 (1) Generalized Linear Models and Nonparametric Regression
Generalized Linear Models and Nonparametric Regression teaches generalized linear models (GLMs), which provide an introduction to classification (through logistic regression); nonparametric modeling, including kernel estimators, smoothing splines; and semi-parametric generalized additive models (GAMs). Emphasis will be placed on a firm conceptual understanding of these tools. Attention will also be given to ethical issues raised by using complicated statistical models.
Grading Basis: Letter Grade

DTSA 5020 (1) Statistical Learning for Data Science: Regression and Classification
Consists of the foundational framework & application of simple and multiple linear regression and classification methods.
Grading Basis: Letter Grade

DTSA 5021 (1) Statistical Learning for Data Science: Resampling, Selection and Splines
Consists of the foundational framework & application of cross-validation, bootstrapping, dimensionality reduction, ridge regression, lasso, GAMs and splines.
Grading Basis: Letter Grade

DTSA 5022 (1) Statistical Learning for Data Science: Trees, SVM and Unsupervised Learning
Consists of the foundational framework & application of tree-based methods, support vector machines, and unsupervised learning.
Grading Basis: Letter Grade

DTSA 5301 (1) Data Science as a Field
This course provides a general introduction to the field of Data Science. It is designed for aspiring data scientists, content experts who work with data scientists, or anyone interested in learning about what Data Science is and what it¿s used for. Topics include the past, present, and future of the field; the academic disciplines that both practice and make use of Data Science; collaboration between data scientists and content experts; and the practice of Data Science in the professional world. This course is part of CU Boulder¿s Master¿s of Science in Data Science and was collaboratively designed by both academics and industry professionals to provide learners with an insider¿s perspective on this exciting, evolving, and increasingly vital discipline.
Grading Basis: Letter Grade

DTSA 5302 (1) Cybersecurity for Data Science
This course aims to help anyone interested in data science understand the cybersecurity risks and the tools/techniques that can be used to mitigate those risks. We will cover the distinctions between confidentiality, integrity, and availability, introduce learners to relevant cybersecurity tools and techniques including cryptographic tools, software resources, and policies that will be essential to data science. We will explore key tools and techniques for authentication and access control so producers, curators, and users of data can help ensure the security and privacy of the data.
Grading Basis: Letter Grade

DTSA 5303 (1) Ethical Issues in Data Science
This course examines ethical issues related to data science, with the objective of making data science professionals aware of and sensitive to ethical considerations that may arise in their careers. It focuses on ethical frameworks, data science applications that lead to ethical considerations, current media and scholarly articles, and the perspectives and experiences of fellow students and computing professionals.
Grading Basis: Letter Grade

DTSA 5304 (1) Fundamentals of Data Visualization
Explores the design, development, and evaluation of information visualizations. Combine aspects of design, computer graphics, HCI, and data science, to gain hands-on experience with creating visualizations, using exploratory tools, and architecting data narratives. Topics include user-centered design, web-based visualization, data cognition and perception, and design evaluation.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5702
Grading Basis: Letter Grade

DTSA 5501 (1) Algorithms for Searching, Sorting, and Indexing
This course covers basics of algorithm design and analysis, as well as algorithms for sorting arrays, data structures such as priority queues, hash functions, and applications such as Bloom filters.
Grading Basis: Letter Grade

DTSA 5502 (1) Trees and Graphs: Basics
Basic algorithms on tree data structures, binary search trees, self-balancing trees, graph data structures and basic traversal algorithms on graphs. This course also covers advanced topics such as kd-trees for spatial data and algorithms for spatial data.
Grading Basis: Letter Grade

DTSA 5503 (1) Dynamic Programming, Greedy Algorithms
This course covers basic algorithm design techniques such as divide and conquer, dynamic programming, and greedy algorithms. It concludes with a brief introduction to intractability (NP-completeness) and using linear/integer programming solvers for solving optimization problems.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5414
Grading Basis: Letter Grade

DTSA 5504 (1) Data Mining Pipeline
This course introduces the key steps involved in the data mining pipeline, including data understanding, data preprocessing, data warehouse, data modeling, interpretation and evaluation, and real-world applications.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5502
Grading Basis: Letter Grade

DTSA 5505 (1) Data Mining Methods
This course covers core techniques used in data mining, including frequent pattern analysis, classification, clustering, outlier detection, as well as time-series mining and graph mining.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5512
Grading Basis: Letter Grade

DTSA 5506 (1) Data Mining Project
This course offers step-by-step guidance and hands-on experience of designing and implementing a real-world data mining project, including problem formulation, literature survey, proposed work, evaluation, discussion and future work.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5522
Grading Basis: Letter Grade

DTSA 5507 (1) Fundamentals of Software Architecture for Big Data
Intended for individuals looking to understand the basics of software engineering as they relate to building large software systems that leverage big data. Students will be introduced to software engineering concepts necessary to build and scale large, data intensive, distributed systems. Starting with software engineering best practices and loosely coupled, highly cohesive data microservices, the course takes students through the evolution of a distributed system over time. Formerly offered as a special topics course.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5008
Grading Basis: Letter Grade

DTSA 5508 (1) Software Architecture Patterns for Big Data
Intended for individuals looking to understand the architecture patterns necessary to take large software systems that leverage big data to production. Students will transform big data prototypes into high quality tested production software. After measuring the performance characteristics of distributed systems, they will identify trouble areas and implement scalable solutions to improve performance. Upon completion of the course they will know how to scale production datastores to perform under load, designing load tests to ensure applications meet performance requirements. Formerly offered as a special topics course.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5018
Grading Basis: Letter Grade

DTSA 5509 (1) Introduction to Machine Learning - Supervised Learning
This course introduces various supervised ML algorithms and prediction tasks applied to different data. Specific topics include linear and logistic regression, KNN, Decision trees, ensemble methods such as Random Forest and Boosting, and kernel methods such as SVM. Formerly offered as a special topics course.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5622
Grading Basis: Letter Grade

DTSA 5510 (1) Unsupervised Algorithms in Machine Learning
Students will learn selected unsupervised learning methods for dimensionality reduction, clustering, finding latent features, and application cases such as recommender systems with hands-on examples of product recommendation algorithms. Formerly offered as a special topics course.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5632
Grading Basis: Letter Grade

DTSA 5511 (1) Introduction to Deep Learning
Course will cover the basics of deep learning, such as multilayer perceptron, convolutional neural network, recurrent neural network, how to build and train neural network models, optimization methods, and application examples. Formerly offered as a special topics course.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5642
Grading Basis: Letter Grade

DTSA 5512 (1) Introduction to Computer Vision
This course guides students through the essential algorithms and methods to help computers 'see' and interpret visual data. Students learn the core concepts and techniques that have been traditionally used to analyze images. Then, students learn modern deep learning methods, such as neural networks and specific models designed for image recognition, can be used to perform more complex tasks like object detection and image segmentation. Additionally, students will learn the creation and impact of AI-generated images and videos, exploring the ethical considerations of such technology.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5222
Grading Basis: Letter Grade

DTSA 5513 (1) Deep Learning for Computer Vision
This course introduces students to the core principles of neural networks and deep learning, focusing on their application in computer vision. Covering advanced CNN architectures like ResNet, Inception, and DenseNet, along with techniques in object detection (R-CNN, SSD, YOLO) and semantic segmentation (FCN, SegNet, U-Net), this course offers a comprehensive overview of theory and practical skills.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5322
Grading Basis: Letter Grade

DTSA 5514 (1) Computer Vision for Generative AI
This course delves into the cutting-edge realm of generative models for images and videos, including GANs and Diffusion Models. It will teach about multimodal foundational models such as CLIP, as well as applications for text-to-image and text-to-video generation. The course also addresses the issue of DeepFakes. Through both practical exercises and theoretical discussion, students will explore the ethical considerations, privacy concerns, and future trends in computer vision.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5422
Grading Basis: Letter Grade

DTSA 5701 (1) Introduction to High Performance and Parallel Computing
This course introduces the fundamentals of high-performance and parallel computing, and the software skills necessary for work in parallel software environments. These skills include big-data analysis, machine learning, parallel programming, and optimization. It covers the basics of Linux environments and bash scripting all the way to high throughput computing and parallelizing code.
Grading Basis: Letter Grade

DTSA 5702 (1) Efficient Programming
This course teaches learners the skills needed to develop software to run efficiently in high-performance computing environments or in the cloud. Students will have understand how to find bottlenecks in their programs as well as how to address those bottlenecks. The course will provide a high-level introduction to modern compute node architectures of high-performance and cloud computing instances.
Grading Basis: Letter Grade

DTSA 5703 (1) Parallel Computing with MPI
Provides a high-level introduction to modern computer node architectures of high-performance and cloud computing instances. This course is targeted to scientists, engineers, scholars, or anyone seeking to develop the software that needs to run efficiently on high-performance computing environments or in the cloud. For this course, students need basic programming skills in either C++, Fortran 90, or Python in addition to basic Linux skills. Students completing this course will have a basic understanding of how to find bottlenecks in their programs as well as how to address those bottlenecks. The course will provide a high-level introduction to modern compute node architectures of high-performance and cloud computing instances.
Grading Basis: Letter Grade

DTSA 5704 (1) Managing, Describing, and Analyzing Data
This course teaches the fundamentals of understanding data and the importance of correctly classifying data. This course covers how to describe data using descriptive statistics and R software, the four probability distributions commonly used in data analysis, steps for analyzing data sets using the appropriate probability distribution, and the basics of sampling error, sampling distributions, and errors in decision-making.
Grading Basis: Letter Grade

DTSA 5705 (1) Stability and Capability in Quality Improvement
Students will learn to analyze data in terms of process stability and statistical control and why having a stable process is imperative prior to performing statistical hypothesis testing. Students will create statistical process control charts for both continuous and discrete data using R software. Students will analyze data sets for statistical control using control rules based on probability. Additionally, students will learn how to assess a process with respect to how capable it is of meeting specifications, either internal or external, and make decisions about process improvement.
Grading Basis: Letter Grade

DTSA 5706 (1) Measurement Systems Analysis
Students will learn to analyze measurement systems for process stability and statistical control and why having a stable measurement process is imperative prior to performing any statistical analysis. Students will analyze continuous measurement systems and statistically characterize both accuracy and precision using R software. Students will perform measurement systems analysis for potential, short term and long term statistical control and capability.
Grading Basis: Letter Grade

DTSA 5707 (1) Deep Learning Applications for Computer Vision
Students will learn about Computer Vision as a field of study and research. They explore several Computer Vision tasks and suggested approaches, from the classic Computer Vision perspective. They'll be introduced to Deep Learning methods and apply them to some of the same problems. They will analyze the results and discuss advantages and drawbacks of both types of methods. Examples of Computer Vision tasks where Deep Learning can be applied include: image classification, image classification with localization, object detection, object segmentation, facial recognition, and activity or pose estimation.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5812
Grading Basis: Letter Grade

DTSA 5714 (1) Applications of Software Architecture for Big Data
Intended for individuals who want to build a production-quality software system that leverages big data. Students will apply the basics of software engineering and architecture to create a production-ready distributed system that handles big data. Students will build and scale a large, data intensive, distributed system, composed of loosely coupled, highly cohesive data microservices.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5028
Grading Basis: Letter Grade

DTSA 5718 (1) Computing, Ethics, and Society 1 - Foundations
Computing systems and technologies fundamentally impact the lives of most people in the world, including how we communicate, get information, socialize, and receive healthcare. This course is the first of a three course sequence that examines ethical issues in the design and implementation of computing systems and technologies, and reflects upon the broad implication of computing on our society. It covers ethical theories, privacy, security, social media, and misinformation.
Grading Basis: Letter Grade

DTSA 5719 (1) Computing, Ethics, and Society 2 - Algorithmic Bias and Professional Ethics
Computing systems and technologies fundamentally impact the lives of most people in the world, including how we communicate, get information, socialize, and receive healthcare. This course is the second of a three course sequence that examines ethical issues in the design and implementation of computing systems and technologies, and reflects upon the broad implication of computing on our society. It covers algorithmic bias in machine learning methods, professional ethics, and issues in the tech workplace.

DTSA 5720 (1) Computing, Ethics, and Society 3 - Applications
Computing systems and technologies fundamentally impact the lives of most people in the world, including how we communicate, get information, socialize, and receive healthcare. This course is the third of a three course sequence that examines ethical issues in the design and implementation of computing systems and technologies, and reflects upon the broad implication of computing on our society. It covers medical applications, uses of robotics, autonomous vehicles, and the future of work.
Grading Basis: Letter Grade

DTSA 5721 (0.7) Neural Networks and Deep Learning
In the first course of the Deep Learning Specialization, you will study the foundational concept of neural networks and deep learning. By the end, you will be familiar with the significant technological trends driving the rise of deep learning; build, train, and apply fully connected deep neural networks; implement efficient (vectorized) neural networks; identify key parameters in a neural network¿s architecture; and apply deep learning to your own applications.
Grading Basis: Letter Grade

DTSA 5722 (0.5) Improving Deep Neural Networks: Hyperparameter Tuning, Regularization and Optimization
In the second course of the Deep Learning Specialization, you will open the deep learning black box to understand the processes that drive performance and generate good results systematically. By the end, you will learn the best practices to train and develop test sets and analyze bias/variance for building deep learning applications; be able to use standard neural network techniques such as initialization, L2 and dropout regularization, hyperparameter tuning, batch normalization, and gradient checking; implement and apply a variety of optimization algorithms, such as mini-batch gradient descent, Momentum, RMSprop and Adam, and check for their convergence; and implement a neural network in TensorFlow.
Grading Basis: Letter Grade

DTSA 5723 (0.4) Structuring Machine Learning Projects
In the third course of the Deep Learning Specialization, you will learn how to build a successful machine learning project and get to practice decision-making as a machine learning project leader. By the end, you will be able to diagnose errors in a machine learning system; prioritize strategies for reducing errors; understand complex ML settings, such as mismatched training/test sets, and comparing to and/or surpassing human-level performance; and apply end-to-end learning, transfer learning, and multi-task learning. This is also a standalone course for learners who have basic machine learning knowledge. This course draws on Andrew Ng¿s experience building and shipping many deep learning products. If you aspire to become a technical leader who can set the direction for an AI team, this course provides the "industry experience" that you might otherwise get only after years of ML work experience.
Grading Basis: Letter Grade

DTSA 5724 (0.7) Convolutional Neural Networks
In the fourth course of the Deep Learning Specialization, you will understand how computer vision has evolved and become familiar with its exciting applications such as autonomous driving, face recognition, reading radiology images, and more. By the end, you will be able to build a convolutional neural network, including recent variations such as residual networks; apply convolutional networks to visual detection and recognition tasks; and use neural style transfer to generate art and apply these algorithms to a variety of image, video, and other 2D or 3D data.
Grading Basis: Letter Grade

DTSA 5725 (0.7) Sequence Models
In the fifth course of the Deep Learning Specialization, you will become familiar with sequence models and their exciting applications such as speech recognition, music synthesis, chatbots, machine translation, natural language processing (NLP), and more. By the end, you will be able to build and train Recurrent Neural Networks (RNNs) and commonly-used variants such as GRUs and LSTMs; apply RNNs to Character-level Language Modeling; gain experience with natural language processing and Word Embeddings; and use HuggingFace tokenizers and transformer models to solve different NLP tasks such as NER and Question Answering.
Grading Basis: Letter Grade

DTSA 5726 (1) Introduction to Bayesian Statistics for Data Science
This course introduces the theoretical, philosophical, and mathematical foundations of Bayesian Statistical inference. Students will learn to apply this foundational knowledge to real-world data science problems. Topics include the use and interpretations of probability theory in Bayesian inference; Bayes¿ theorem for statistical parameters; conjugate, improper, and objective priors distributions; data science applications of Bayesian inference; and ethical implications of Bayesian statistics.
Grading Basis: Letter Grade

DTSA 5727 (1) Computational Bayesian Statistics for Data Science
This course introduces students to the theoretical underpinnings and applications of computational algorithms in Bayesian statistics. Topics include maximum a posteriori estimation; rejection sampling; and Markov chain Monte Carlo algorithms, such as the Gibbs sampler and several variations of the Metropolis-Hastings algorithm. This course also provides an introduction to the Stan computing environment.
Grading Basis: Letter Grade

DTSA 5728 (1) Bayesian Statistical Modeling for Data Science Applications
This course introduces students to applied Bayesian statistical modeling. Topics include Bayesian linear regression, Bayesian generalized linear models, and an introduction to Bayesian hierarchal modeling. Special emphasis will be placed on the application of maximum a posterior estimation and Markov chain Monte Carlo algorithms on Bayesian statistical models. This course also demonstrate Bayesian statistical modeling in the Stan computing environment.
Grading Basis: Letter Grade

DTSA 5733 (1) Relational Database Design
This course will prepare students with the tools needed to design a Relational Database System. Formerly offered as a special topics course.
Grading Basis: Letter Grade

DTSA 5734 (1) The Structured Query Language (SQL)
In this course students will thoroughly learn the Structured Query Language. Study includes all ANSI standard SQL commands and syntax. Lectures are supplemented with thorough hands-on lab assignments and exercises. Formerly offered as a special topics course.
Grading Basis: Letter Grade

DTSA 5735 (1) Advanced Topics and Future Trends in Database Technologies
The course will have an overview of future trends in databases, including non-relational databases (NoSQL) and Big Data. Formerly offered as a special topics course.
Grading Basis: Letter Grade

DTSA 5737 (1) Protecting Individual Privacy on the Internet
This is the second of three courses exploring Internet Policy: Principles and Problems, which is part of CU Boulder¿s Master of Science in Data Science and Master of Science in Computer Science programs on Coursera. This course critiques and develops regulatory approaches to real-world privacy problems created by the Internet. Learners will create a privacy brief based upon the exposure of their own private information when surfing the web. Successful completion of the first course in this series is recommended.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5443
Recommended: Prerequisite DTSA 5736/CSCA 5433.
Grading Basis: Letter Grade

DTSA 5738 (1) Cybersecurity in Crisis: Information and Internet Security
This is the third of three courses exploring Internet Policy: Principles and Problems, which is part of CU Boulder¿s Master of Science in Data Science and Master of Science in Computer Science programs on Coursera. This course examines policy approaches to real-world cybersecurity problems occurring on the Internet. Learners will develop a privacy brief on a cybersecurity government policy, law or regulation of their choice. Successful completion of the first course in this series is recommended.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5453
Recommended: Prerequisites DTSA 5736/CSCA 5433 and DTSA 5737/CSCA 5443.
Grading Basis: Letter Grade

DTSA 5740 (1) Global Climate Change Policies and Analysis
This course explores and critically analyzes historical and contemporary climate policies (e.g. Kyoto Protocol and the Paris Agreement). Political issues pertaining to energy sources, such as nuclear energy, will be reviewed. The course will focus on understanding key climate principles and terms surrounding policy development, specifically for low-income or developing countries/communities. Further, this course explores up-to-date technologies that are used in climate analysis. This course also introduces the Python programming language.
Grading Basis: Letter Grade

DTSA 5741 (1) Modeling Climate Anomalies with Statistical Analysis
This course introduces the use of statistical analysis in Python programming to study and model climate data, specifically with the SciPy and NumPy package. Topics include data visualization, predictive model development, simple linear regression, multivariate linear regression, multivariate linear regression with interaction, and logistic regression. Strong emphasis will be placed on gathering and analyzing climate data with the Python programming language.
Recommended: Prerequisite DTSA 5740 - Global Climate Change Policies and Analysis.
Grading Basis: Letter Grade

DTSA 5742 (1) Predicting Extreme Climate Behavior with Machine Learning
This course reviews current global climate policies with the goal of gathering data and applying machine learning algorithms to predict extreme climate behaviors, specifically in developing countries. Topics include multivariate linear regression, time-series analysis, and numerical weather prediction. The use of monte carlo simulations to forecast extreme weather events will be analyzed. Strong emphasis will be placed on application in the Python programming language.
Recommended: Prerequisites DTSA 5740 and DTSA 5741.
Grading Basis: Letter Grade

DTSA 5743 (1) Cryptography and Information Theory
This course combines cryptography (the techniques for protecting information from unauthorized access) and information theory (the study of information coding and transfer). More specifically, the course studies cryptography from the information-theoretical perspectives and discusses he concepts such as information entropy and the adversary¿s knowledge capability, e.g., Kerckhoff¿s Principle. It also contrasts the information-theoretic security and computational security to highlight the different train of thoughts that drive the cryptographic algorithmic construction and security analyses.
Grading Basis: Letter Grade

DTSA 5744 (1) Symmetric Cryptography
This course teaches the principles, requirements, constructions, and applications of symmetric cryptography based on the shared secret key. The course describes substitution and transposition techniques which have been invented before computers. Then, we build on the product ciphers to learn about the modern block ciphers and review the popular cipher algorithms of DES, 3-DES, and AES. We also describe the block cipher operation modes to enable the block cipher to support variable data length.
Recommended: Prerequisite DTSA 5743.
Grading Basis: Letter Grade

DTSA 5745 (1) Asymmetric Cryptography and Key Management
This course will teach the principles of asymmetric cryptography (a.k.a. public-key cryptography) and describe how the key-pair use can enable different security properties/applications. We will study the popular ciphers, e.g., RSA and the Diffie-Hellman Exchange, and learn how/why they work to secure networking, including the mathematical problems anchoring their security. We will learn about the key distribution and management and digital certificates. Required for this course is a working knowledge of discrete mathematics.
Recommended: Prerequisites DTSA 5743, DTSA 5744.
Grading Basis: Letter Grade

DTSA 5746 (1) Cryptographic Hash and Integrity Protection
This course describes the cryptographic hash functions and explains their security properties enabling their use for integrity protection. The course will also describe hash chain and Merkle tree. We will study message authenticity and the message authentication code (MAC) based on symmetric keys. Then, we will discuss digital signatures based on asymmetric cryptography, providing security objectives of non-repudiation which were unavailable in the symmetric-cryptography-based MAC.
Recommended: Prerequisites DTSA 5743, DTSA 5744, DTSA 5745.
Grading Basis: Letter Grade

DTSA 5747 (1) Fundamentals of Natural Language Processing
The field of natural language processing aims at getting computers to perform useful and interesting tasks with human language. This course introduces students to the fundamental problems in NLP, the fundamental techniques that are used to solve those problems and lays the foundation for understanding state-of-art methods. At the end of the course, students will be able to implement and analyze text classifiers, sequence labelers, discrete probabilistic models, and vector-based approaches to word meaning.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5832
Grading Basis: Letter Grade

DTSA 5748 (1) Deep Learning for Natural Language Processing
Deep learning has revolutionized the field of natural language processing and led to many state-of-the-art results. This course introduces students to neural network models and training algorithms frequently used in natural language processing. At the end of this course, learners will be able to explain and implement feedforward networks, recurrent neural networks, convolutional neural networks, and transformers. They will also have an understanding of transfer learning, the paradigm behind popular models such as BERT and GPT-3.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5842
Grading Basis: Letter Grade

DTSA 5749 (1) Model and Error Analysis for Natural Language Processing
Understanding the performance of natural language processing models goes beyond simply computing measures like accuracy. In this course we will learn methods for analyzing the strengths and weaknesses of NLP systems, both neural and non-neural. We will also learn about problematic biases in NLP data and systems. Methods covered include standard benchmarks, qualitative error analysis, confusion matrices, contrastive and diagnostic evaluation, and probing experiments.
Equivalent - Duplicate Degree Credit Not Granted: CSCA 5852
Grading Basis: Letter Grade

DTSA 5798 (1) Supervised Text Classification for Marketing Analytics
Marketing data often requires categorization, or labeling. In today¿s age, marketing data can also be very big, or larger than what humans can reasonably tackle. In this course students will learn how to use supervised deep learning to train algorithms to tackle text classification tasks. Students will walk through a conceptual overview of supervised machine learning, and dive into real-world datasets through instructor-led tutorials in Python. The course will conclude with a major project.
Grading Basis: Letter Grade

DTSA 5799 (1) Unsupervised Text Classification for Marketing Analytics
Marketing data is often so big that humans cannot read or analyze a representative sample of it to understand what insights might lie within. In this course students will learn how to use unsupervised deep learning to train algorithms to extract topics and insights from text data. Students will walk through a conceptual overview of unsupervised machine learning, and dive into real-world datasets through instructor-led tutorials in Python. The course will conclude with a major project.
Grading Basis: Letter Grade

DTSA 5800 (1) Network Analysis for Marketing Analytics
Network analysis is a long-standing methodology used to understand the relationships between words and actors in the broader networks in which they exist. This course will cover network analysis at it pertains to marketing data, specifically text datasets and social networks. Students will walk through a conceptual overview of network analysis, and dive into real-world datasets through instructor-led tutorials in Python. The course will conclude with a major project.
Grading Basis: Letter Grade

DTSA 5840 (1) Data Science Applied Capstone Project
The Data Science Applied Capstone Project course will allow you to apply the knowledge and skills from the MS-DS degree to a real-world data set provided by industry collaborators and connections. This project will allow you to work independently on a data set that will test your skills in acquiring, cleaning, modeling data, and analyzing a dataset using data mining and machine learning techniques. By the end of this course, you will have a project that you can add to your data science portfolio to show off to employers and demonstrate your data science expertise. It is strongly recommended that you take the Data Science Applied Capstone Project course as one of your final courses in the program as you will work with real-world data sets that will use MS-DS core concepts. In order to be successful in this course, only students who have completed the following specializations should register for the Capstone Project: Data Science Foundations: Data Structures and Algorithms, Data Science Foundations: Statistic
Grading Basis: Letter Grade

DTSA 5841 (1) IBM Capstone Project
The IBM Capstone Project course will allow you to apply the knowledge and skills from the MS-DS degree to a real-world data set provided by IBM. This project will allow you to work independently on a data set that will test your skills in acquiring, cleaning, modeling data, and analyzing a dataset using data mining and machine learning techniques. By the end of this course, you will have a project that you can add to your data science portfolio to show off to employers and demonstrate your data science expertise. This course uses the IBM dataset from the IBM Applied Data Science Capstone course, part of the IBM Data Science Professional Certificate, and provides additional instruction and assessments in order to apply this capstone as an elective for the MS-DS Coursera degree at the University of Colorado Boulder. Because CU is collaborating with IBM on this course, all students will have full access to the IBM Applied Data Science Capstone Course while taking DTSA 5841. It is strongly recommended that you t
Grading Basis: Letter Grade

DTSA 5842 (1) Effective Communication: Writing, Design, and Presentation
This course teaches students how to present themselves effectively through writing, design, and presentation. Students will focus on how to write well-organized, clear business documents; to design elegant presentation slides, reports, and posters; and to present and speak with confidence and power. More broadly, the course charts a journey toward each student¿s best professional self. This course is a prerequisite for the Effective Communication Capstone.
Grading Basis: Letter Grade

DTSA 5843 (1) Effective Communication Capstone Project
In this course students will create a portfolio of work that demonstrates their mastery of writing, design, and presentation skills. The portfolio includes three elements¿a memo, a slide deck, and deliver presentation¿integrated around a single topic. The capstone allows learners to engage meaningfully in their world by choosing a project relevant to their job. Effective Communication: Writing, Design, and Presentation is a prerequisite for this course.
Grading Basis: Letter Grade

DTSA 5900 (1) Special Topics
Examines a special topic in Data Science.
Repeatable: Repeatable for up to 23.00 total credit hours. Allows multiple enrollment in term.
Grading Basis: Letter Grade

DTSA 5901 (1) Special Topics
Examines a special topic in Data Science.
Repeatable: Repeatable for up to 9.00 total credit hours.
Grading Basis: Letter Grade