Bilkent University
Faculty of Engineering

Data Science and Engineering (DSE) Certificate

Data science analyzes big and complex data and extracts knowledge and insight for use in a broad range of applications. The goal is to create data centric solutions to scientific, social, or business questions. Data science deals with data collection, storage, integration, analysis, modeling, inference, communication, and ethics. It involves obtaining, wrangling, curating, managing, processing, and exploring data. It defines questions, analyzes data, and communicates the results.

DSE certificate aims at training interested Bilkent University undergraduate students with data science skills and getting them ready for taking data science related jobs. Students taking the required number of courses from three course pools and getting a letter grade B or better from each course are awarded with the DSE certificate.

Students awarded with the certificate will be capable of making good judgments and decisions in problems involving large data sets and use appropriate tools effectively to draw key conclusions. They will become competent in
- collecting and preparing data for analysis,
- setting up, operating, and managing big data systems,
- doing and coordinating the data analysis, statistical modeling, computational modeling, and machine learning,
- solving data-driven problems with appropriate algorithmic approach and software,
- data visualization and outputs of data analysis,
- supporting data driven decision making, uncovering the stories buried in data.

The coursework required for the certificate span mathematical, computational, and statistical foundations of data analytics, data management and curation, data description and visualization, data modeling and assessment, workflow and reproducibility, communication and teamwork, domain specific considerations, and awareness of ethical problems.

Application for the Certificate

Every student who thinks s/he satisfies the requirements can apply to the Dean of the Engineering Office and will get the certificate after checks are done.

The Certificate Courses

To get the certificate, a student must complete a total of at least six courses from the lists below with the indicated number of courses from each of three sets, with a grade of B or better from all six courses.

Set 1 includes courses that provide mathematical, programming and data systems foundations and computational thinking principles for data science.

Set 1: *General Foundations for Data Science*
(One or two courses)

CS281 Computer and Data Organization
CS353 Database Systems
CS426 Parallel Computing
CS471 Numerical Methods
CS473 Algorithms I
EEE361 Linear Algebra in Data Analysis and Machine Learning
EEE424 Digital Signal Processing
EEE533 Random Processes
IE411 Introduction to Nonlinear Optimization
IE421 Introduction to Stochastic Processes
MATH260 Introduction to Statistics
ME361 Numerical Methods for Engineers

Set 2 includes courses about foundations of data analysis and analytics, statistical and mathematical models, tools, and computational techniques for data science.

Set 2: *Statistical, Computational, and Algorithmic Foundations, Models, Tools and Techniques of Data Analysis*
(One to three courses)

GE461 Introduction to Data Science
CS433 Information Retrieval Systems
CS461 Artificial Intelligence
CS464 Introduction to Machine Learning
CS478 Computational Geometry
EEE443 Neural Networks
EEE448 Reinforcement Learning and Dynamic Programming
EEE485 Statistical Learning and Data Analytics
IE451 Applied Data Analysis
IE452 Algebraic and Geometric Methods in Data Analysis
IE456 Reinforcement Learning and Dynamic Programming
IE553 Applied Statistical Modeling and Data Analysis
IE586 Computational Optimization
MATH465 Mathematical Foundations of Data Science

Set 3 includes courses about applications, different domains, and more advances topics related with data science.

Set 3: *Applications and Advanced Topics in Data Science*
(One to three courses)

CS425 Algorithms for Web-scale Data
CS429 Dynamic and Social Network Analysis
CS443 Cloud Computing

CS477 Biometrics
CS481 Bioinformatics Algorithms
CS483 Natural Language Processing
CS484 Introduction to Computer Vision
CS 485 Deep Generative Networks
CS550 Machine Learning
CS551 Pattern Recognition
CS553 Intelligent Data Analysis
CS554 Computer Vision
CS558 Data Mining
CS559 Deep Learning
EEE482 Computational Neuroscience
EEE486 Statistical Foundations of Natural Language Processing
IE468 Pricing and Revenue Optimization
IE469 Industrial Applications of Operations Research