

DATA SCIENCE (DATS-SHU)

DATS-SHU 200 Topics in Machine Learning (4 Credits)

Typically offered Fall and Spring

Topics in Machine Learning courses are designed to explore a variety of subject matters within the dynamic fields of computer science and data science. The course content is adapted to the expertise and research interests of the current instructor, ensuring a relevant and up-to-date curriculum. Throughout this course, students will delve into a specific topic within computer science or data science, addressing both practical and theoretical aspects. Students will learn about the topic through lectures, hands-on assignments, as well as reading and discussions. Prerequisite: CSCI-SHU 11 Introduction to Computer Programming or placement test AND MATH-SHU 131 Calculus AND MATH-SHU 140 Linear Algebra/ MATH-SHU 141 Honors Linear Algebra I. Fulfillment: CS elective; DS AI concentration.

Grading: Ugrd Shanghai Graded

Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: Computer Science Elective
- SB Crse Attr: NYU Shanghai: Data Science Elective Concentration in AI

DATS-SHU 235 Information Visualization (4 Credits)

Typically offered Fall

Information visualization is the graphical representation of data to aid understanding, and is the key to analyzing massive amounts of data for fields such as science, engineering, medicine, and the humanities. This is an introductory undergraduate course on Information Visualization based on a modern and cohesive view of the area. Topics include techniques such as visual design principles, layout algorithms, and interactions as well as their applications of representing various types of data such as networks and documents. Overviews and examples from state-of-the-art research will be provided. The course is designed as a first course in information visualization for students both intending to specialize in visualization as well as students who are interested in understanding and applying visualization principles and existing techniques. Fulfillment: CS Electives, Data Science Data Analysis Required; Data Science Courses for Concentration in Artificial Intelligence. Prerequisite or Co-requisite: Data Structures. Students must be CS or DS major and have junior or senior standing.

Grading: Ugrd Shanghai Graded

Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: Computer Science Elective
- SB Crse Attr: NYU Shanghai: Data Science Elective Concentration in AI
- SB Crse Attr: NYU Shanghai: Data Science Required Data Analysis

DATS-SHU 236 Mathematical Foundations of Data Science and Machine Learning (4 Credits)

Typically offered Spring

This is an advanced topic course for undergraduate students interested in the modern mathematics of data science and machine learning. Tentative topics include dimension reduction and data visualization, the geometry of high dimensional data, and optimization-based data analysis. Topics may change every year to reflect the current research trends. The course requires an excellent understanding of advanced calculus, linear algebra, and probability theory. Programming skills and knowledge in optimization are strongly recommended but not required. Prerequisite: DATS-SHU 234 Mathematical of Statistics (used to be MATH-SHU 234). Fulfillment: Math Constrained Math elective or additional Math elective; Honors Math elective; Data Science Concentration in AI.

Grading: Ugrd Shanghai Graded

Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

DATS-SHU 240 Introduction to Optimization and Mathematical Programming (4 Credits)

Typically offered occasionally

This is an introductory course to introduce the model building and mathematical programming for the infrastructure systems optimization. This course prepares students with the systems-level approach to the analysis, design, operation and management of civil infrastructure systems. Topics include model building, linear programming, nonlinear programming, integer programming, network optimization models and the use of algebraic modeling languages for describing and solving large-scale optimization models. Pre-requisites: ICP; AND Calculus (MATH-SHU 121) or Honor Calculus (MATH-SHU 201). Fulfillment: CS Electives, Data Science Data Analysis Required; Data Science Courses for Concentration in Artificial Intelligence.

Grading: Ugrd Shanghai Graded

Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: Computer Science Elective
- SB Crse Attr: NYU Shanghai: Data Science Elective Concentration in AI
- SB Crse Attr: NYU Shanghai: Data Science Required Data Analysis

DATS-SHU 369 Machine Learning with Graphs (4 Credits)*Typically offered every year*

Complex data can be represented as a graph of relationships between objects. Such networks are a fundamental tool for modeling social, technological, and biological systems. This course focuses on the computational, algorithmic, and modeling challenges specific to the analysis of massive graphs. By means of studying the underlying graph structure and its features, students are introduced to machine learning techniques and data mining tools apt to reveal insights on a variety of networks. Topics include: representation learning and Graph Neural Networks; algorithms for the World Wide Web; reasoning over Knowledge Graphs; social network analysis. Prerequisite: CSCI-SHU 360 Machine Learning or MATH-SHU 235 Probability and Statistic Fulfillment: CS Electives, and DS course for AI concentration.

Grading: Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Computer Science Elective
- SB Crse Attr: NYU Shanghai: Data Science Elective Concentration in AI

DATS-SHU 377 Computer Vision (4 Credits)*Typically offered every year*

Computer Vision is concerned with enabling computers to interpret and understand visual information from the world around us. It has become ubiquitous in our society, with applications in search, image understanding, video surveillance, medical image analysis, drones, self-driving cars, and smart manufacturing. In recent years, developments on deep learning have greatly advanced the performance of various computer vision tasks. The course will start by looking the established area of geometric vision. It will then provide a deep dive into details of neural network based deep learning methods for computer vision and its profound impact on task in recognition, segmentation, and many other vision problems. Prerequisite: CSCI-SHU 101 Introduction to Computer Programming and (CSCI-SHU 360 Machine Learning or MATH-SHU 235 Probability and Statistic or MATH-SHU 238 Theory of Probability) Fulfillment: CS elective; DS Concentration in AI.

Grading: Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Computer Science Elective
- SB Crse Attr: NYU Shanghai: Data Science Elective Concentration in AI

DATS-SHU 420 Data Science Senior Project (4 Credits)*Typically offered Fall*

The purpose of the Senior Project is for the students to apply the theoretical knowledge they acquired during the Data Science program to a concrete project in a realistic setting. During the semester, students engage in the entire process of solving a real-world data science project. It requires students to pursue a long-term, mentored learning experience that culminates in a piece of original work. At the end of the semester, the proposed work comes to fruition in the form of a working software prototype, a written technical report, and an oral presentation at a capstone project symposium. Prerequisite: senior standing and primary major in Data Science. Fulfillment: DS Required.

Grading: Ugrd Shanghai Graded**Repeatable for additional credit:** No

- SB Crse Attr: NYU Shanghai: Data Science Required Senior Project

DATS-SHU 997 Independent Study: Data Science (2-4 Credits)*Typically offered Fall and Spring*

Prerequisite: department consent. Fulfillment: general elective.

Grading: Ugrd Shanghai Graded**Repeatable for additional credit:** Yes