

HEALTH DATA SCIENCE (HDS)

HDS 5000 - Foundations in Health Data Science

3 Credits

This dynamic, innovative course immerses first-semester graduate students in the rapidly evolving world of health data science. Focusing on real-world healthcare challenges, students will explore introduction to data, visualization, statistics and analytics, machine learning, and artificial intelligence. Delve into critical topics like personalized medicine, population health trends, and real-time clinical decision-making. Ethical use of artificial intelligence, data privacy, and regulatory frameworks will also be explored, preparing you to be a leader in the future of data-driven healthcare.

HDS 5130 - Healthcare Organization, Management, and Policy

3 Credits

This course offers students a comprehensive exploration of health policy and the U.S. healthcare system, with a focus on recent reforms and emerging trends. It equips students with the knowledge and tools to navigate the evolving healthcare landscape, covering the organization, financing, and regulation of healthcare while critically evaluating key policy initiatives. Special attention is given to the impact of the Affordable Care Act (ACA), ongoing healthcare reforms, and developments such as value-based care, health equity initiatives, and digital health legislation. Students will analyze the challenges of access, cost, and quality in the U.S. healthcare system and explore innovative solutions to improve care delivery and outcomes. Through interactive discussions, case studies, and policy simulations, students will apply evidence-based strategies to real-world scenarios, preparing them to lead and advocate for future healthcare reforms.

HDS 5210 - Programming for Health Data Scientists

3 Credits

Students will be introduced to concepts in computer programming using the Python programming language. Students will learn to conceptualize steps required to perform a task, manipulate files, create loops, and functions. By the end of this course, students will have a basic understanding of computer programming, a working knowledge of the Python programming language, and they will be able to share their scripts to collaborate with other team members.

Attributes: BME Graduate Elective, MPH-Biostatistics, Grad Pol Sci Skills, Social Work PhD Specilization

HDS 5230 - High-Performance Computing and Health Artificial Intelligence

3 Credits

This course explores the introduction of high-performance computing (HPC) and advanced artificial intelligence (AI) in addressing complex health data challenges. Students will gain hands-on experience with scalable computing platforms and AI-driven methodologies to analyze large-scale health data sets. Emphasis will be placed on optimizing computational workflows, deploying AI solutions in real-world health settings, and ensuring ethical and equitable applications in healthcare innovation.

Prerequisite(s): HDS 5310; HDS 5210

Attributes: Social Work PhD Specilization

HDS 5310 - Analytics, Statistics & Visualization Methods in Health Data Science

3 Credits (Repeatable for credit)

This course offers a modern and immersive introduction to analytics, statistics, and visualization methods utilizing Python, SAS, and R programming, tailored for the fast-evolving field of health data science. Through engaging, hands-on projects and real-world applications, students will develop not just a basic understanding of programming but the practical skills to leverage Python, SAS, and R for data manipulation, automation, and collaboration within healthcare settings. This course also emphasizes innovative approaches, including cloud-based coding environments and collaborative tools like GitHub, enabling students to work on team-based projects and share code seamlessly. By the end of the course, students will be able to build functions, automate tasks, and work efficiently in data-driven health research.

Attributes: Bioinformatics & Comp Bio Elec, MPH-Epidemiology, MPH-Health Management & Policy, Social Work PhD Specilization

HDS 5320 - Inferential Modeling

3 Credits

Students will learn to conceptualize research questions as statistical models, and parameterize those models from real-world data. The course will start by introducing the linear model, then expand into generalized linear models, nonlinear models, mixed and multilevel models, and Cox survival models. Students will have a working knowledge of how to use statistical models to gain an understanding of the influence of individual predictor variables on health outcomes.

Prerequisite(s): HDS 5310

HDS 5330 - Predictive Modeling and Health Machine Learning

3 Credits

This course will focus on the application of sophisticated machine learning models and statistical techniques to healthcare data. Students will explore algorithms such as regression, decision trees, ensemble methods, neural networks among other deep learning methods. Emphasizing the unique challenges of healthcare data, the course addresses high-dimensionality, missing values, ARIMA, classification, clustering, and visualization equipping students with strategies to optimize model performance and reliability. Through hands-on work with real-world datasets, students will develop the skills to design, implement, and evaluate advanced machine learning models while effectively communicating results to technical and non-technical audiences to support innovation and decision-making in healthcare.

Attributes: AI Applications, Bioinformatics & Comp Bio Elec, MPH-Epidemiology, MPH-Biostatistics, Social Work PhD Specilization

HDS 5430 - Health Image Processing and Deep Learning

3 Credits

This level course equips students with advanced skills in visualizing and analyzing complex health data, integrating both traditional data visualization techniques and modern approaches such as image processing and deep learning. Students will learn to transform raw health data, including clinical and imaging data, into meaningful and interactive visual representations that support data-driven decision-making. The course covers image segmentation and edge detection, visual analytics, and dashboard design, alongside innovative applications of deep learning for medical image analysis and diagnostics. Additionally, deep learning predictive modeling techniques will cover CNN, RNN, and LSTM. By the end of the course, students will be proficient in using advanced visualization tools and deep learning techniques to effectively present and interpret health data for diverse healthcare stakeholders.

HDS 5530 - Natural Language Processing and Large Language Models in Healthcare

3 Credits

This graduate-level course offers an in-depth exploration of Natural Language Processing (NLP) and the application of large language models (LLMs) in the healthcare sector. Students will tackle the complexities of processing unstructured clinical text, medical records, and other health-related documents using advanced NLP techniques. Core topics include text mining, named entity recognition, sentiment analysis, and document classification, with a focus on implementing innovative LLMs like Generative Pre-trained Transformers (GPT) for tasks such as clinical note summarization, patient data extraction, and decision support. Additionally, this course will cover concepts of Generative Adversarial Network (GANs) and diffusion models and their applications in healthcare analytics. The course also addresses ethical concerns, data privacy, and the transformative impact of NLP on patient care and health outcomes. By the end of the course, students will have the expertise to design, develop, and apply NLP models to solve critical healthcare challenges.

HDS 5930 - Special Topics

3 Credits (Repeatable for credit)

HDS 5960 - Capstone Experience

3 Credits

This course is designed to offer data science students an opportunity to practice their skills in an industry setting, to learn the roles that various members of a data science team play in an organization, and to begin building a network of professional contacts and references.

Prerequisite(s): ORES 5300; HDS 5210; HDS 5310**HDS 5980 - Graduate Independent Study in Health Data Science**

1 or 3 Credits (Repeatable for credit)