GOERGEN INSTITUTE
FOR DATA SCIENCE & ARTIFICIAL INTELLIGENCE

Online MS Program in Healthcare Data Science & Artificial Intelligence
Information Session – April 2025

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Deputy Director
Professor of Data Science

Lisa Altman, MBA
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UR HEALTH LAB
A Hub for Tech-Enabled Healthcare Impact

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Director of Data & Analytics, UR Health Lab

UNIVERSITY of ROCHESTER

Outline

- Welcome/Introductions
  - Goergen Institute for Data Science and Artificial Intelligence
  - UR Health Lab

- What is Data Science and AI?
  - How is Data Science and AI used in Healthcare?

- Curriculum
  - Background preparation
  - Course Plans
  - Course descriptions
  - Online Instruction/Logistics

- Application Process
- Q&A

Today's Speakers

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Barney Ricca
Professor
Director, MS program in Healthcare Data Science and AI
Goergen Institute for Data Science and Artificial Intelligence
(starting May 1, 2025)

Goergen Institute for Data Science and Artificial Intelligence (GIDS-AI) and the UR Health Lab

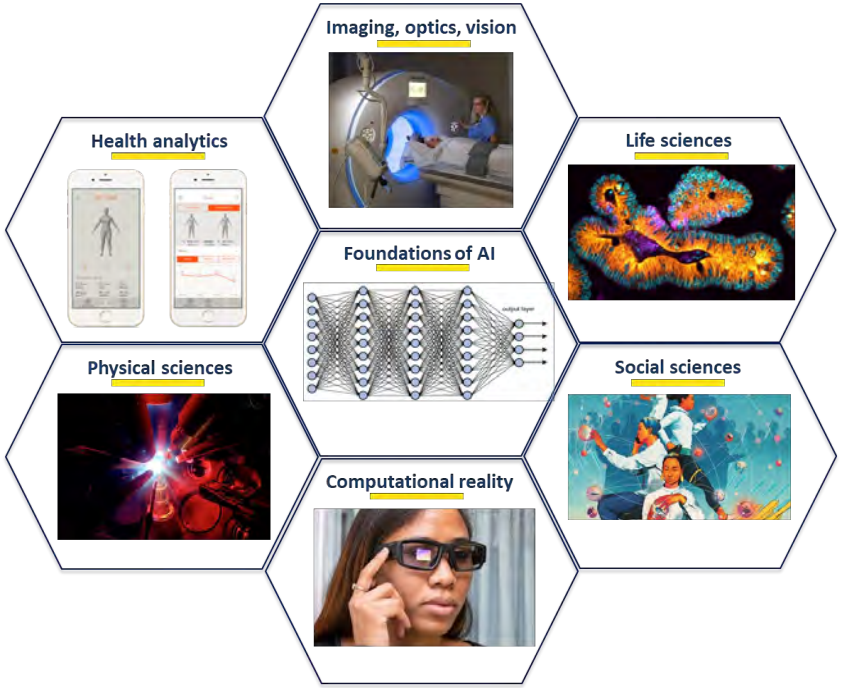
Goergen Institute for Data Science and Artificial Intelligence (GIDS-AI)

- GIDS-AI is Rochester's interdisciplinary data science and artificial intelligence hub
- Brings together faculty and students from across University of Rochester to pioneer new advances in data science & AI

- ***Data Science Education:***
  - Undergraduate Program [BA/BS] *(since 2016)*
  - Graduate Program [MS] *(since 2015)*
  - Advanced Certificate Program *(since 2020)*

- ***Economic Impact and Community Outreach:***
  - Develop industry-academic partnerships in data science & AI.
  - GIDS-AI houses the NY State Center of Excellence (CoE) in Data Science & AI

- ***Research:***
  - Interdisciplinary research in data science & AI at the University of Rochester



UR Health Lab

Who Are We?

The UR Health Lab is comprised of talented professionals from diverse fields like technology, data science, and healthcare. Our collaborative approach empowers us to drive innovation and revolutionize healthcare through disruptive technologies.

What Do We Do?

At the UR Health Lab, we harness the power of cutting-edge technology and data to innovate healthcare solutions. By bridging healthcare, academia, and industry, we foster collaboration and find the best solutions to complex problems that lead to better healthcare outcomes.

UR HEALTH LAB

A Hub for Tech-Enabled Healthcare Impact

Our Mission

At UR Health Lab, our mission is to be at the forefront of healthcare innovation. Through interdisciplinary collaboration and the integration of data, education, and, engineering, we strive to create technologies that revolutionize healthcare and provide accessible, better health solutions, all while preparing the next generation of healthcare leaders.

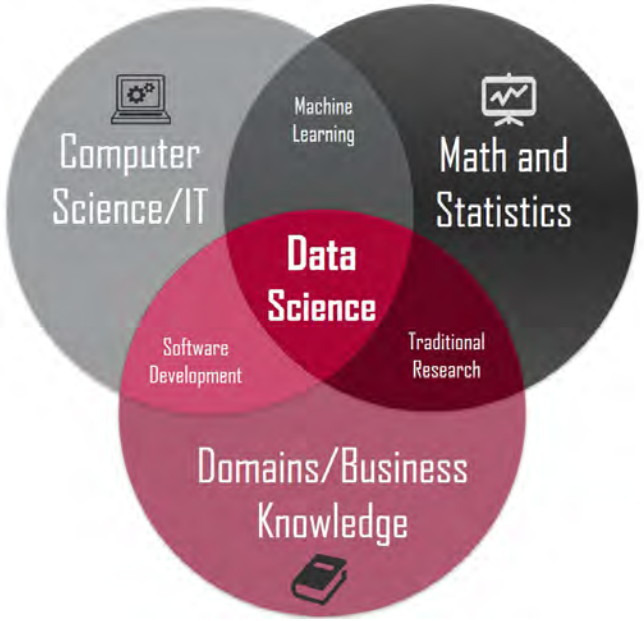
Our Vision

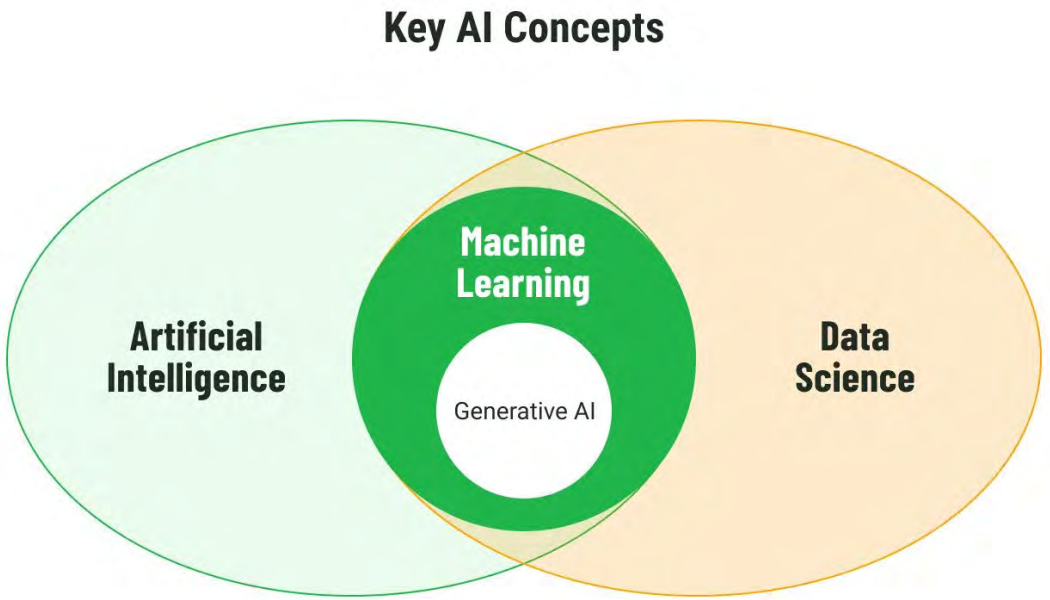
Our vision at the UR Health Lab is to be a leading innovation center that pioneers groundbreaking solutions in healthcare. By leveraging cutting-edge technology and embracing an interdisciplinary approach, we aspire to create a future where digital healthcare transforms lives and elevates the well-being of individuals worldwide.

What is Data Science
and
How Can It Be Used in Healthcare?

What is Data Science and AI ?

- Data science is the creation and application of novel techniques to **collect, curate, analyze,** and **make discoveries from large-scale data**.
- Artificial Intelligence (AI) represents the development of computer systems capable of **emulating human intelligence**





Applications of Data Science and AI in Healthcare

Clinical Insight

Generative AI (GEN-AI) chart summarization to provide concise, targeted synopses of patients' chronic disease management

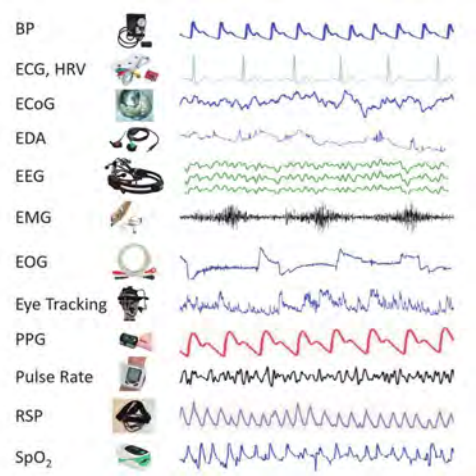
Predicting likelihood of admission to skilled nursing facility after surgery to enable better surgical management and planning

Operational Impact & Analytics

Transforming unstructured radiology report text into actionable, structured follow-up recommendations

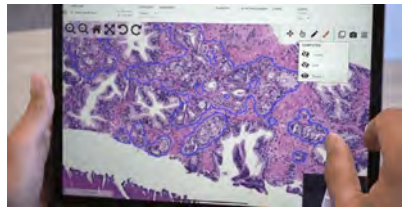
Novel data collection and machine learning to predict 'actionability' and minimize unnecessary alarms in the PICU

Wearable Sensors / Digital Health



- AI-Powered Early Detection of Cardiac Arrhythmias
- Non-invasive cuffless Blood Pressure measurement (NIBP)
- Parkinson's disease diagnosis aid using wearable sensors

Medical Imaging / Computer Vision



FDA clears AI-based device for diabetic eye disease detection

The US Food and Drug Administration (FDA) has approved the sale of an artificial intelligence (AI) based medical device for the detection of an eye disease associated with diabetes called diabetic retinopathy.

- Automated labeling of anatomical structures (Cardiac chambers, Nerve on Ultrasound Images)
- Alzheimer's Disease Progression from Longitudinal Brain MRI Scans

Careers in Healthcare Data Science & AI

Job titles / Responsibilities:

- **Healthcare Data Scientist:** Analyzing healthcare data (EHRs, imaging, claims data) to extract meaningful insights.
- **AI/ML Engineer in Healthcare:** Developing and deploying Gen-AI and machine learning models for healthcare applications.
- **Data Analyst:** Working with clinical trial data, patient registries, and outcome databases. Performing operational analytics and business intelligence.
- **Health Informatics Specialist:** Applying data science techniques to improve healthcare systems and workflows.
- **Computer Vision / Medical Imaging Analyst:** Developing AI algorithms for image analysis, diagnosis, and treatment planning.

Potential Employers:

- **Industry:** Health Tech, Medical Devices, Digital Health, Big Tech
- **Insurance:** Health Insurance Providers
- **Medical Centers:** Informatics/Data Science/Health Informatics Units
- **Academic Research Groups:** University labs, Computational research groups

Healthcare Data Science and Artificial Intelligence Curriculum

Healthcare Data Science & AI - Master of Science (32 credits)

- Learning Objectives
  - Apply various data science, AI, and machine learning methods and techniques applicable to deriving new insights from healthcare data
  - Gain proficiency in practical aspects of accessing (including understanding its provenance) and analyzing healthcare data
  - Develop data science solutions with real-world clinical/healthcare data sets in a fair, reproducible, and ethical manner

Background Preparation

- ❑ A completed Bachelor's degree (all majors are considered)

- ❑ Exposure to introductory computer programming and undergraduate level calculus
  - If you have not had the pre-requisite courses and/or would like a refresher, we suggest an online bridging course.
  - E.g. : **Mathematics for Machine Learning: Multivariate Calculus**; **Intro to Python**
  - If a student does not have this background at the time of application, this recommendation may be stated in your admission offer letter to complete before enrolling in the relevant courses

- ❑ Interest in and motivation to pursue large scale quantitative data analytics in healthcare

Healthcare Data Science & AI - Master of Science

- Eight (8) Graduate Level Courses (32 credits)
  - Completed in as few as 4 semesters or up to 8 semesters of part-time study. Can also be completed in 2 semesters of full-time study.
  - Courses are offered during the fall and spring semesters; no summer courses.

Program Structure and Content Delivery

- All courses in the program will be delivered ONLINE
  - The lectures will be Synchronous (at designated class times during the week) and recordings will be available for offline review.
  - Class times will be in the evening to accommodate working professionals
  - Course Management via Blackboard Learn and Zoom
- *OPTIONAL:* There will be opportunities for in-person immersions
    - Capstone project introduction/presentations
    - UR-wide events (Meliora weekend)

8 Semester (4 YEAR) Plan (1 course per semester)

Semester	Course	Title	Prerequisites
Year 1 – FALL	**DSCC 481**	**Python Programming and Tools for Data Science**	
Year 1 - SPRING	**DSCC 486**	**Applied Machine Learning and Healthcare Data Mining**	*DSCC 481: Python Programming and Tools for Data Science*
Year 2 - FALL	**DSCC 482**	**Statistical Foundations and Data Visualization**	
Year 2 - SPRING	**DSCC 487**	**Inferential Statistics for Data Science**	*DSCC 482: Statistical Foundations and Data Visualization*
Year 3 - FALL	**DSCC 484**	**Healthcare Data Management and Clinical Informatics**	
Year 3 - SPRING	**DSCC 488**	**Deep Learning for Healthcare**	*DSCC 481: Python Programming and Tools for Data Science*
Year 4 - FALL	**DSCC 485**	**Introduction to Privacy Fairness and Ethical Considerations for Healthcare Data Science**	
Year 4 - SPRING	**DSCC 489**	**Healthcare Data Science Practicum**	*Python Programming and Tools for Data Science AND Statistical Foundations and Data Visualization; Co-Requisite: DSCC 484-488*

TWO YEAR Plan - Fall Year 1: DSCC 481 & DSCC 482

DSCC 481: Python Programming and Tools for Data Science (fall)

Topics include introduction to Python programming and data structures relevant to healthcare data. The course will also provide a hands-on introduction to widely used tools for data science, languages and packages used for statistical analysis and visualization; parallel computing and Spark; libraries for machine learning and deep learning; databases including NoSQL; and cloud services.

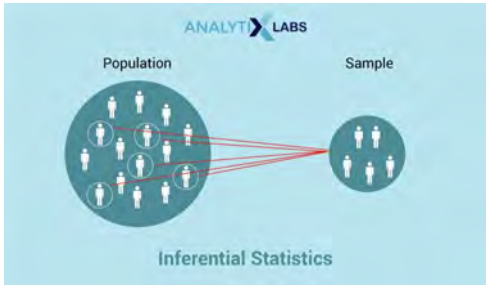
DSCC 482: Statistical Foundations and Data Visualization (fall)

The course covers the essentials of the statistical foundations for interpretation and visualization of data. Using statistical tools, gain an understanding of how to interpret data quantitatively and to explore data-oriented structures. The primary focus is on descriptive statistics used to present and summarize numerical information. The course also emphasizes the design of systems for data visualization and related best practices for use in a healthcare setting. Course projects and assignments will involve accessing public healthcare data sources (e.g. MIMIC-III) or a deidentified data repository to extract relevant patient level attributes and create dashboards and visualizations to practice data storytelling for relevant healthcare problems. Students will be introduced to the R programming language which is a mainstay in statistical computing.

TWO YEAR Plan - Spring Year 1: DSCC 486 & DSCC 487

DSCC 486: Applied Machine Learning and Healthcare Data Mining (spring)

Foundational course focusing on the understanding, application, and evaluation of machine learning and data mining approaches in data-intensive scenarios. Imbalanced data, outlier detection, text mining, introduction to natural language processing (NLP). Supervised, unsupervised learning. Emerging methods such as semi-supervised and self-supervised learning. Introduction to neural network-based models. *PREREQUISITE: Python Programming and Tools for Data Science*



DSCC 487: Inferential Statistics for Data Science (spring)

Fundamental concepts in probability and statistics from a data science perspective; rigorous probabilistic reasoning and problem-solving; statistical methods used in data science. Topics to be covered include data exploration through descriptive statistics (with an emphasis on using R for such analyses), random variables, statistical inference, and statistical modeling. The inference portion of the course will focus on building and applying hypothesis tests and confidence intervals for population means, proportions, variances, and correlations. Non-parametric alternatives will also be introduced. The modeling portion of the course will include ANOVA, and simple and multiple regression and their respective computational methods. *PREREQUISITE: Statistical Foundations and Data Visualization*

TWO YEAR Plan - Fall Year 2: DSCC 484 & DSCC 485

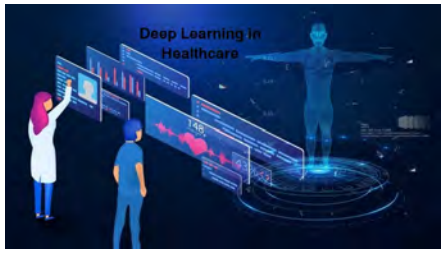
DSCC 484: Healthcare Data Management and Clinical Informatics (fall)

This course will explore the variety of clinical data collected during the delivery of healthcare. Explore the types and sources of healthcare data, along with methods for selecting, preparing, querying, and transforming healthcare data. You will learn to construct analysis-ready datasets and apply computational procedures to answer clinical questions. In addition, you will learn the basics of SQL programming or improve your SQL skills, within the concepts of other course topics. You will learn to perform exploratory analysis on the curated datasets to compute the descriptive statistics and present the data as visualizations and dashboards. You will be introduced to the transaction standards, vocabulary, terminologies, and nomenclatures, data taxonomies and ontologies used in healthcare. You will learn best practices to address challenges commonly experienced with real-world healthcare data including missingness, heterogeneity in data collection methods, and disparate independent data sources that need to be time-aligned in preparation for analysis.

DSCC 485: Introduction to Privacy Fairness and Ethical Considerations for Healthcare Data Science (fall)

This course will provide an overview of the US healthcare system, introduction to healthcare data science project lifecycle, fairness, ethics, and privacy considerations in healthcare. Considerations around unintended consequences of AI-based decisions. One of the goals of the course is to train students to think critically about these considerations when choosing data science and machine learning techniques to apply to healthcare data.

TWO YEAR Plan - Spring Year 2: DSCC 488 & DSCC 489



DSCC 488: Deep Learning for Healthcare (spring)

This course will focus on deep learning technologies as applied to healthcare. The course will start with the basics of deep learning, then move to the use of using CNNs to process a variety of medical images for tasks such as classification, regression, and segmentation. Applications of deep learning for NLP will cover how to apply deep learning to clinical notes, radiology reports, etc., for text summarization, context review, and other inference tasks. The project exercises will also introduce students to text mining concepts applied to healthcare data. Emerging deep learning models including transformers, LLMs and an introduction to Generative AI will also be presented. *PREREQUISITES: Python Programming and Tools for Data Science*

DSCC 489: Healthcare Data Science Practicum (spring)

This is a culminating experiential learning course where students will work in teams or individually on real-world data analytic challenges; Each student will prepare a final presentation and report documenting their work which will also serve as the culminating exam for the program; Students will work with real-world clinical data and implementable solutions for delivery to actual or potential stakeholders. The course will also introduce students to the process of how to structure a clinical question as a data science/machine learning problem, data acquisition/provenance, insight generation, and enable them to practice effective communication and storytelling to diverse stakeholders encountered in healthcare settings. Students will have the opportunity to work with datasets and problems originating from various areas within healthcare including bioinformatics/genomics, medical imaging, physiological signals and sensor data. Students can work with the course instructor to identify suitable project opportunities in collaboration with URMC clinical departments, research groups such as UR Health Lab and/or from their professional network/current place of work. *PREREQUISITES: Python Programming and Tools for Data Science AND Statistical Foundations and Data Visualization*

DSCC 489: Healthcare Data Science Practicum (Experiential Learning)

- A culminating experience in the program
- Students will work with real-world clinical data and implement solutions for delivery to actual or potential stakeholders.
- Team-based or individual activity
- Key outcomes:
  - Learn to structure a clinical question as a data science/machine learning problem
  - Practice effective storytelling to real-world stakeholders
  - Learn best practices around data acquisition/provenance in a clinical setting
- Opportunity to work with datasets and problems originating from various areas within healthcare: including bioinformatics/genomics, medical imaging, physiological signals and sensor data.
- Collaboration with URMC clinical departments, research groups such as UR Health Lab and/or professional network/current place of work.

Application Process

Applications

- ❑ Online Application at https://apply.grad.rochester.edu/
- ❑ Personal statement describing:
  - ❑ Career and educational goals
  - ❑ Prior experience
- ❑ Transcript(s) from bachelor's degree (and higher)
- ❑ Resume/CV
- ❑ Two letters of recommendation (must be received for application review to begin)

- ➢ NOT REQUIRED - GRE and TOEFL/IELTS scores
- ➢ NO APPLICATION FEE – we will waive the $30 fee

***Rolling deadline** until **July 15, 2025**. Admission decisions conveyed within 30 days from application*

FAQ

Tuition

Graduate Tuition (AS&E 2025-26): $2150/credit hour

- UR Employees: tuition benefits
- Current Graduate Students: tuition scholarships are awarded on a competitive basis.
- Non-UR Employees: ask your company about professional development/tuition benefits
- All applicants: Considered for competitive partial-tuition scholarships. No separate scholarship application required.

Academic Calendar 2025-26

MONDAY August 25	**First Day of Fall Semester**
MONDAY September 1	**Labor Day – NO Classes**
MON-TUES October 13-14	**Fall Break – NO Classes**
WED-SUN November 26-30	**Thanksgiving Recess – NO Classes**
MONDAY December 8	**Last Day of Classes**
December 12-17	**Final Exams**
December 18-January 19	**WINTER BREAK**
TUESDAY January 20	**First Day of Spring Semester**
March 7-15, 2026	**Spring Break – NO Classes**
MONDAY May 1	**Last Day of Class**
May 5-10	**Final Exams**

Questions?

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