TERA
Technion-Rambam Initiative in Medical AI

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Introduction to AI and Machine Learning for the Medical Sciences: A Code Free Approach

Preliminary requirements

This course is tailored for medical doctors and healthcare professionals without prior coding experience. While a basic grasp of probability theory and algebra is beneficial, it is not mandatory.

Course description

In this course, you will be introduced to fundamental ideas such as predictive versus descriptive statistical models, classification versus clustering, supervised versus unsupervised learning. These concepts will be taught using simple examples and user-friendly software tools. You will learn these techniques through interactive discussion and exercises that do not necessitate programming. We discuss regression, decision trees, neural networks, k-means, hierarchical models, and other elementary techniques which are the building blocks of machine learning and artificial intelligence (AI).

Throughout the course, we will also engage in discussions about artificial intelligence (AI), examining state-of-the-art Large Language Models and their diverse applications. As you advance in the course and grasp the basics of machine learning techniques, you'll also be guided to consider the strengths (S), weaknesses (W), opportunities (O), and threats (T) (SWOT) of Ai in healthcare.

Course purposes

This course is designed to introduce beginners to the foundational principles of Machine Learning and Artificial Intelligence (ML/AI) and their applications in Healthcare and Natural Sciences. Students will be exposed to large data structures and their potential uses for data mining and machine learning. This course aims to empower students and researchers with the knowledge to understand the transformative role AI can play in data analysis and management both for research and daily practice.

Learning outcomes

Participants will learn to identify the types of problems that AI techniques can help solve, such as exploring and condensing extensive datasets, utilizing data for diagnosis and forecasting, employing AI tools to navigate scientific data, and comprehending the methodologies supporting AI-enhanced services and devices. Students will gain proficiency in the language of data science, enabling them to communicate effectively with AI specialist and lead proactively large data projects.

Course duties

The students will be given three assignments and one final project. For the three intermediary assignments, they will work on small data projects using established datasets from public repositories. The final project will offer them greater autonomy. Therefore, once they have selected a dataset and a research question, they will apply an appropriate AI method to address the tasks they are undertaking in a personal and creative way. The Results are guaranteed to be surprising. Each assignment will contribute 25% towards the total grade.

Course topics according to weekly meetings

Week 1: Ai/ML and big data in the medical context

Overview of machine learning, deep learning, and AI terminology.

How AI is different from classic statistical models.

Large language models in academic research and knowledge discovery.

Week 2: Data, models, and tasks

Types of domains: clinical, epidemiologic, imaging, genomic, etc.

Types of models: predictive vs. descriptive.

Typey of tasks: prediction, classification, clustering

Week 3: Machine Learning Fundamentals

Supervised, unsupervised, and reinforcement learning.

Model evaluation metrics and cross-validation techniques.

Week 4: AI in practice

Case studies: Prediction of drug dose-response with Ai

Case studies: Clustering behavioral data and predicting health outcomes.

Case studies: Monitoring and alert systems.

Dealing with uncertainty in AI-based diagnoses.

Reviewing the strengths, weaknesses, opportunities, and threats (SWOT) of AI.

Week 5: Interdisciplinary work in medical data science

Presentation of medical AI projects.

AI in medicine and interdisciplinary team work.

Technion-Rambam collaborations in medical AI.

Students engage in AI projects related to healthcare uses.

Week 6: Projects and Presentations "now is your turn, bring your idea!"

Presenting the results and discoveries of projects.

Award and seed fund for the winning project.

Reading/bibliography

• Mandatory (selected topics)

Olson, David L., and Özgür M. Araz. "Analytics and knowledge management in healthcare." In Data Mining and Analytics in Healthcare Management: Applications and Tools, pp. 7-19. Cham: Springer Nature Switzerland, 2023.

• Elective (selected topics)

Rokach, Lior, Oded Maimon, and Erez Shmueli, eds. Machine Learning for Data Science Handbook: Data Mining and Knowledge Discovery Handbook. Springer Nature, 2023.

Lecturer's contact details

Course team: Dr. Salvatore Campisi-Pinto (main instructor), Dr. Ronit Almog (Rambam HCC), Dr. Joachim Behar (Technion-IIT, AIMLab.)

About the main instructor: Salvatore Campisi-Pinto (PhD) is a data scientist, statistician, and epidemiologist with extensive experience in coordinating and promoting data-driven research projects. He has authored over 30 peer-reviewed publications in top international scientific journals. Currently, he is part of Clalit Research, where he collaborates with medical doctors and physicians to analyze large medical health record datasets. His focus is on healthcare research and the application of machine learning (AI) to enhance the availability and accuracy of care. Salvatore is also recognized for his exceptional pedagogic skills, effectively communicating complex concepts to diverse audiences

Application should be made at URL.
For further questions Netta Glebotzki (n_glebotzki@rambam.health.gov.il)