AI and Physics (PHYS570 (AI)

The course is designed to be highly interactive, with a mix of foundational and applied machine-learning topics. These are directly applicable to the analysis of large scientific data. Students will not only learn the theory behind various machine learning algorithms and tools but also how to apply them to problems in their research.
The first half of the course is dedicated to lectures on the fundamentals of machine learning, and popular algorithms, including decision and rule-based methods, deep learning-based models, and others. The lectures will be accompanied by hands-on exercises, fostering a collaborative learning environment. The second half of the course will revolve around a course project, example projects from previous classes, literature discussions and guest lectures on cutting-edge AI and physics research topics.
In the course project, you will propose ideas for applying ML in your research area or area of interest. Throughout the course, we will bring these ideas to life through pre-proposal, proposal, progress reports, and final reports. The process will involve oral and verbal presentations, as well as mock-up peer reviews, to practice effective scientific communication skills.

Lecture time: Tue/Thur 10:30 am

Topics:
Statistical Learning and Optimization, Algorithm architectures: Deep Neural Networks, CNN, GNN, Transformers; Probabilistic programming and differential programming, deep Generative Models: Hidden Variables and Restricted Boltzmann Machines (RBMs), Variational AutoEncoders (VAEs) and Generative Adversarial Networks (GANs), ML Hardware, ML & Microelectronics. Fully/Semi/Self-supervised learning;