ECSE 4850/6850

Introduction to Deep Learning

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Meeting Hours & Place : 2:00-3:20 pm, Mondays and Thursdays, JROWL 2C22
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Lecture notes: Available on RPI Learning Management System

This course introduces fundamentals in deep learning and demonstrates its applications in computer vision. While it covers both deterministic and probabilistic deep models, the course focuses on deterministic deep models, including Deep Neural Networks, Convolutional Neural Networks, Recurrent Neural Networks, Generative Models (Generative Adversarial Networks, the auto-encoders, and stable diffusion), and Deep Reinforcement learning. It will also briefly introduce probabilistic deep models, including Bayesian Neural Networks, Deep Boltzmann Machine, Deep Belief Networks, and Deep Bayesian Networks. The course is self-contained. It starts with an introduction of the background needed for learning deep models, including probability, linear algebra, standard classification and optimization techniques. To demonstrate various deep models, we will apply them to different computer vision tasks.

Prerequisites

This is a senior and graduate level course. Students are required to have good knowledge in linear algebra and multivariate calculus, and basic knowledge in optimization. Strong programming skills in Python and Tensorflow/Pytorch are required. The course does NOT teach Tensorflow/Pytorch. In addition, students should have access to sufficient compute power such GPUs to complete the class projects. Prior courses in machine learning/ pattern recognition and computer vision/image processing are preferred but not required.

Optional textbooks

Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016, http://www.deeplearningbook.org (download the book quickly for free!)

Linear Algebra and Learning from Data, Gilbert Strang, Wellesley-Cambridge Press , 2018. http://math.mit.edu/~gs/learningfromdata/

Software

Many of the assignments and projects will be implemented in PyTorch (https://pytorch.org/), which is implemented in Python. Mastery of Python or being able to quickly learn it is required.

Course Evaluation

The course will involve homework assignments (15%), class projects (40%), a mid-term exam (25%), and a final project (20%). All exams are open book and comprehensive.