MATH 404/504:

Mathematics of Deep Learning

Spring 2018

TIME: TR 9:30-10:45 AM. LOCATION: AAS 103

Topics highlight:

- From Perceptron to Neural Network
- Minimal Neural Networks
- Distances and Loss Functions
- Softmax and Probabilistic Interpretation
- Activation Functions: ReLu, Sigmoid and beyond
- Architecture: DenseNet and More
- Initialization and Noise Reduction: Randomness and Whitening
- Batch Normalization
- Optimization: regularization and Backpropagation
- Parameter Reduction: Weight Sharing and Pooling
- Support Vector Machine: Insight to and from Deep Learning

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In 2015 and 2016, AlphaGo beat the world best players in Go, an ancient Chinese board game with notorious sophistication, marking a new level of Artificial Intelligence. The algorithm behind AlphGo is Deep Learning, a machine learning technique that uses graphical structures called Deep Neural Networks. Deep Learning has also made new landmarks in robotics, self-driving car, and healthcare. It is penetrating almost all scientific areas that involve big data.

In this course, we will study the mathematical foundation of Deep Learning. With the knowledge learned in this course, the students will be able to implement the common Neural Networks as well as design new Neural Networks for their applications.

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