

## FS18 MTH994-Sec-001: Machine Learning

**Instructor:** Guowei Wei – wei@math.msu.edu  
**Office:** D301 Well Hall

**Course Description:** Machine Learning (ML) is a powerful technique widely used in many big data areas such as insurance, economics, biology, bioinformatics, medicine, engineering, face recognition etc. In this course, we will not only discuss theoretical framework of ML algorithms and architectures but also put an emphasis on programming skills so that each student is able to implement ML algorithms for real-world problems. The course starts with linear regression, logistic regressions, k-means,  $k$ -nearest neighbors, support vector machine, and decision trees. After discussing these elementary materials, more advanced methodologies such as random forests, gradient boosting trees and deep neural networks will be studied. The course will try to help graduate students with their research needs in ML.

**Prerequisites:** None but assuming a student knows calculus, linear algebra, and has some coding skill.

**Text:** There is no required text for this course.

## SS19 MTH994-Sec-001: Machine Learning

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**Office:** D301 Wells Hall

**Course Description:** The second semester on machine learning (ML) will be focused on advanced techniques and algorithms, including the design of artificial neural networks (ANN), multitask deep learning, convolutional neural network (CNN), recurrent neural network (RNN), capsule network (CapsNet), generative adversarial network (GAN), Boltzmann machine, etc. We will also discuss research-level topics, such as making deep learning more transparent (less a black-box) and more robust in hyperparameter selection, designing new machine algorithms and analyzing ML algorithms from the mathematical point of view. This course draws on a variety of mathematical subjects, including algebra, topology, geometry, analysis, differential equation, optimization, statistics and probability. The course will try to help graduate students with their research needs in ML.

**Prerequisites:** None but assuming a student knows calculus, linear algebra, and has some coding skill.

**Text:** There is no required text for this course