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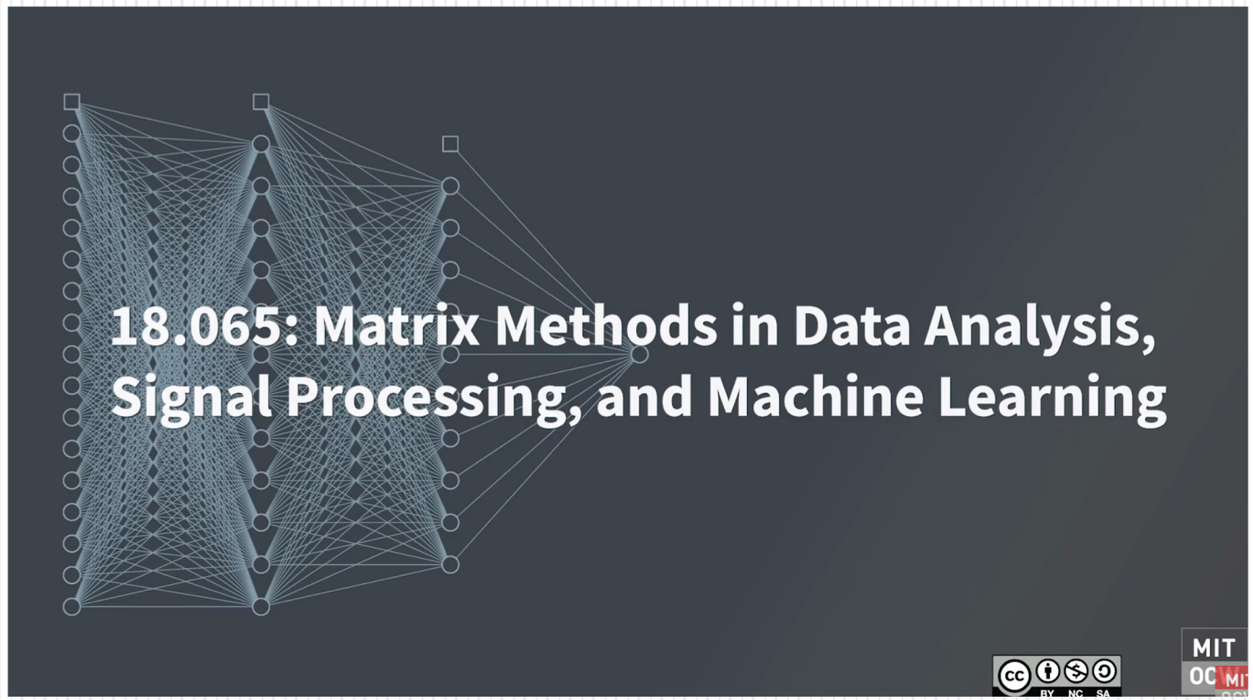
# Matrix Methods in Data Analysis, Signal Processing, and Machine Learning



# Site:

## Matrix Methods in Data Analysis, Signal Processing, and Machine Learning

COURSE HOME

SYLLABUS

CALENDAR

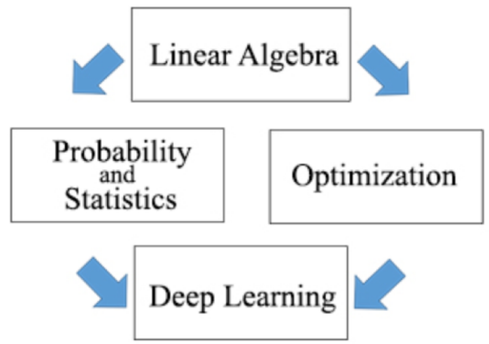
READINGS

VIDEO LECTURES

ASSIGNMENTS

FINAL PROJECT

DOWNLOAD COURSE MATERIALS




Relationship among linear algebra, probability and statistics, optimization, and deep learning. Courtesy of Jonathan Harmon. Used with permission.

**Instructor(s)**
Prof. Gilbert Strang

**MIT Course Number**
18.065 / 18.0651

**As Taught In**
Spring 2018

**Level**
Undergraduate / Graduate

CITE THIS COURSE

### Course Features

- Video lectures
- Assignments: problem sets (no solutions)
- Captions/transcript
- Instructor insights

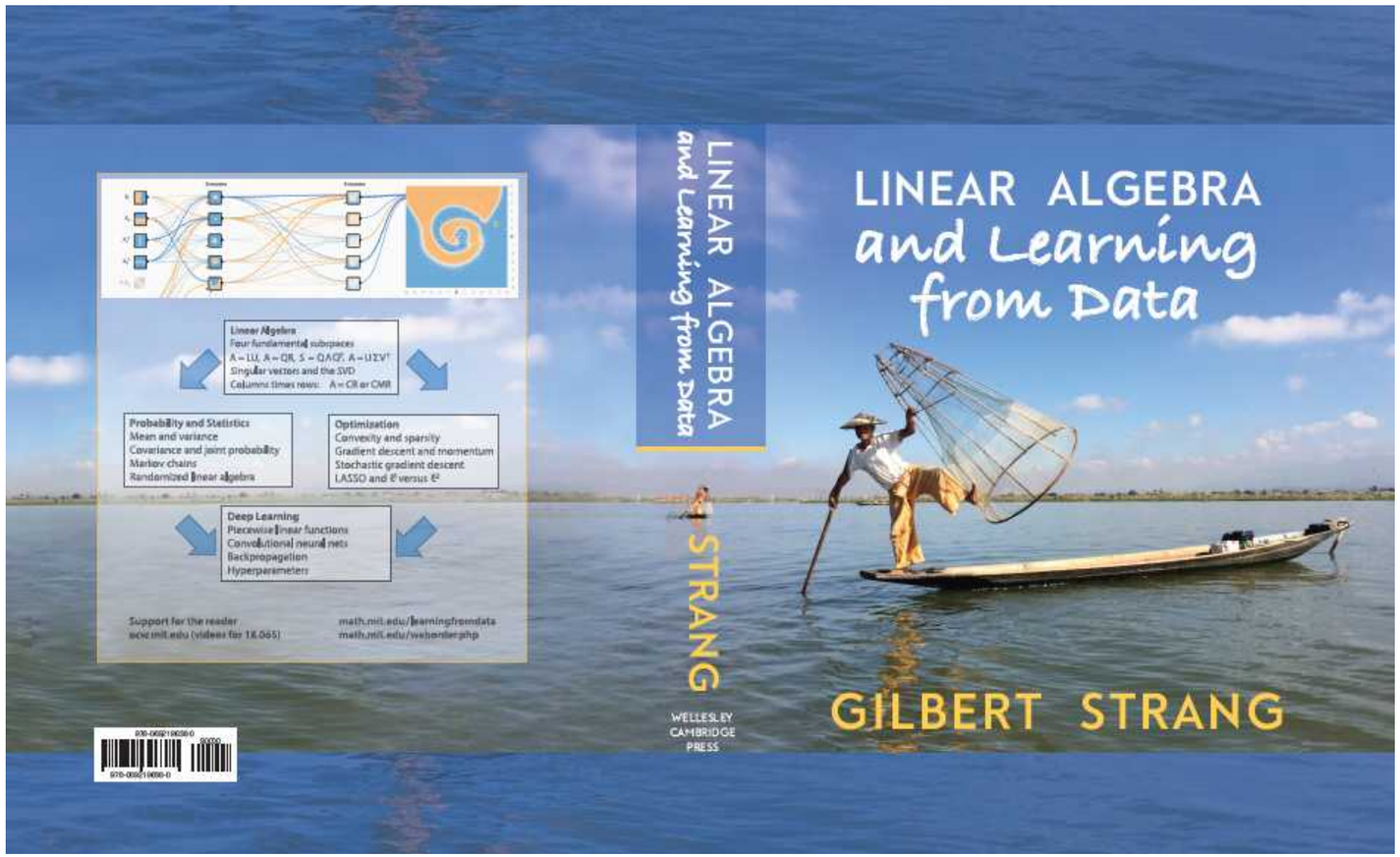
### Course Description

Linear algebra concepts are key for understanding and creating machine learning algorithms, especially as applied to deep learning and neural networks. This course reviews linear algebra with applications to probability and statistics and optimization–and above all a full explanation of deep learning.

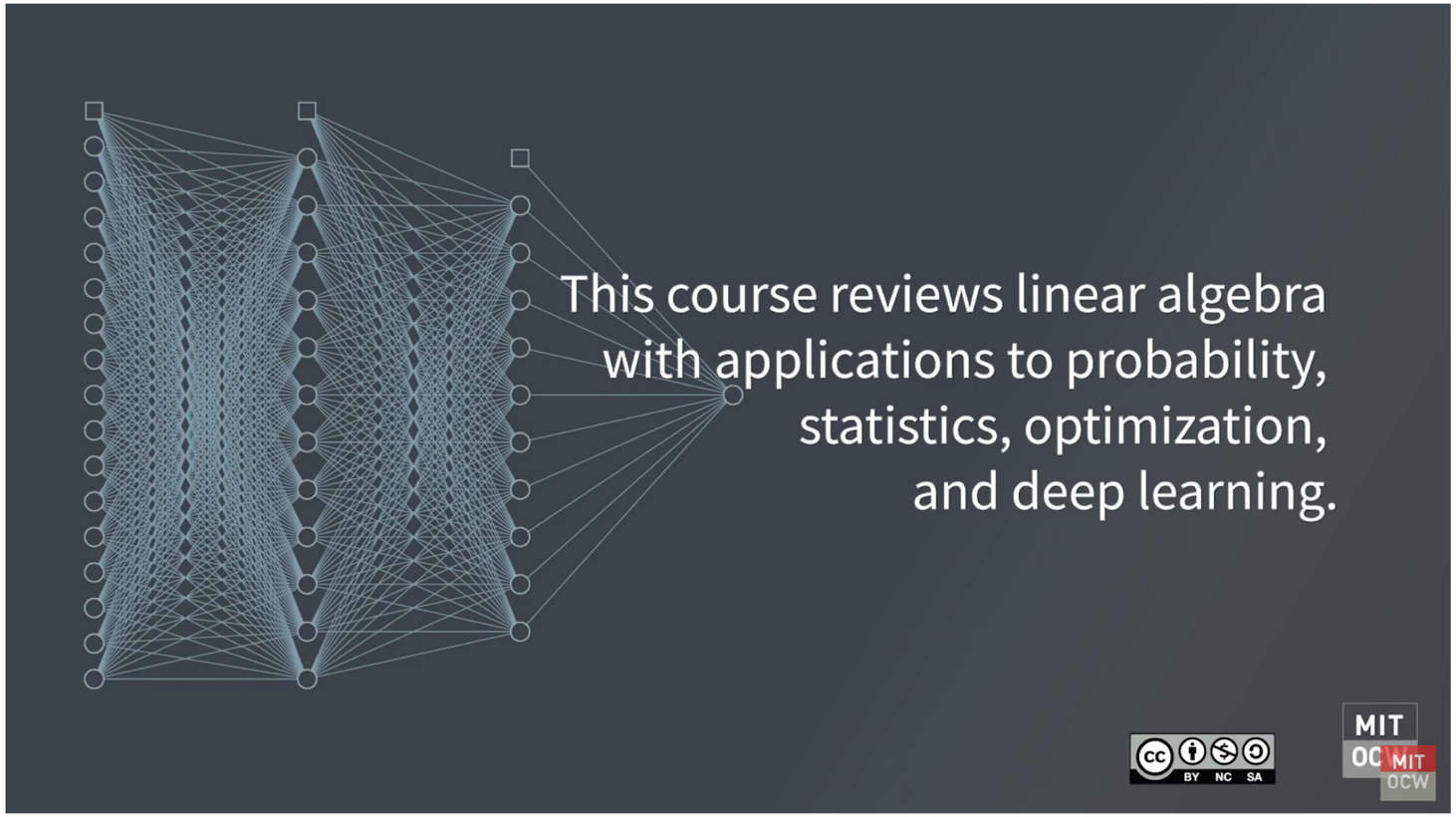
### MITx Versions

MITx offers a free version of this subject on edX. Please register to get started:

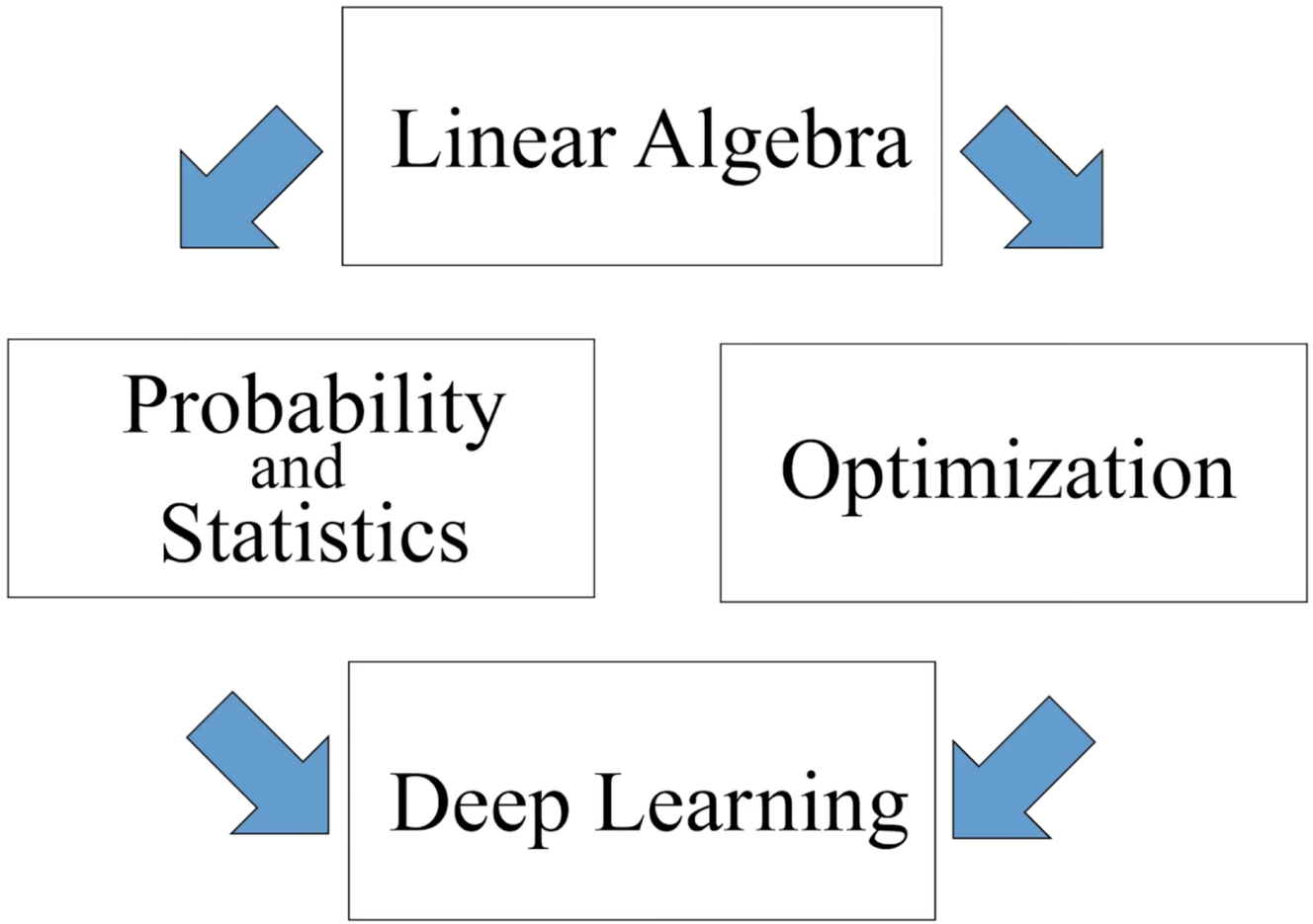
# textbook


Linear Algebra
Four fundamental subspaces
A = LU, A = QR, S = QΛQ^T, A = UΣV^T
Singular vectors and the SVD
Columns times rows: A = CR or CMR
Probability and Statistics
Mean and variance
Covariance and joint probability
Markov chains
Randomized linear algebra
Optimization
Convexity and sparsity
Gradient descent and momentum
Stochastic gradient descent
LASSO and ℓ¹ versus ℓ²
Deep Learning
Piecewise linear functions
Convolutional neural nets
Backpropagation
Hyperparameters
Support for the reader
ocw.mit.edu (videos for 18.065)
math.mit.edu/learningfromdata
math.mit.edu/weborder.php
LINEAR ALGEBRA
and Learning from Data
STRANG
WELLESLEY
CAMBRIDGE
PRESS
LINEAR ALGEBRA
and Learning from Data
GILBERT STRANG

# Course Introduction of 18.065 by Professor Strang



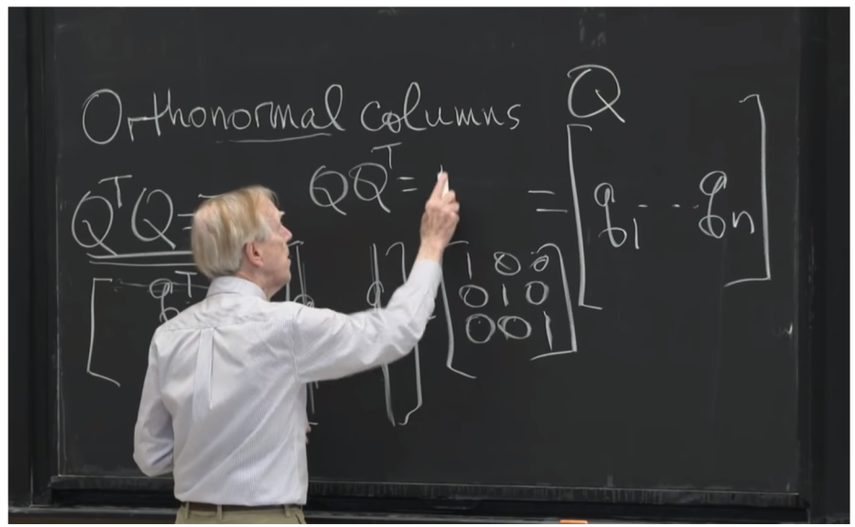
# Topics


Linear Algebra
Probability and Statistics
Optimization
Deep Learning

# Linear Algebra

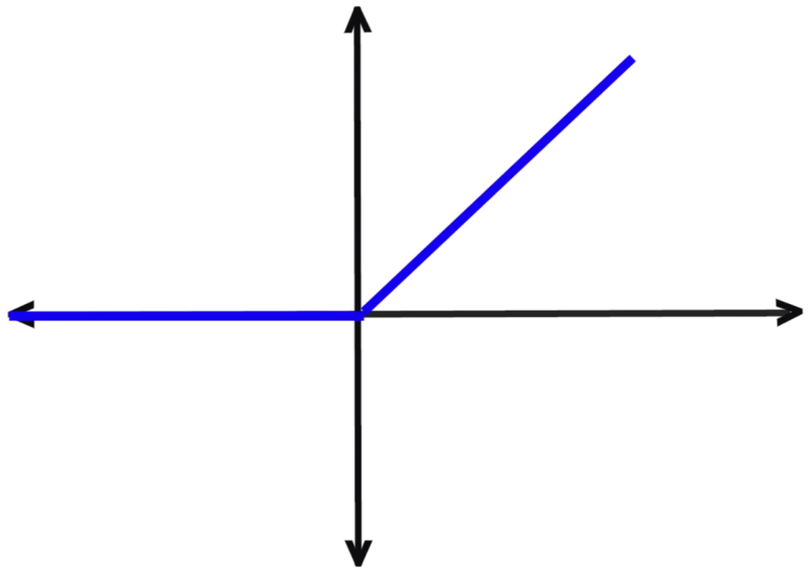
Symmetric Matrices
Othogonal Matrices

Single Value Decomposition
(SVD)



# Deep learning

$f(x) = x \rightarrow x \geq 0$
$f(x) = x \rightarrow x < 0$



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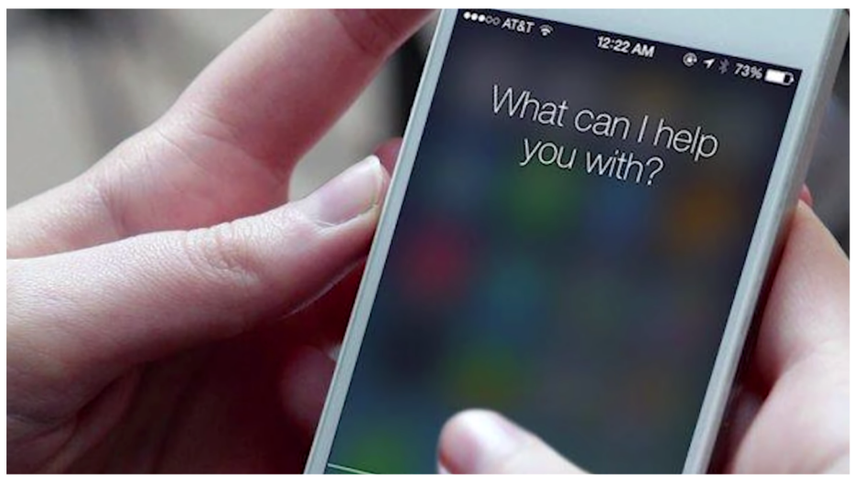
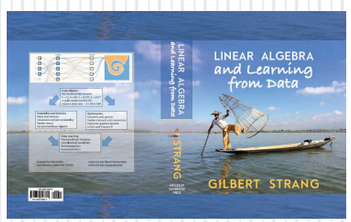


https://github.com/aegiloru/lald

# Credits

https://ocw.mit.edu/courses/mathematics/18-065-matrix-methods-in-data-analysis-signal-processing-and-machine-learning-spring-2018/index.htm

Gilbert Strang Web Site http://www-math.mit.edu/~gs/




http://math.mit.edu/~gs/learningfromdata/