

## Introduction to Machine learning

Topic	No. of Session
<b>Introduction</b>	<b>1</b>
<b>Concepts of Machine Learning</b>	
• What is learning?	<b>1</b>
• A formal model of learning	<b>1</b>
• Empirical Risk Minimizer (ERM)	<b>1</b>
• Probably Approximately Correct (PAC) learnability	<b>1</b>
<b>Linear Predictors</b>	
• Halfspace	<b>1</b>
• Linear regression, Logistic regression	<b>1</b>
<b>Theory of Learning</b>	
• VC-dimension, Shattering	<b>1</b>
• Fundamental theory of learning	<b>1</b>
• Bias-Complexity trade-off	<b>1</b>
<b>Boosting</b>	
• Weak learners	<b>1</b>
• Ada-boost	<b>1</b>
<b>Validation and Model Selection</b>	
• The model selection curve, k-fold cross validation	<b>1</b>
• What to do if learning fails?	<b>1</b>
<b>Support Vector Machines</b>	
• Hard SVM, Soft SVM	<b>2</b>
• Kernel trick, SVM kernel	<b>1</b>
<b>Decision trees</b>	
• Decision stumps, Gain measures	<b>1</b>
• Random forests	<b>1</b>
<b>Neural Networks</b>	
• Network architectures, Back-propagations	<b>1</b>
• Convolutional neural networks, Tips for learning deep neural nets	<b>1</b>
<b>Generative Models</b>	
• Maximum Likelihood (ML) estimator, Naïve Bayes Classifier	<b>1</b>
• Linear Discriminator Analysis (LDA), Relations between ML and ERM	<b>1</b>

• Expectation-Maximization (EM) algorithm	<b>1</b>
<b>Clustering</b>	
• Clustering model, Linkage based clustering	<b>1</b>
• K-means, Spectral clustering	<b>1</b>
<b>Graphical models</b>	
• Bayesian Networks, Markov property	<b>1</b>
• Inference in Bayesian networks	<b>1</b>
<b>Feature Selection and Feature Generation</b>	
• Filtering, Greedy selection approaches	<b>1</b>
• Feature manipulations	<b>1</b>

## References:

[1] S. Shalev-Shwartz and S. Ben-David. Understanding machine learning: From theory to algorithms. Cambridge university press.

[2] T. Mitchell, Machine learning, McGraw-Hill Boston, MA.

[3] C. M. Bishop, Pattern Recognition and Machine Learning, Springer.

[4] S. Russell, and P. Norvig, Artificial Intelligence: A modern approach (Third edition), Prentice-Hall.