Machine learning

ETHEM ALPAYDIN

Unit I :-

1. What is M/c learning?
2. Eg's of m/c learning applications.
3. Supervised learning: 1. learning a class from ex's.
   2. Vapnik-Chervonenkis dimension.
   3. Probably approximately correct learning.
   4. Noise
   5. learning multiple classes
   6. Regression
   7. Model selection & generalization.
   8. Dimensions of a supervised m/c learning algo.
4. Decision Tree learning: 1. Introduction,
   2. Decision Tree representation.
   3. Appropriate prblms for decision tree learning.
   4. Basic decision tree learning algorithm.
   5. Hypothesis space search in decision tree learning.
   6. Inductive bias in decision tree learning.
5. Artificial Neural N/w's:- 1. Introduction.
   2. Neural N/w Representation.
   3. Prblms
   4. Perceptrons
   5. Multilayer N/w's & Back Propogation algo.
   6. Remarks on the back Propogation algo.
7. An illustrative ex: 1. Face Recognition.
   2. Advanced Topics in Artificial Neural N/w's.

Unit 2 :-

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1. Evaluating Hypothesis : 1) Motivation
   2. Estimating hypothesis accuracy
   3. Basics of sampling theory
   4. A general approach for deriving confidence intervals.
   5. Differences in error of two hypotheses
   6. Comparing learning algorithms.

3. Bayesian learning : 1) Introduction
   2) Bayes theorem
   3. Bayes theorem & concept learning
   4. Maximum likelihood & least squared error hypothesis
   5. Maximum likelihood hypothesis for predicting probabilities
   6. Minimum Description length principle
   7. Bayes optimal classifier
   8. Gibbs Algo
   9. Naive Bayes classifier
   10. Bayesian Belief n/w
   11. EM Algo.

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Unit 3 :-

1. Dimensionality Reduction : 1. Introduction.
   2. Subset selection
   3. principle component analysis
   4. Feature embedding
   5. Factor analysis

6. Singular value decomposition & matrix factorization.
7. Multidimensional scaling
8. linear discriminant analysis
9. canonical correlation analysis
10. Isomap
11. Locally linear embedding
12. Laplacian eigenmaps.

2. Clustering: 1. Introduction
2. Mixture densities
3. k-means clustering
4. Expectations - Maximization algorithm
5. Mixture of latent variable models.
6. Supervised learning after clustering
7. Spectral clustering
8. Hierarchal clustering
9. Choosing the no. of clusterings (clusters).

3. Non parametric Methods: 1. Introduction
2. Non-parametric density estimation.
3. generalization to multivariate data
4. Nonparametric classification
5. condensed nearest neighbour
6. Distance based classification.
7. outlier detection
8. Non parametric regression: 1. smoothing methods. models ③
2. How to choose the smoothing param

Unit 4 :-

1. Linear Discrimination : 1. Introduction
2. Generalizing the linear model
3. Geometry of the linear discriminate
4. pair wise seperation
5. parametric discrimination revisited
6. Gradient descent
7. Logistic discrimination
8. Discrimination by regression
9. learning to rank.

2. Multilayer perceptrons : 1. Introduction.
2. The perception.
3. Training a perception
4. learning Boolean functions
5. Multilayer perceptions
6. MLP as a universal appeximater.
7. Back propegation algo
8. Training procedures
9. Tuning the nlw size
10. Bayesian view of learning
11. Dimensionality Reduction
12. learning time
13. Deep learning

unit 5:-

1. Kernel m/c's: 1. Introduction

2. Optimal separating hyperplane

3. The non separable case: soft Margin Hyperplane

4. V-SVM

5. Kernel Trick

6. Vectorial Kernels

7. Defining kernels

8. Multiple kernel learning

9. Multicast kernel m/c's

10. Kernel m/c's for regression

11. Kernel m/c's for ranking.

12. One-class kernel m/c's.

13. Large margin nearest neighbor classifie

14. Kernel dimensionality reduction.

Graphics models: 1. Introduction

2. Canonical cases for conditional independence,

3. Generative models.

4. d-Seperation

5. Belief Propagation.

Undirected Graphs: 1) Markov Random fields

2) learning the str. of a graphical model

3) Influence diagrams.