

Exam Preparation

Ralf Herbrich

Unit 1: Probability Theory

1. History of Machine Learning
2. Probability in Machine Learning
3. Probability Theory
4. Probability Distributions

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Unit 2: Inference and Decision Making

1. Inference Methods

- Bayesian Inference
- Maximum Likelihood Estimation

2. Decision Making

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Unit 3: Graphical Models: Independence

1. Graphical Models
2. Bayesian Networks
3. Conditional Independence

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Unit 4: Graphical Models: Inference

1. Factor Graphs
2. The Sum-Product Algorithm
3. Practical Considerations in Message Passing
4. Approximate Message Passing

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Unit 5: Bayesian Ranking

1. Ranking Problem
2. Probabilistic Ranking Models
3. TrueSkill: Expectation Propagation on Ranking Factor Graphs
4. TrueSkill Through Time

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Unit 6: Linear Basis Function Models

1. Linear Basis Function Models
2. Modelling Data
 - Modelling Text
 - Modelling Images
3. Linear Algebra
 - Vector Spaces
 - Linear Mappings and Matrices
 - Matrix Derivatives
4. Maximum A Posterior Learning and (Regularized) Least Squares

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Unit 7: Bayesian Regression

1. Bayesian Linear Regression
2. Bayesian Linear Regression via Message Passing
 - Normal Distribution Revisited
 - Posterior and Predictive Distribution
3. Fast Bayesian Linear Regression
4. Bayesian Linear Regression via Linear Algebra

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Unit 8: Bayesian Classification

1. Bayesian Classification Learning
2. Bayesian Classification Learning via Approximate Message Passing
3. Appendix: Bayesian Classification via Optimization
 - Laplace Approximation
 - Bayesian Linear Logit Regression

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Unit 9: Non-Bayesian Classification Learning

1. Geometry of Linear Classifiers
2. Fisher's Linear Discriminant
3. Perceptron Learning Algorithm
4. Logistic Regression

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Unit 10: Gaussian Processes

1. Basic Concepts
2. Gaussian Processes for Regression
 - Weight-Space View
3. Gaussian Processes for Classification
4. Evidence Maximization for Gaussian Processes

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Unit 11: Information Theory

1. Basics of Information Theory
2. Arithmetic Coding
3. Distance Measures for Probabilities

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Unit 12: Real-World Applications

1. adPredictor: Bayesian Probit in e-Commerce
2. MatchBox: Bayesian Recommendation Systems
3. The Path of Go: Bayesian Pattern Ranking for Games

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See you at the exam!