

Machine Learning Methods (Third Edition)

Hang Li

Volume 1 (Part 1) Supervised Learning

Chapter 1 Introduction to Machine Learning
Chapter 2 Introduction to Supervised Learning
Chapter 3 Linear Regression
Chapter 4 Perceptron
Chapter 5 K-Nearest Neighbors (KNN)
Chapter 6 Naive Bayes Method
Chapter 7 Decision Trees
Chapter 8 Logistic Regression and Maximum Entropy Models
Chapter 9 Support Vector Machines (SVM)
Chapter 10 Boosting Methods
Chapter 11 Hidden Markov Models (HMM)
Chapter 12 Conditional Random Fields (CRF)
Chapter 13 Summary of Supervised Learning Methods

Volume 2 (Part 2) Unsupervised Learning

Chapter 14 Introduction to Unsupervised Learning
Chapter 15 Clustering Methods
Chapter 16 Singular Value Decomposition (SVD)
Chapter 17 Principal Component Analysis (PCA)
Chapter 18 EM Algorithm and Variational EM Algorithm
Chapter 19 Markov Chains
Chapter 20 Markov Chain Monte Carlo (MCMC) Methods

Chapter 21 Latent Semantic Analysis (LSA) and Non-negative Matrix Factorization (NMF)

Chapter 22 Probabilistic Latent Semantic Analysis (PLSA)

Chapter 23 Latent Dirichlet Allocation (LDA)

Chapter 24 Summary of Unsupervised Learning Methods

Volume 3 (Part 3) Deep Learning

Chapter 25 Introduction to Deep Learning

Chapter 26 Feedforward Neural Networks

Chapter 27 Convolutional Neural Networks (CNN)

Chapter 28 Recurrent Neural Networks (RNN)

Chapter 29 Transformer

Chapter 30 GPT and BERT

Chapter 31 Autoencoders

Chapter 32 Generative Adversarial Networks (GAN)

Chapter 33 Variational Autoencoders (VAE)

Chapter 34 Diffusion Models

Chapter 35 Flow Matching Models

Chapter 36 Summary of Deep Learning Methods

Volume 4 (Part 4) Reinforcement Learning

Chapter 37 Introduction to Reinforcement Learning

Chapter 38 Markov Decision Processes (MDP)

Chapter 39 Multi-Armed Bandit

Chapter 40 Value-Based Methods

Chapter 41 Deep Q-Networks (DQN)

Chapter 42 Policy-Based Methods

Chapter 43 Proximal Policy Optimization (PPO)

Chapter 44 Summary of Reinforcement Learning Methods

Appendix

A Probability Theory

A.1 Basic Concepts and Theorems
A.2 Probability Distributions
A.3 Stochastic Differential Equations
B Statistics
B.1 Maximum Likelihood Estimation (MLE)
B.2 Bayesian Inference
C Information Theory
C.1 Entropy and KL Divergence
C.2 Data Compression
D Linear Algebra
D.1 Matrix Spaces
D.2 Linear Transformations and Matrix Decompositions
E Optimization Theory
E.1 Gradient Descent
E.2 Newton's Method and Quasi-Newton Methods
E.3 Adam Algorithm
E.4 Lagrangian Duality
F Functional Analysis
F.1 Hilbert Spaces