

Data Mining
Topics, 2023

1. Definition of data mining. Motivations, examples. Origins of data mining. Prediction and description, data mining tasks. Challenges of data mining. Exploring data: Summary statistics and visualization.
(Slides: Introduction + Exploring Data)
2. Data analysis pipeline, the 5-step process. Data, types of data and types of attribute. Types of data sets. Quality of data. Preprocessing: aggregation, sampling, dimension reduction, feature subset selection, feature creation, discretization and binarization, attribute transformation.
(Slides: Data preprocessing)
3. Classification: Basic concepts. Decision trees. Tree induction algorithms: Hunt, CART, CHAID, C4.5. Model evaluation: confusion matrix, metrics, ROC curve.
(Slides: Classification: Basic Concepts, Decision Trees, and Model Evaluation)
4. Classification techniques I: Rule-based classifiers, Nearest neighbor classifiers, Bayesian classifiers.
(Slides: Classification: Alternative Techniques)
5. Classification techniques II: Artificial neural networks, Support vector machines, Logistic regression, Ensemble methods.
(Slides: Classification: Alternative Techniques)
6. Similarity and dissimilarity (distance). Clustering: definition, K-means algorithm and its variants. Cluster validity: similarity matrix, correlation, SSE, silhouette coefficient.
(Slides: Data preprocessing + Cluster Analysis: Basic Concepts and Algorithms)
7. Clustering: Hierarchical and density based methods. Agglomerative clustering algorithm: single, complete and average link. Dendrogram. DBSCAN.
(Slides: Cluster Analysis: Basic Concepts and Algorithms)
8. Market-basket data. Frequent itemset, support. Apriori principle and Apriori algorithm. Candidate generation. Confidence. Association rule mining. Pattern evaluation: statistical based measures, lift value.
(Slides: Association Analysis: Basic Concepts and Algorithms)
9. Anomaly detection: definition, problems, applications. Anomaly detection schemes: graphical and statistical-based, distance-based, model-based.
(Slides: Anomaly Detection)

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