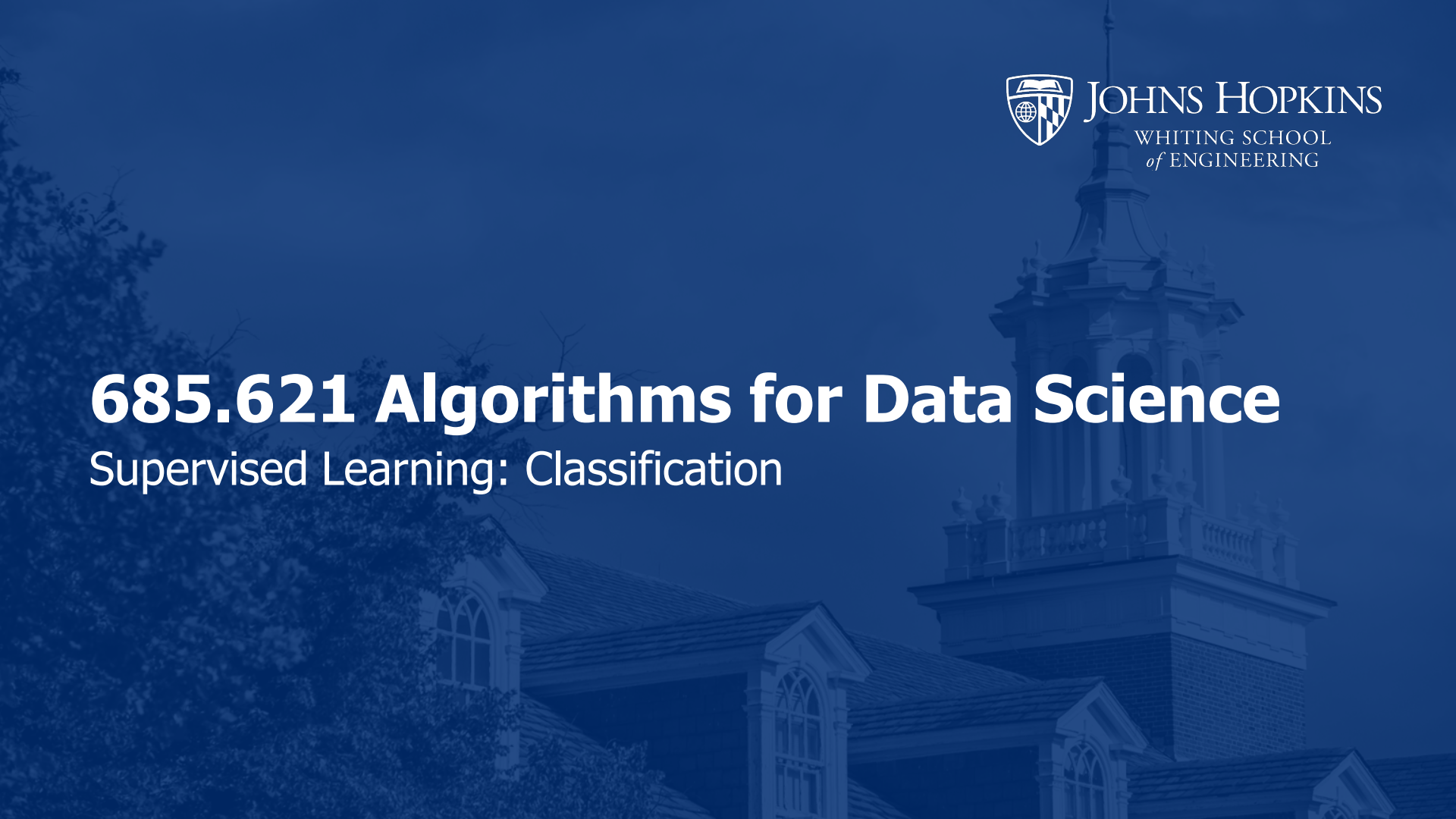
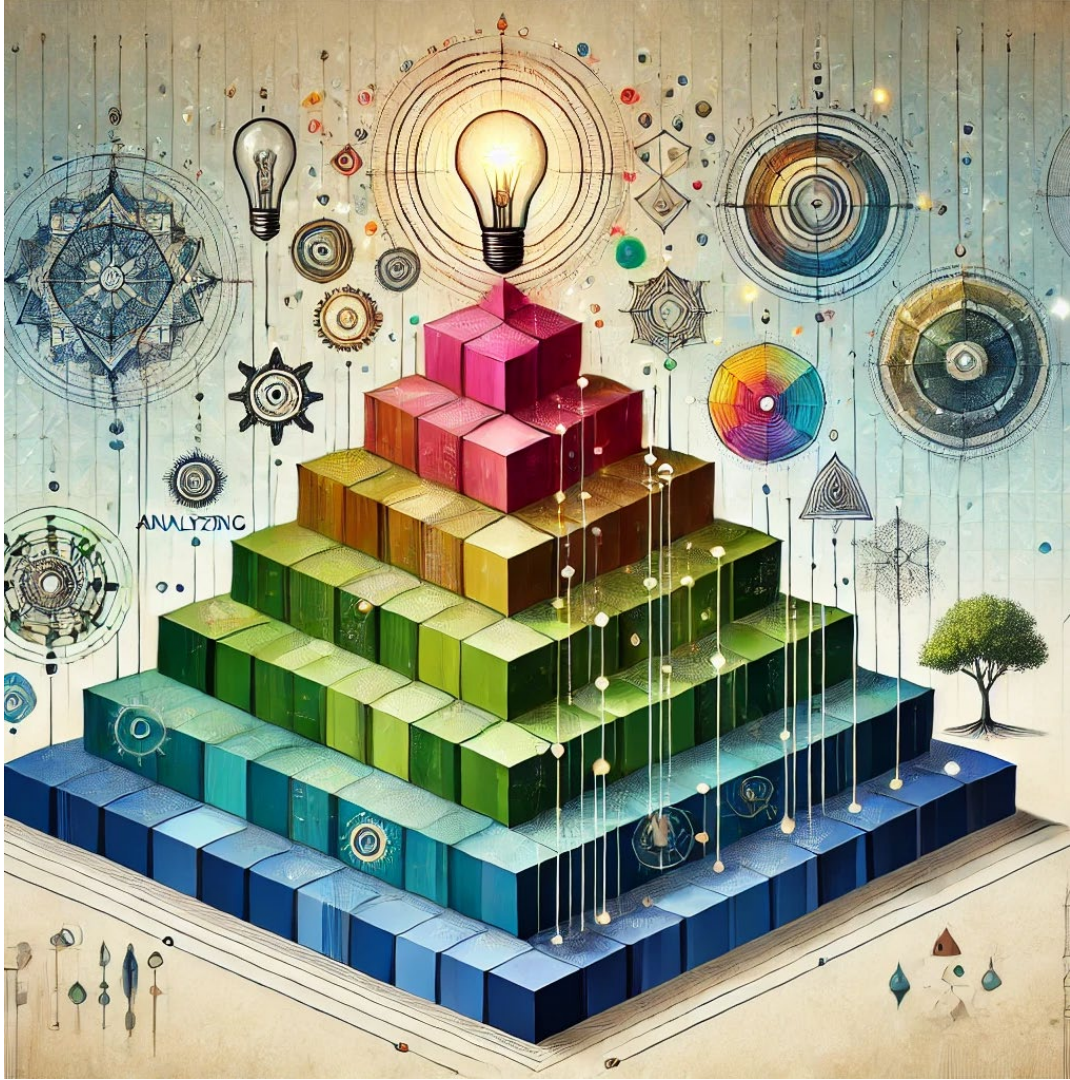


685.621 Algorithms for Data Science

Supervised Learning: Classification

Module Learning Objectives

- 8.1 Identify the key differences between various classification problems, including binary, multi-class, and multi-label classification.
- 8.2 Explain the mathematical foundations of supervised classification, such as probability theory, loss functions, and decision boundaries.
- 8.3 Apply classification algorithms, such as Logistic Regression, K-Nearest Neighbors, Decision Trees, Random Forest, and Support Vector Machines, to real-world datasets.
- 8.4 Analyze the performance of classification models using evaluation metrics like precision, recall, F1-score, ROC-AUC, and confusion matrices.



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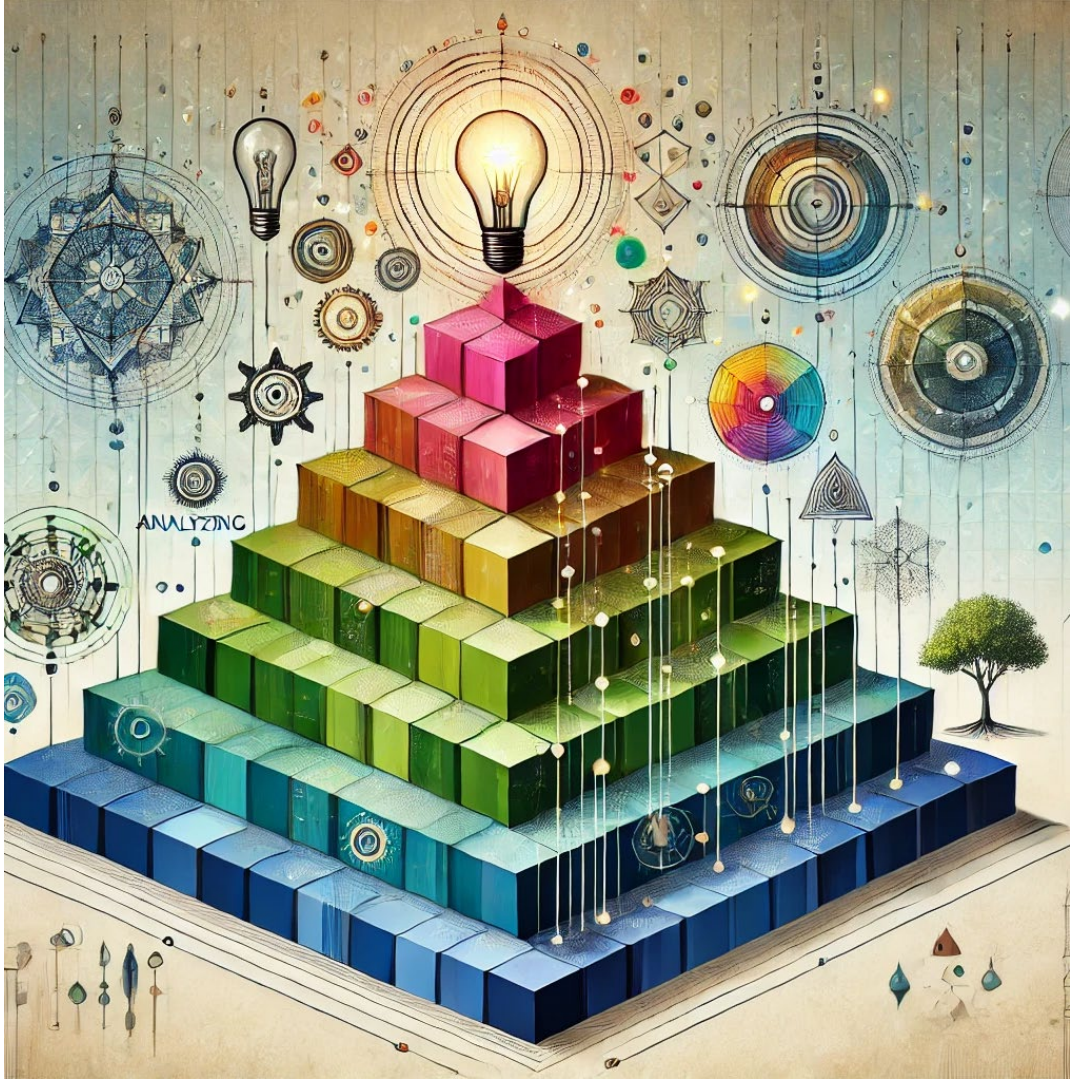
Module Learning Objectives

- 8.5 Compare and contrast the advantages and limitations of different supervised classification methods and determine their appropriate use cases.
- 8.6 Optimize classification models by implementing techniques such as feature engineering, hyperparameter tuning, and handling imbalanced datasets.
- 8.7 Critique the interpretability of classification models using tools like SHAP and LIME, assessing their impact on decision-making in high-stakes applications.



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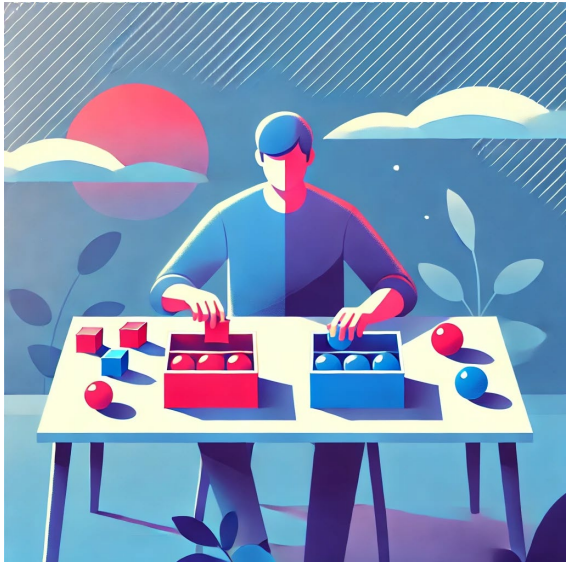
Supervised Learning Classification: An Overview

Supervised learning classification predicts discrete categories or class labels for new, unseen data based on input features after being trained on a labeled dataset

Key Features

- Versatility and Scalability
- Automation



Applications

- Image Recognition
- Sentiment Analysis
- Medical Diagnosis

Classes of Classification Problems

Binary	Multi-class	Multi-label	Imbalanced
Separates data into two categories	Separates data into more than two categories	Assigns multiple labels to a single instance	Separating data when there are unequal class distributions