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Machine Learning
UNIT 7

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Introduction to Machine Learning

- -Machine Learning: field of AI where systems learn from data
- -Goal: Improve performance on tasks through experience
- -Key Focus: Learning from observations
- -Applications: speech recognition, vision, recommendation systems

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Different Forms of Learning

- -Supervised Learning: Learning with labeled examples
- -Unsupervised Learning: Discovering patterns in unlabeled data
- -Semi-supervised Learning: Using limited labels with unlabeled data
- -Reinforcement Learning: Learning by interacting with environment
- -Online Learning: Learning continuously as data arrives

Learning Decision Trees

- - A decision tree is a predictive model mapping inputs to outputs
- - Internal nodes: represent tests on attributes
- - Branches: outcomes of tests
- - Leaves: final decision/class
- - Algorithms: ID3, C4.5, CART
- - Advantages: Easy to interpret, handles categorical data well

Computational Learning Theory

- - Provides a framework to study feasibility of learning
- - PAC Learning (Probably Approximately Correct)
- - VC Dimension: Capacity of a hypothesis class
- - Trade-off between complexity and generalization
- - Helps understand theoretical limits of learning algorithms

Statistical Learning Methods

- - Based on principles of statistics and probability
- - Regression: Predict continuous values
- - Classification: Predict categorical outcomes
- - Bayesian Learning: Using Bayes' theorem for predictions
- - Support Vector Machines: Optimal separating hyperplane
- - Focus on inference and generalization from data

Neural Networks and Connectionist Learning

- - Inspired by the structure of the brain
- - Neurons: basic computational units
- - Layers: Input, hidden, and output layers
- - Learning: Adjusting weights using algorithms like backpropagation
- - Connectionist learning emphasizes distributed representations
- - Applications: Image recognition, NLP, game playing

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Summary

- - Machine learning enables systems to learn from observations
- - Different learning forms: supervised, unsupervised, reinforcement, etc.
- - Decision trees: simple and interpretable learning models
- - Computational learning theory: feasibility and limits of learning
- - Statistical methods: probability-based learning techniques
- - Neural networks: connectionist approach for complex tasks