
Pattern Recognition: Review

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Overview of Topics

Pattern Recognition, Experimental Methods

- Problems; Classification; Issues in designing and interpreting experiments

Classification

- Nonparametric (Parzen Window, k-NN; effect of distance metrics)
- Linear Classifiers (Gradient Descent in *Parameter Space*; Perceptron rule, MSE minimization, *Separability*, non-linear mapping of features to “*y space*”)
- Neural Networks (Backpropagation, Feature Mapping in 3-layer networks)

Overview, Cont'd

Classifier Combination

- Bias and Variance; Voting procedures;
- Bagging, Boosting (Adaboost); Combining discr. outputs: Naive Bayes, Decision Templates, Fuzzy Integral

Unsupervised Learning and Clustering

- Unsupervised learning vs. Supervised learning
- Estimating mixture densities (for multiple classes simultaneously) using MLE, Bayesian learning
- k-means, fuzzy k-means clustering
- Criterion functions for clustering; role of scatter matrices

Overview, Cont'd

Syntactic Pattern Recognition

- Constructing structural descriptions using formal languages (grammars); i.e. parsing input primitives to produce an (attributed) graph
- Stochastic Grammars: augmenting a CFG with probabilities for each non-terminal (LHS symbol); assume that rewriting of non-terminals is independent: $p(x|G)$ is the product of the production rule probabilities used to derive x from G . CYK algorithm for CNF grammars will produce result.
- Can be used for classification (e.g. classify based on similarity or exact match to existing structures: graph/tree edit distance).