CSCE 970: Pattern Recognition **Spring Semester, 1999**

List of Topics

January 11, 1999 *Handout 2*

— SUBJECT TO CHANGE —

1. Overview of Pattern Recognition: Features (attributes) and feature vectors, classification, supervised vs. unsupervised learning
   [Chapter 1]

2. Bayesian classifiers: Bayesian decision theory, discriminant functions, Bayesian classification for Gaussian distributions, estimation of unknown pdfs, k-nearest neighbor techniques
   [Sections 2.1–2.4, 2.5.1, 2.5.2, 2.5.6, 2.6]

3. Linear classifiers: Linear discriminant functions, perceptron algorithm, Winnow, exponentiated gradient, least squares methods
   [Sections 3.1–3.3, 3.4.1, 3.4.2, skim 3.5, selected papers]

4. Nonlinear classifiers: 2- and 3-layer perceptrons, backpropagation, setting network size (esp. pruning), Cover's theorem, RBF networks, decision trees
   [Sections 4.1–4.4, 4.6 (skip proof), 4.7, 4.9, 4.10, 4.13–4.15, 4.17]

5. Feature selection: Preprocessing, hypothesis testing, class separability measures, feature subset selection, Vapnik-Chervonenkis theory/structural risk minimization
   [Sections 5.1–5.3, 5.5, 5.6, skim 5.9]

6. Feature generation **(time permitting)**: Regional features (first- and second-order statistics, run length method), chain codes
   [Sections 7.1, 7.2.1, 7.3.2]

7. Template matching: Optimal path searching (dynamic programming, edit distance, dynamic time warping), correlation finding
   [Chapter 8]

8. Context-dependent classification **(time permitting)**: Markov chain models, Viterbi algorithm, hidden Markov models, Markov random fields
   [Sections 9.1–9.4, 9.6–9.8]

9. System evaluation: Estimating classification error (resubstitution, holdout, leave-one-out), improving performance (bagging, boosting)
   [Chapter 10, selected papers]

10. Clustering introduction: Applications, examples, cluster types, feature types, proximity measures, categories of algorithms
    [Chapter 11, Sections 12.1–12.2]

11. Sequential clustering algorithms: BSAS, MBSAS, TTSAS, estimating the number of clusters
[Sections 12.3–12.6]

12. Hierarchical clustering algorithms: Agglomerative schemes (dendograms, single link algorithm, complete link algorithm), determining the best number of clusters
[Sections 13.1, 13.2.1–13.2.4, 13.5]

13. Algorithms based on function optimization: Isodata algorithm, fuzzy clustering methods (also fuzzy classification, if time permits)
[Sections 14.1, 14.3.1, 14.3.6, 14.5, selected papers]

14. Cluster validity **(time permitting)**: More on hypothesis testing, internal criteria, external criteria, relative criteria, validity of individual clusters, cluster tendency
[Chapter 16]

Important dates: Monday, January 18 (Martin Luther King Holiday, no class)
Monday, March 15–Friday, March 19 (spring break, no class)
Monday, April 26–Friday, April 30 (dead week, project presentations)
Monday, May 3 (project reports due)
Monday, May 3–Tuesday, May 4 (project demonstrations)