Proposed Course Outline: Pattern Recognition

1. Introduction –

* What is Pattern Recognition
* Interdisciplinary Nature of Pattern
* Brief Outline of Three Principal Paradigms
* Statistical Pattern Recognition
* Neural Pattern Recognition
* Syntactic Pattern Recognition - touched briefly in a separate module
* `Flavour' of Prequisites
* Linear Algebra
* Probability Theory

2. What does my data look like: Do I need all of it ?

* Introducing Statistical Analysis, Principal Component Analysis
* Feature Vector Representation, Normalization
* Eigenvector-Eigenvalue Transformation (KLT)
* Singular Value Decomposition (SVD) and Applications

3. Important Paradigm: Drawing the Line

* Getting a Decision Boundary
* Comparing two patterns, and Distance Measures
* Isolated Patterns
* Patterns from a group of patterns
* Distance Measures
* Minkowski, Euclidean, Mahalanobis
* Bayesian Decision Theory
* Classifiers, Discriminant Functions, Decision Surfaces, Maximum Likelihood Estimation (MLE), Expectation Maximization (EM)

4. Neural Networks

* Classic Neural Networks
* Convolutional Neural Networks
* Recurrent Neural Networks (RNNs)
* Generative Adversarial Networks
* Auto-encoders
* Feed Forward
* Convolution Networks
* Recurrent Networks
* Memory Cells
* LSTMs
* ANN(Multi-layer perceptron)
* Neurons
* Weights
* Connectivity and Logic Gates
* Activation Function
* NN Model building
* Loss Function
* NN Architecture

5. Unsupervised Learning and Clustering

1. Statistical Approaches

* Bayes Decision Theory (Covered in detail above)
* K-Means Algorithm
* Neirest Neighbour Classification
* Hierarchical Methods
* Graph-Theoretic Methods
* Simulated Annealing

1. Neural Approaches

* Kohonen's Net, and Self-Organizing Maps (Neural Equivalent of K-Means)
* Adaptive Resonance Theory (ART)
* Other Similar Approaches for Neural Networks

6. Syntactic Pattern Recognition

* Introduction to Syntactic Pattern Recognition
* Performing Correspondence mapping between two images of an object.

7. Additional Topics

Hidden Markov Models (HMMs)

Support Vector Machines (SVMs)