

# Pattern Recognition

## Lecture 12 : Repetition

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# Lecture 1 – Classification

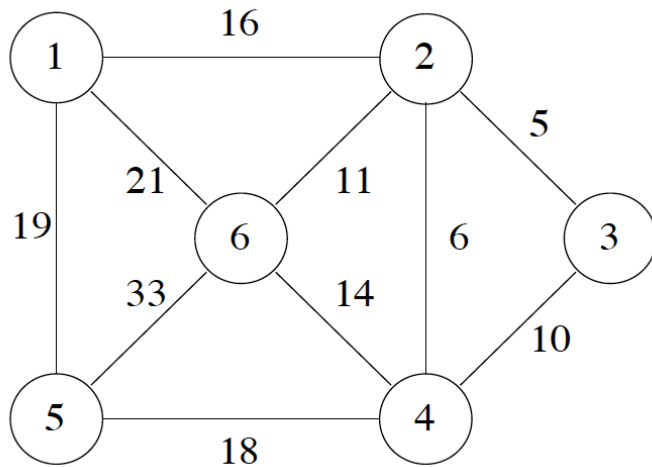
- What is the difference between generative and discriminative classification?

## Lecture 2 – Bayes Classifier

- Two classes, known prior probabilities  $p(C_1)$  and  $p(C_2)$ .
- Known likelihoods  $p(x | C_1)$  and  $p(x | C_2)$ .
- According to Bayes' theorem, what is the optimal decision rule for classifying a pattern  $x$ ?

## Lecture 3 – Clustering

- What is the minimum spanning tree (MST) of the graph shown below?
- Divide the nodes into three clusters based on the MST.



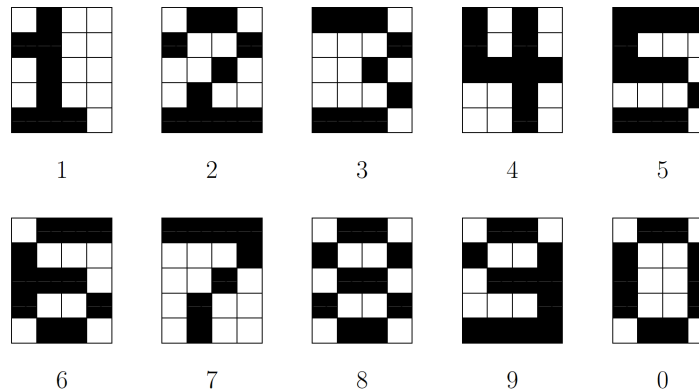
## Lecture 4 – Support Vector Machine

- What is a kernelizable algorithm?
- Kernelize the K-nearest neighbor (KNN) algorithm:

$$\|\varphi(x) - \varphi(y)\|^2 = \dots$$

# Lecture 5 – Artificial Neural Networks

- Design a multi-layer perceptron (MLP) for digit classification. Draw the different layers, perceptrons, and connections between the perceptrons (details of individual perceptrons can be omitted).



## Lecture 6 – Feature Select. & Classifier Combination

- Consider the class rankings of classifiers  $K_1, \dots, K_4$  below. Which class should be chosen based on the Borda count?

$K_1: (C_3, C_1, C_4, C_2)$

$K_2: (C_1, C_4, C_3, C_2)$

$K_3: (C_3, C_4, C_2, C_1)$

$K_4: (C_4, C_3, C_2, C_1)$

## Lecture 7 – String Matching I

- Consider the cost function below. What is the string edit distance (SED) between the strings  $x = ABABBB$  and  $y = BABAAA$ ?

$$c(A \rightarrow \varepsilon) = c(B \rightarrow \varepsilon) = c(\varepsilon \rightarrow A) = c(\varepsilon \rightarrow B) = 1$$

$$c(A \rightarrow B) = c(B \rightarrow A) = 2 \quad A \neq B$$

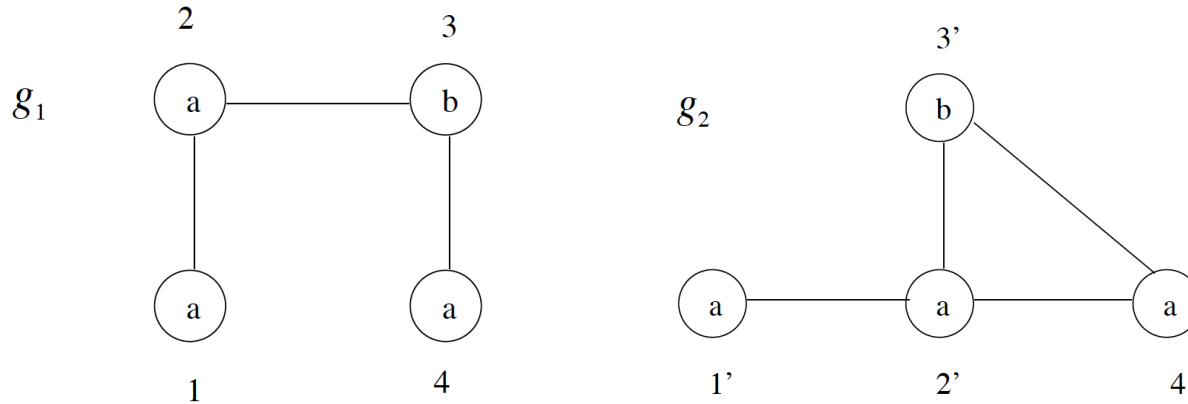


## Lecture 8 – String Matching II

- Design a continuous hidden Markov model (HMM) for cursive handwriting recognition. What are the model components of a character HMM? Draw a sketch of the model.

## Lecture 9 – Graph Matching I

- Find the maximum common subgraph of  $g_1$  and  $g_2$  based on the maximum clique in their association graph.



## Lecture 10 – Graph Matching II

- Consider the two graphs below. Draw a sketch of the linear sum assignment problem (LSAP) for bipartite approximation of graph edit distance. What are the four parts of the corresponding cost matrix?



# Lecture 11 – Kernel Functions

- Compute the common walk kernel  $\kappa(g, g')$  of graphs  $g$  and  $g'$  based on their product graph.

