

KECE470 Pattern Recognition

Introduction

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Many slides are modified from Serigos Theodoridis's own notes.

Course Outline

- Pre-requisites
 - High School Math
 - or **Common Sense**
- Course Homepage
 - Homepage: <http://mcl.korea.ac.kr>
- Questions
 - You are welcome to come to my office (Engineering Bldg, Rm 508) and ask any questions any time
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 - Email: changsukim@korea.ac.kr

Course Outline

- Assessment Methods
 - Assignments & Attendance: 30%
 - Small coding projects
 - Problem solving assignments
 - Mid-term Exam: 30%
 - Final Exam: 40%
- Textbook and References
 - Sergios Theodoridis and Konstantinos Koutroumbas, *Pattern Recognition*, 4th edition, Academic Press, 2009
 - E-book: <http://www.sciencedirect.com/science/book/9781597492720>, freely accessible in Korea University
 - Sergios Theodoridis, *Machine Learning: A Bayesian and Optimization Perspective*, Academic Press, 2015
 - E-book: <http://www.sciencedirect.com/science/book/9780128015223>, freely accessible in Korea University

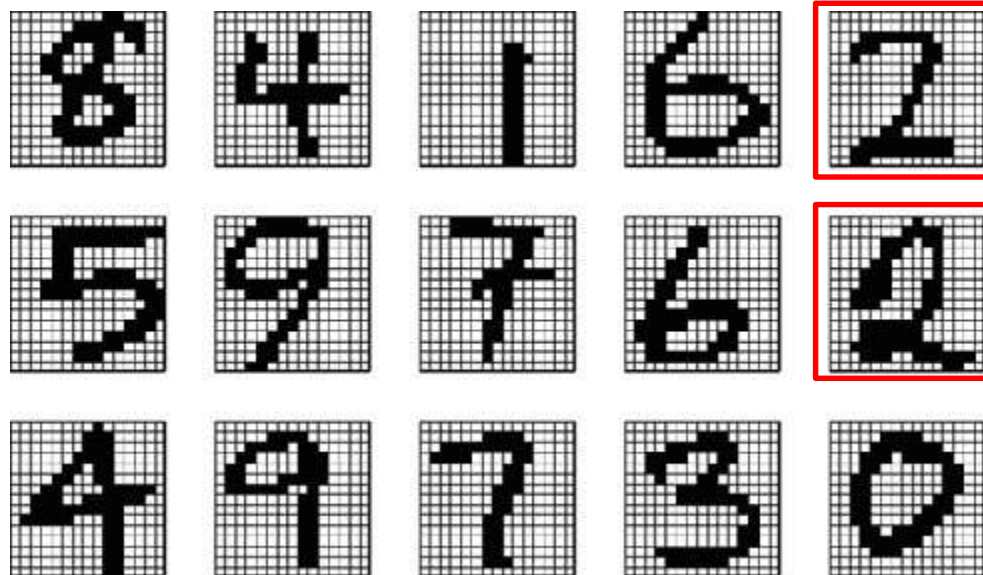
Tentative Course Outline

Week	Topics	Events
1	Introduction	
2	Bayesian Decision	
3	Bayesian Decision	
4	Linear Classifiers	
5	Linear Classifiers	
6	Nonlinear Classifiers	
7	N/A	Mid exam (12 OCT 2016)
8	Nonlinear Classifiers & Deep Learning	
9	Deep Learning	
10	Feature Extraction	
11	Feature Extraction	
12	Context-Dependent Classification	
13	Clustering	
14	Clustering	
15	Clustering	
16	N/A	Final exam (12 DEC 2015)

What is pattern recognition?

Pattern Recognition

- Its goal is to classify objects into a number of classes (or categories)
 - Objects are called patterns



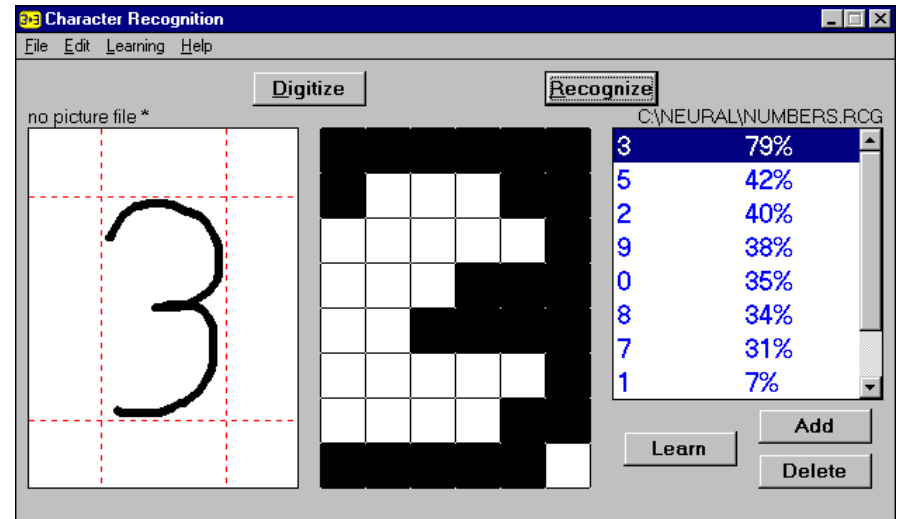
Pattern Recognition

- Ex 1) Machine vision (computer vision)



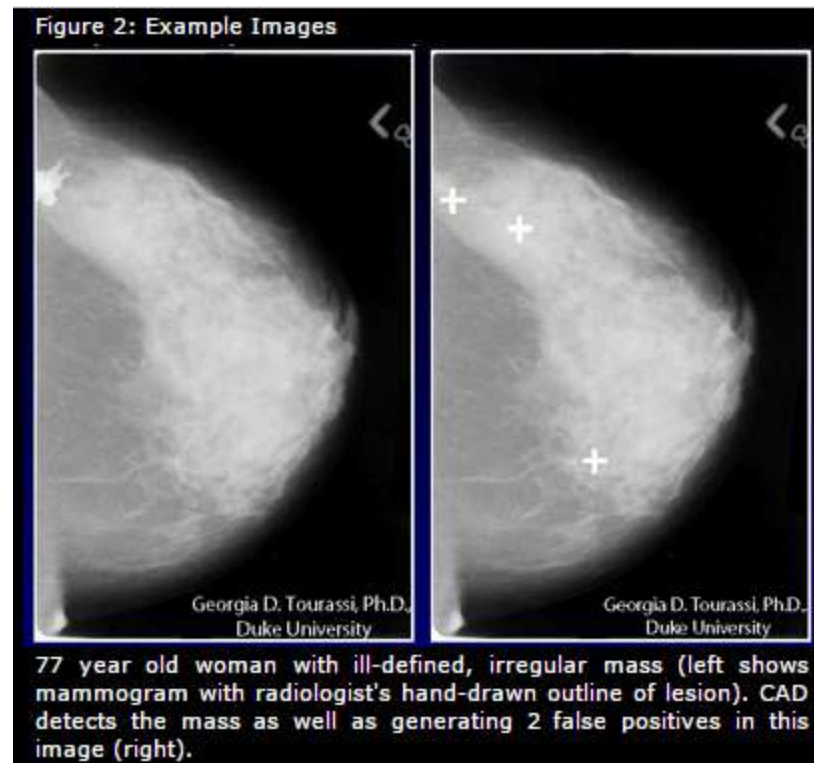
Pattern Recognition

- Ex 2) Character recognition



Pattern Recognition

- Ex 3) Computer-aided diagnosis



Pattern Recognition

- Ex 4) Speech recognition



Pattern Recognition

- Ex 5) State-of-the-art segmentation (2016)

Pattern Recognition

- Ex 5) State-of-the-art tracking (2016)

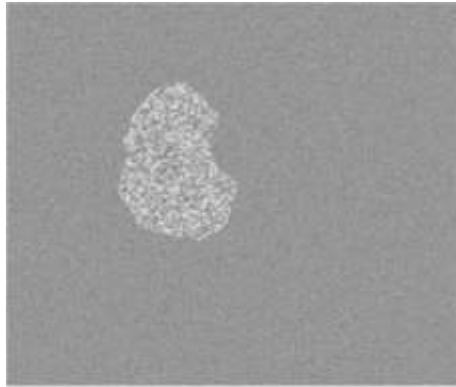
CDT: Cooperative Detection and Tracking for
Tracking Multiple Objects in Video Sequences
- Supplementary material -

Anonymous ECCV submission

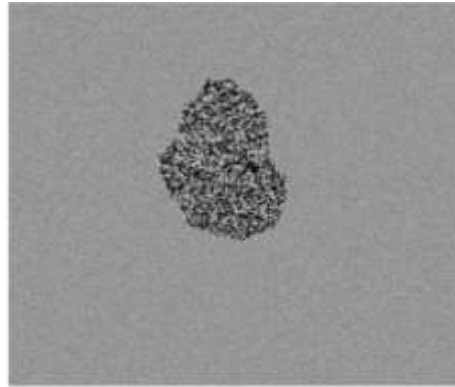
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Terminology

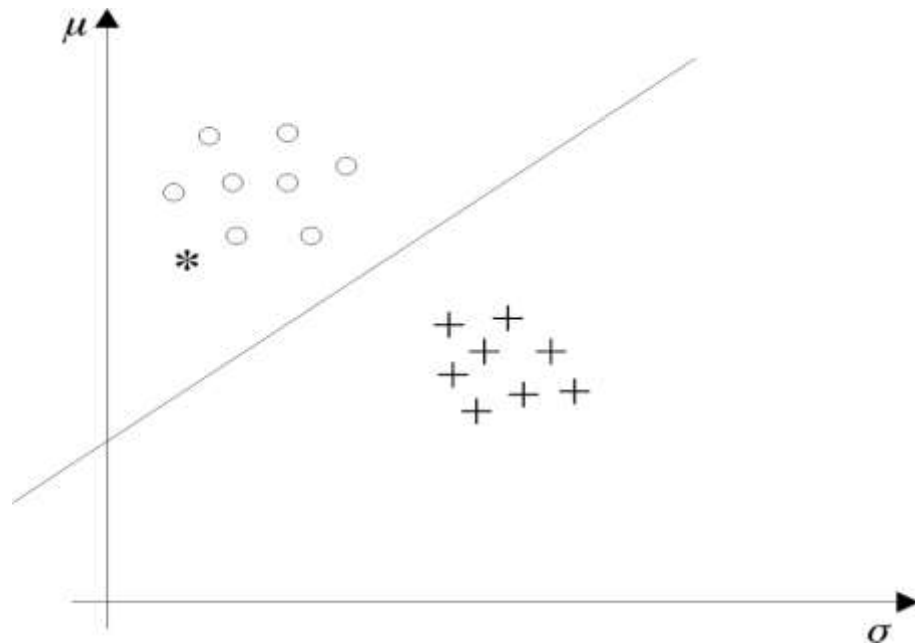
An example:



(a) benign lesion



(b) malignant lesion (cancer)



- **Features:** measurable quantities obtained from patterns
 - The classification task is based on their values.
- **Feature vector:** a number of features x_1, \dots, x_l constitute the feature vector
$$\mathbf{x} = [x_1, \dots, x_l]^T$$
- A **classifier** divides the feature space into regions that correspond to the classes.
- **Decision line**
- **Training patterns**
- **Test patterns**

Design of Classification System

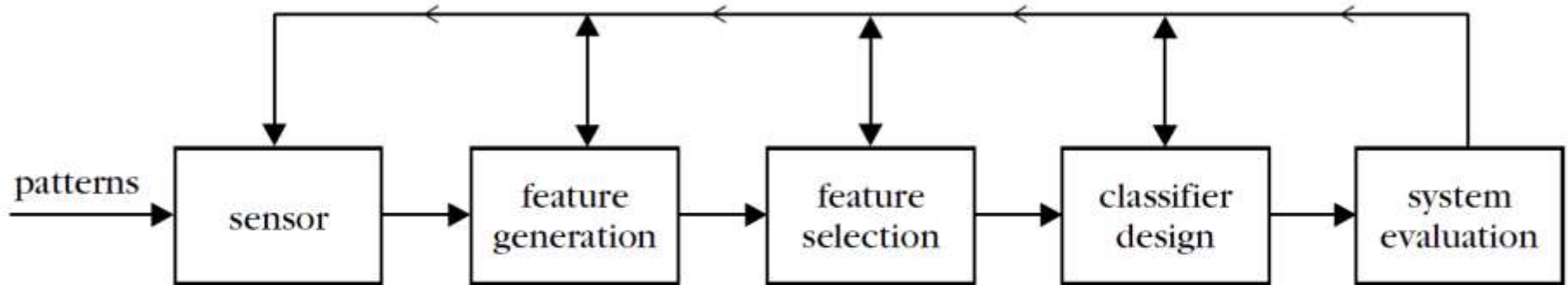


FIGURE 1.3

The basic stages involved in the design of a classification system.

Supervised vs Unsupervised

- Supervised learning (supervised pattern recognition)
 - Patterns, whose classes are known *a priori*, are used for training
- Unsupervised learning (unsupervised pattern recognition, clustering)
 - The number of classes is unknown in general and no training pattern is available
 - Find underlying similarities and group similar vectors together

Example of Unsupervised Learning (Clustering)

Supplementary Video

Multiple Random Walkers and Their Applications to Clustering

Anonymous CVPR Submission

Paper ID 950