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
  - Tel: 02-3290-3217
  - Email: changsukim@korea.ac.kr

Course Outline

- Assessment Methods
  - Quizzes & Attendance: 30%
  - 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
  - Thomas M. Cover and Joy A. Thomas, *Elements of Information Theory,* 2nd Edition, Wiley, 2006
  - 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	Information Theory	
3	Information Theory	
4	Information Theory	
5	Information Theory	
6	Bayesian Decision	
7	Bayesian Decision	
8		Mid Exam (24 APR 2017)
9	Linear Classifiers	
10	Linear Classifiers	
11	Nonlinear Classifiers	
12	Nonlinear Classifiers & Deep Learning	
13	Deep Learning	
14	Feature Selection	
15		Final exam (5 JUN 2017)

3) 말을 천천히해주세요

4) 너무 물흐르듯이 수업을 진행하시는데 좀 더 체계적으로 진행해주시면 좋겠습니다.

5) 없음

6) 감사

7) .

8) 너무 늦게 수업이 진행되었다.

9)

2) 실제 응용 연결시켜서 설명해주심

그러나 설명이 너무 빠르셔서, 바로 이해해야 한다는 어려움이 따름

3) 모르겠습니다

19) 어려운내용인데 잘설명해주셨습니다

20) 교수님의 전공분야와 어느 정도 관련은 있지만 전문 분야는 아닌 수업내용이다보니 강의 내용 전달 면에서 아쉬운 부분이 있었습니다.

21) 교수님 특유의 직설적 화법이 좋았습니다.

13) 없다.

14) .

15) 없음

16) .

17) 없다

18) .

19) 감사합니다

20) .

21) 기초적인 과정의 수업이었기 때문에, 이 수업을 수강하는 학생들을 기초가 부족하여 수업을 수강하는 경우가 많을텐데, 기초과정이라고 너무 러프하게 설명하고, 제대로된 설명 없이 수업이 진행되었다. 그러면서 새로나온 이론을 설명할 때에 자세한 설명없이 진행을 하는 경우가 너무 많았다.

22) 수강 과목에 좀 더 충실한 수업이 되었으면 좋겠다

23) 없음

14) 시험 여러 번 봐도 점수 공개를 한 번도 하지 않음

15) 없음

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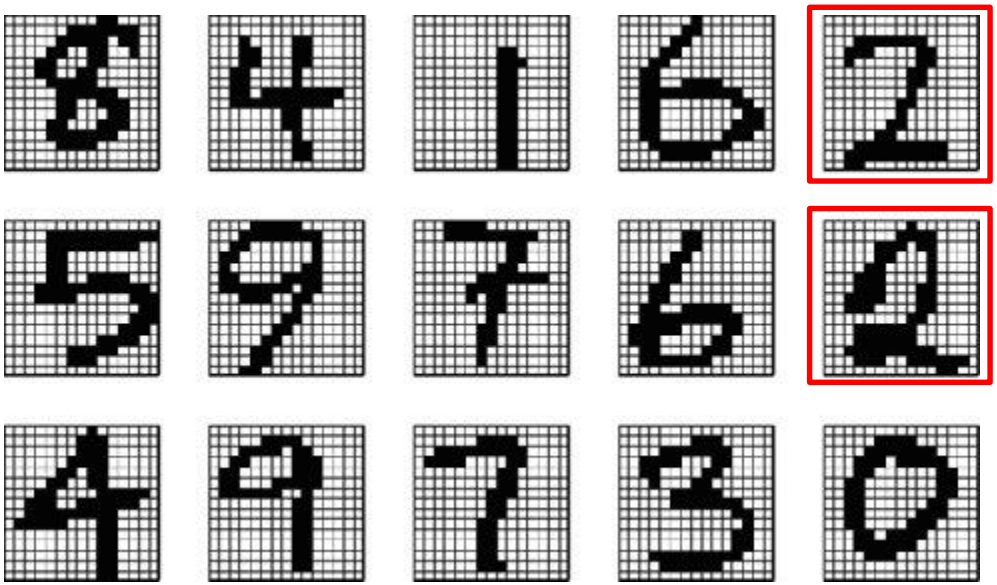
What is pattern recognition?

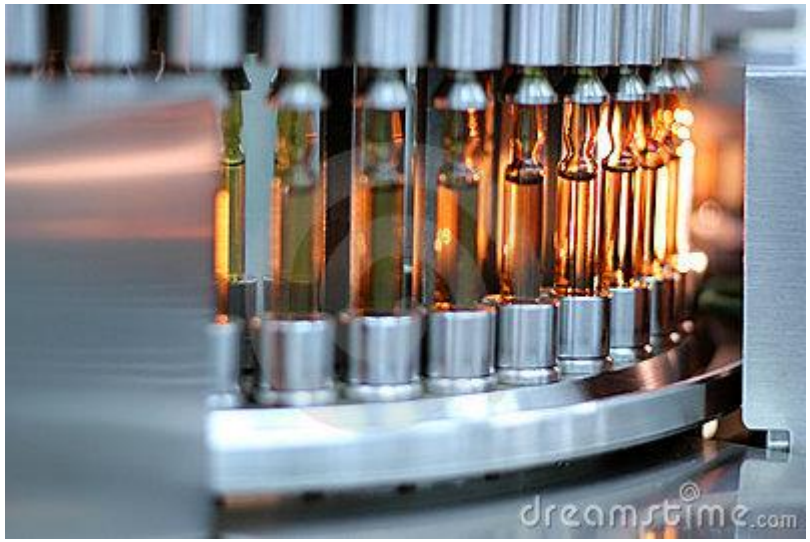
Pattern Recognition

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



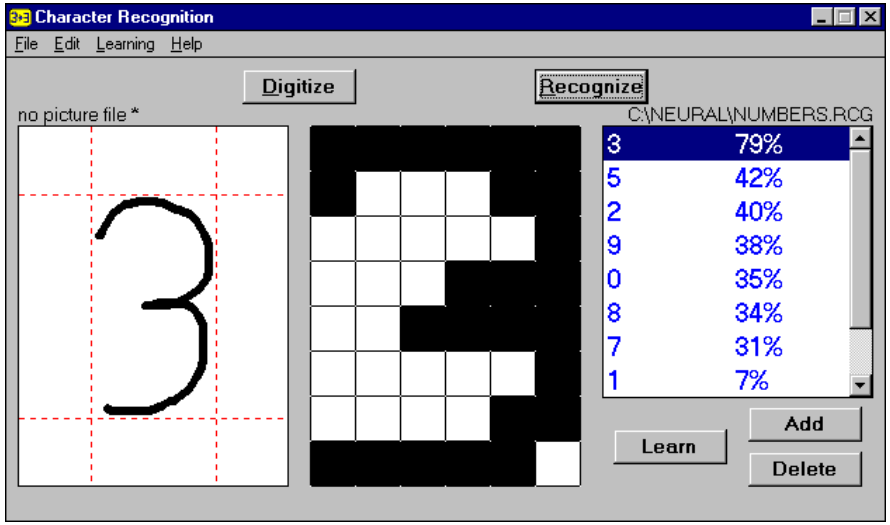
Pattern Recognition

- Ex 1) Machine vision (computer vision)



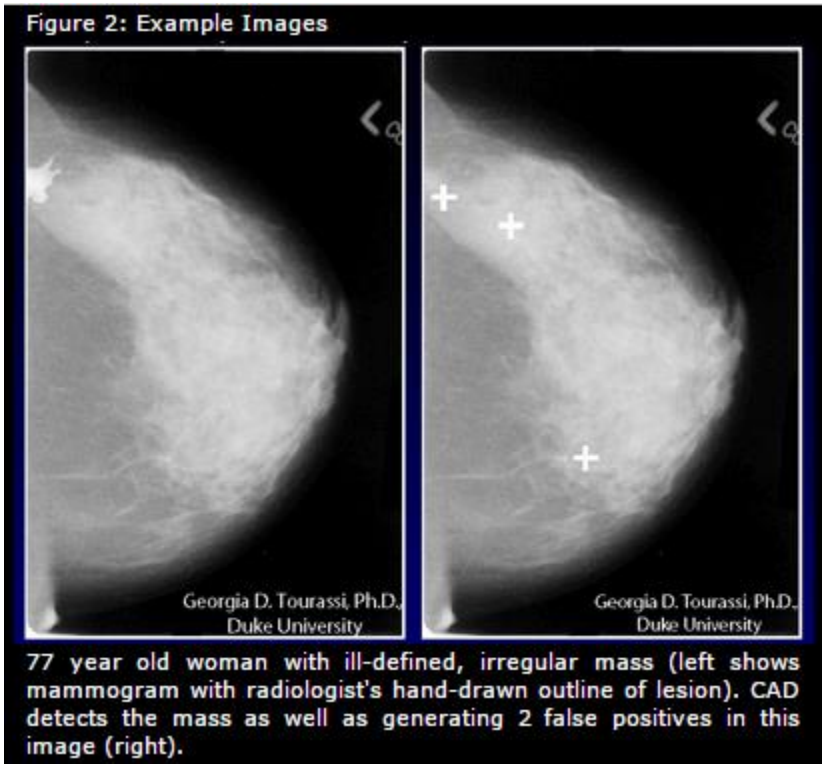
Pattern Recognition

- Ex 2) Character recognition



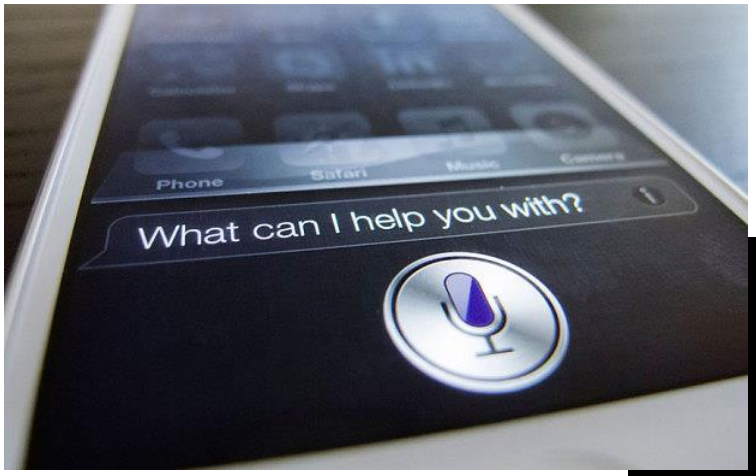
Pattern Recognition

- Ex 3) Computer-aided diagnosis



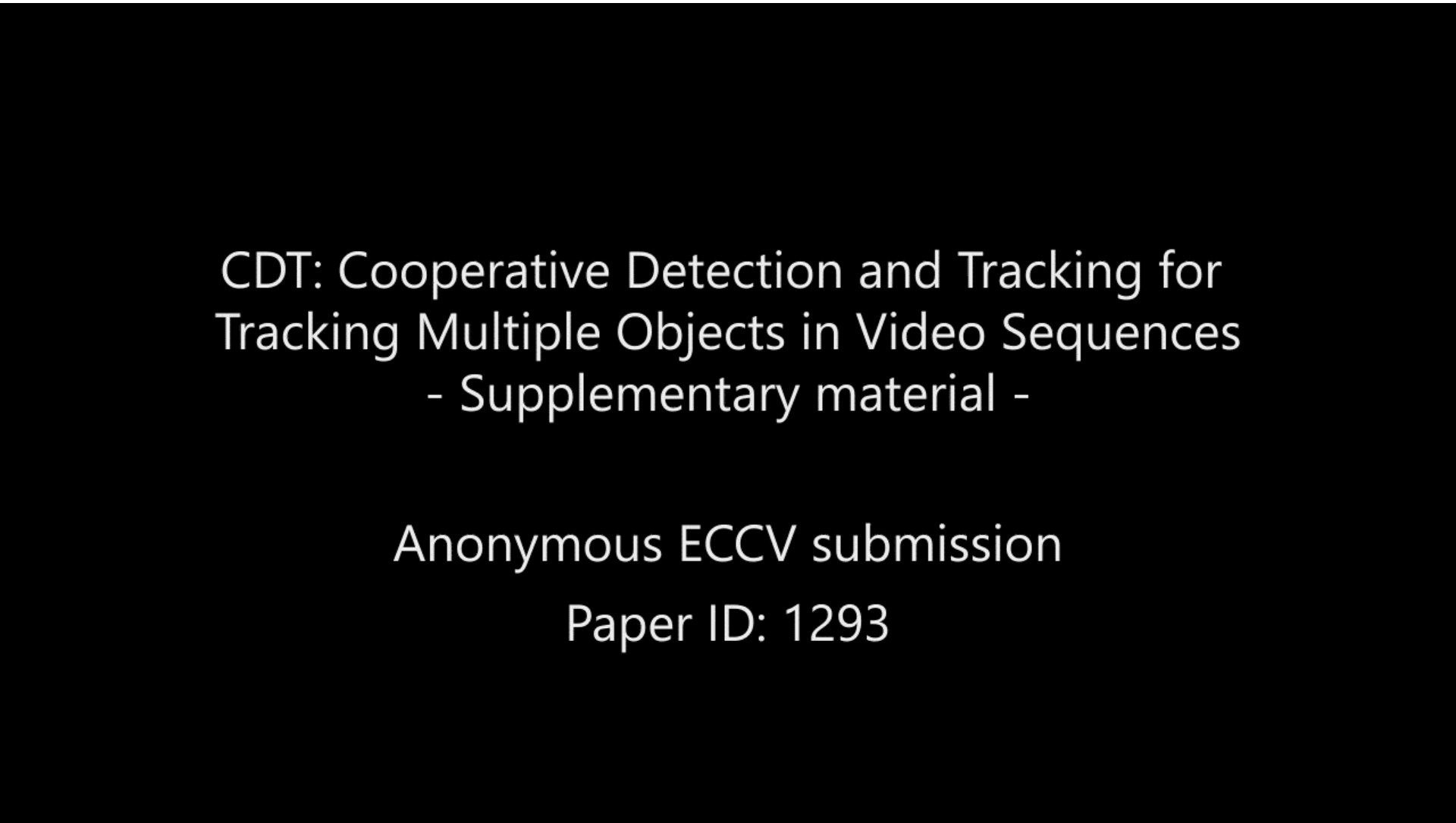
Pattern Recognition

- Ex 4) Speech recognition



Pattern Recognition

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



Pattern Recognition

- Ex 5) State-of-the-art segmentation (2017)

Supplemental Materials

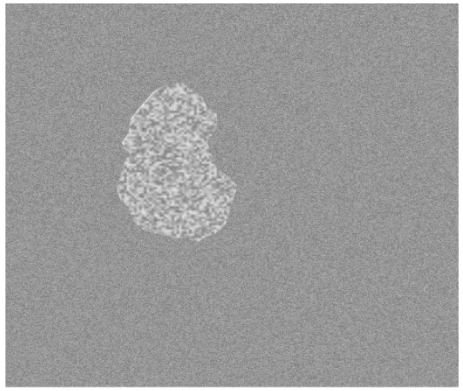
Primary Object Segmentation in Videos Based on Region Augmentation and Reduction

Anonymous CVPR Submission

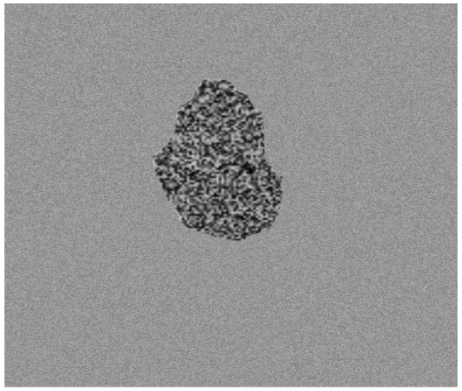
Paper ID 1272

Terminology

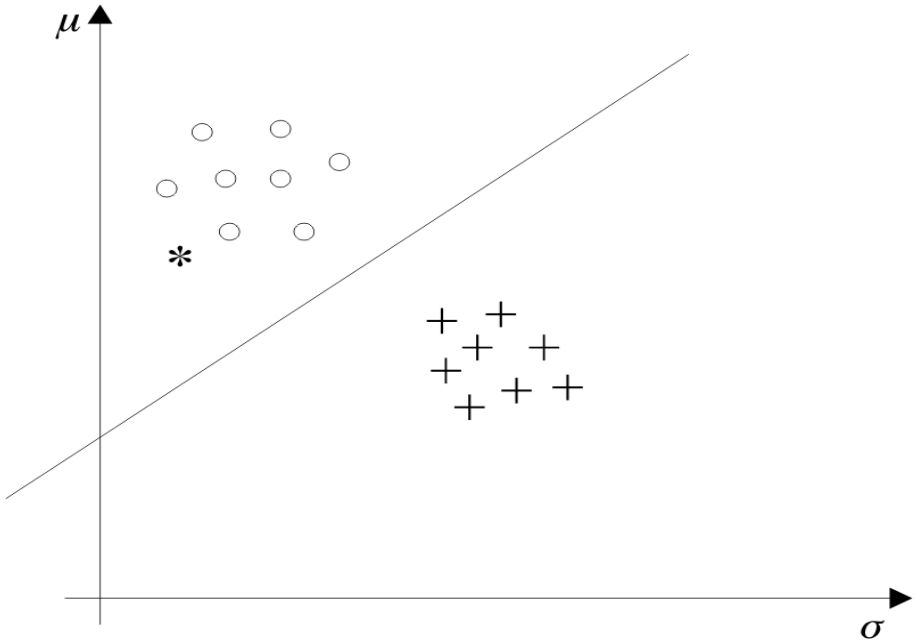
An example:



(a) benign legion



(b) malignant legion (cancer)



- **Features:** measurable quantities obtained from patterns
  - The classification task is based on their values.
- **Feature vector:** a number of features $x_1, \cdots, x_l$ constitute the feature vector

$$\mathbf{x} = [x_1, \ldots, x_l]^T$$

- A **classifier** divides the feature space into regions that correspond to the classes.
- **Decision line**
- **Training patterns**
- **Test patterns**

Design of Classification System

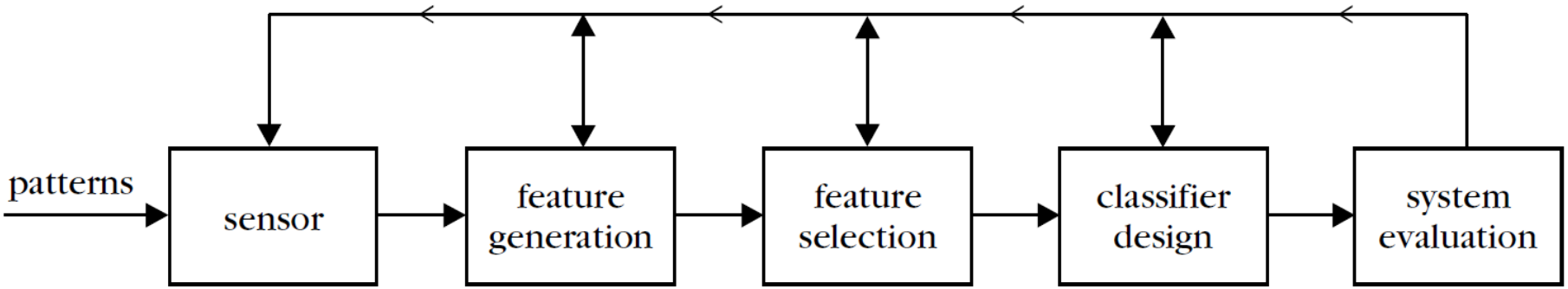


FIGURE 1.3

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)