CS7616 - Pattern Recognition - Introduction

Henrik I Christensen

Robotics & Intelligent Machines @ GT Georgia Institute of Technology, Atlanta, GA 30332-0280 hic@robotics.gatech.edu

Introduction

- 2 Objective / Motivation
- 3 Schedule / Structure
- 4 Homework / Exercises
- 5 Material ...
- 6 Background examples

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Introduction

- Welcome to CS7616
- Pattern Recognition
- Today:
 - Outline of the course Objective / Motivation
 - Schedule of lectures
 - Style of the course
 - Exercises / Projects
 - Material to be used in the course

Information

• Class website:

http://www.cc.gatech.edu/~hic/CS7616 Schedule, Material, Slide copies, General Information

- T-Square Usual stuff, announcements, ...
- Slides PDF copy will be posted after class with summary
- Piazza You will receive an invitation for the class forum Use it for general questions / discussions

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Staffing



Henrik I Christensen Lecturer



Sidd Choudhary, TA



Steven Hickson, TA



Ruffin White, TA

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Objective

- Get a solid knowledge of key methods in pattern recognition
- Discuss state of the art methods / techniques in pattern recognition
- Explore a few representative data sets that illustrate use of pattern recognition
- Explore increasingly complex methods over the semester
- This is *not* a general machine learning course

Motivation

PR is used everywhere in daily lives

Speech Recognition



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Medical Diagnostics



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Face Recognition



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Scene Labeling



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Netflix Movie Recommendation



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Generic Problem Structure



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Structure

- A mixture of foundational lectures and
- Group discussions of influential/current papers
 - We will divide class into 4 groups for smaller discussions
 - Every student is expected to present 1 paper during term as part of the group discussions
- Large group lectures are a challenge for in-depth discussions

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Lecture topics

- Bayes Decision Theory
- 2 Linear Methods for Classification
- Sub-space Methods
- Insemble Methods
- Hidden Markov Models
- Prototype/memory based methods
- Kernels and other tricks
- Tree based techniques
- Large Margin Classifiers
- Deep Learning

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Discussion Sessions

- Discuss two papers per class:
- Each paper:
 - $\bullet\,$ Student presentation of paper $\approx\,15$ minutes intro
 - Group: What are the main lessons/key insight from the paper
 - Group: How could it be improved / what would you do differently?
 - TA/Lecturer: guide discussion / presentation

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Homework

- Leverage of a set of datasets varying in complexity, ...
- A homework assignment roughly every month
- 4 assignments in total
- First three will use the common datasets (Gaussian / Ensemble / Temporal)
- Final homework option to use your own dataset large margin / deep learning

Credit / Grading

- 45% Homeworks 1-3
- 25% Homework 4
- 25% Class Presentation / Discussions
- 5% Class participation
- There will no final exam!

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Submission of material

- Please submit home work on time.
- Late submissions will be 75% for 1 day late, 50% for 2 days late and then 25% after that
- You can ask for permission with a good motivation, but have to do it well ahead of time (not an hour before!)
- Do not expect that we are online the last hour before a deadline. Unfair to the TAs and others.

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Book 1: Elements of Statistical Learning



Main textbook
 Elements of Statistical Learning

 T. Hastie, R. Tibshirani & J.
 Freiedman
 Springer Verlag, 2nd Edition, 2009
 http://www-stat.stanford.edu/
 ~tibs/ElemStatLearn

Book 2: Machine Learning - Kevin Murphy



• Machine Learning

K. Murphy MIT-Press, 2013

Book 3: Duda, Hart and Stork



• Pattern Classification

R. O. Duda, P. E. Hart and D. G. Stork Wiley Interscience, 2nd, 2001, ISBN 0-471-05669-3

- You can use Matlab or Python we will try to support both
- Some demonstrations using Matlab / K. Murphy Toolkit
 - https://github.com/probml/pmtk3
- Some examples using Scikit-Learn Toolkit
 - http://scikit-learn.org
- Still try to finalize 2-3 datasets for homework

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Model based recognition

- Google has 2.5 million objects in the 3D object warehouse
- Can we use these for recognition of objects?
- Can we provide context for object recognition?





Image: A math a math

Gesture based recognition



- Tracking of hands for person for robot interaction
- Color classification of hands and head of user
- Tracking of objects using Kalman filter
- HMM based recognition of gestures

Recognition of daily activities

- Images of standard objects to recognize daily activities
- Example application for assistance to people with memory challenges
- Using Deep Learning for Recognition of situations



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Next Lecture

- Thursday Bayes Decision Theory
- DHS: Chapter 2 (2.1-2.6)
- We will provide the initial list of papers for class discussions
- Discuss the datasets for home work

Questions?

Questions?

Henrik I Christensen (RIM@GT)

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