CS7616 - Pattern Recognition - Introduction

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Outline

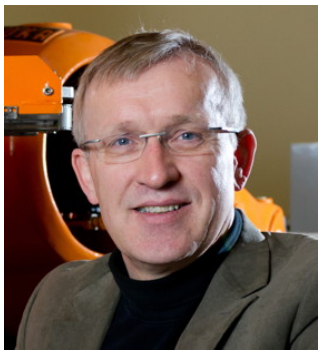
Introduction

- 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

Staffing



Henrik I Christensen
Lecturer

Sidd Choudhary, TA

Steven Hickson, TA

Ruffin White, TA

Outline

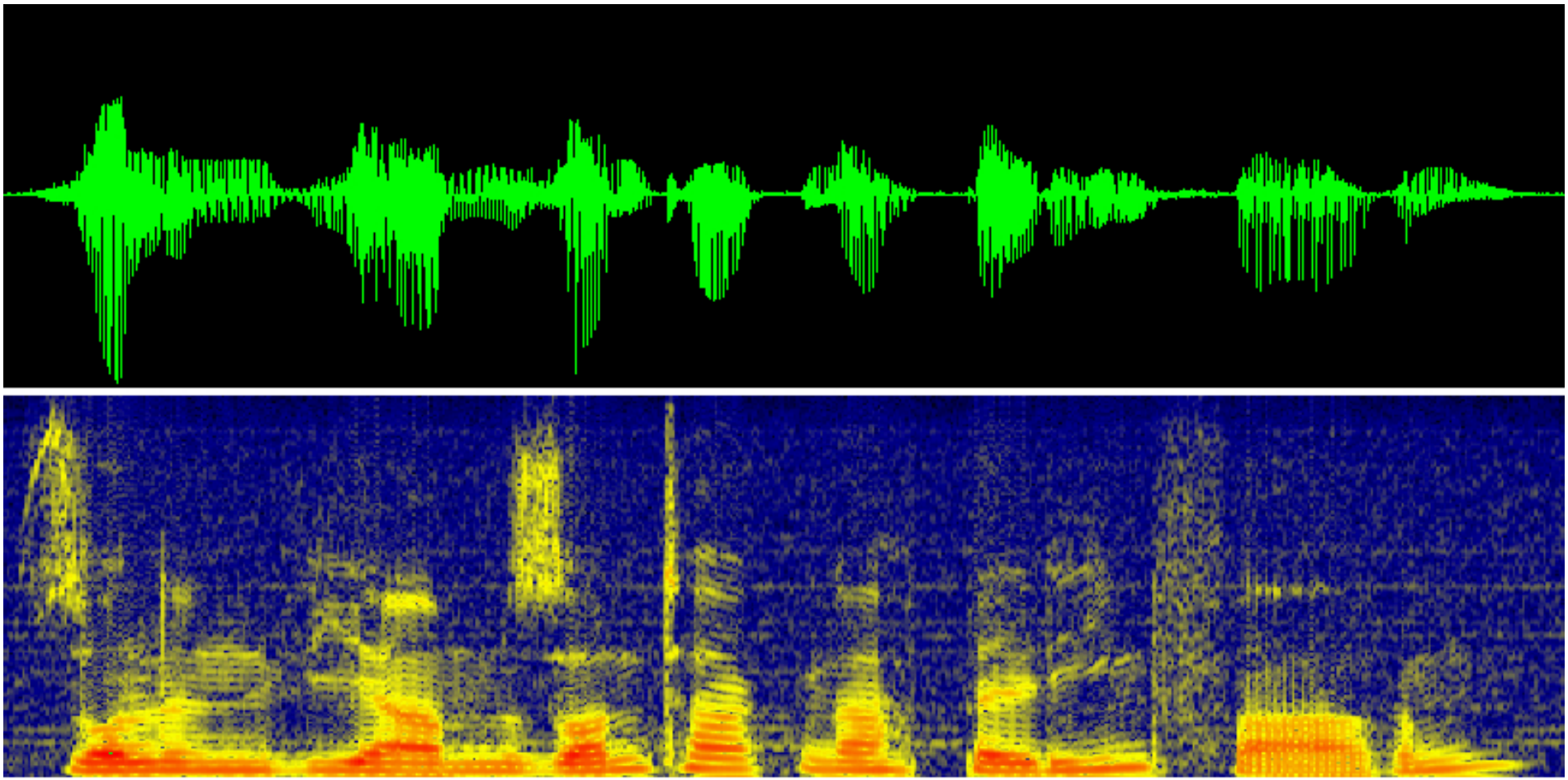
Objective

- 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

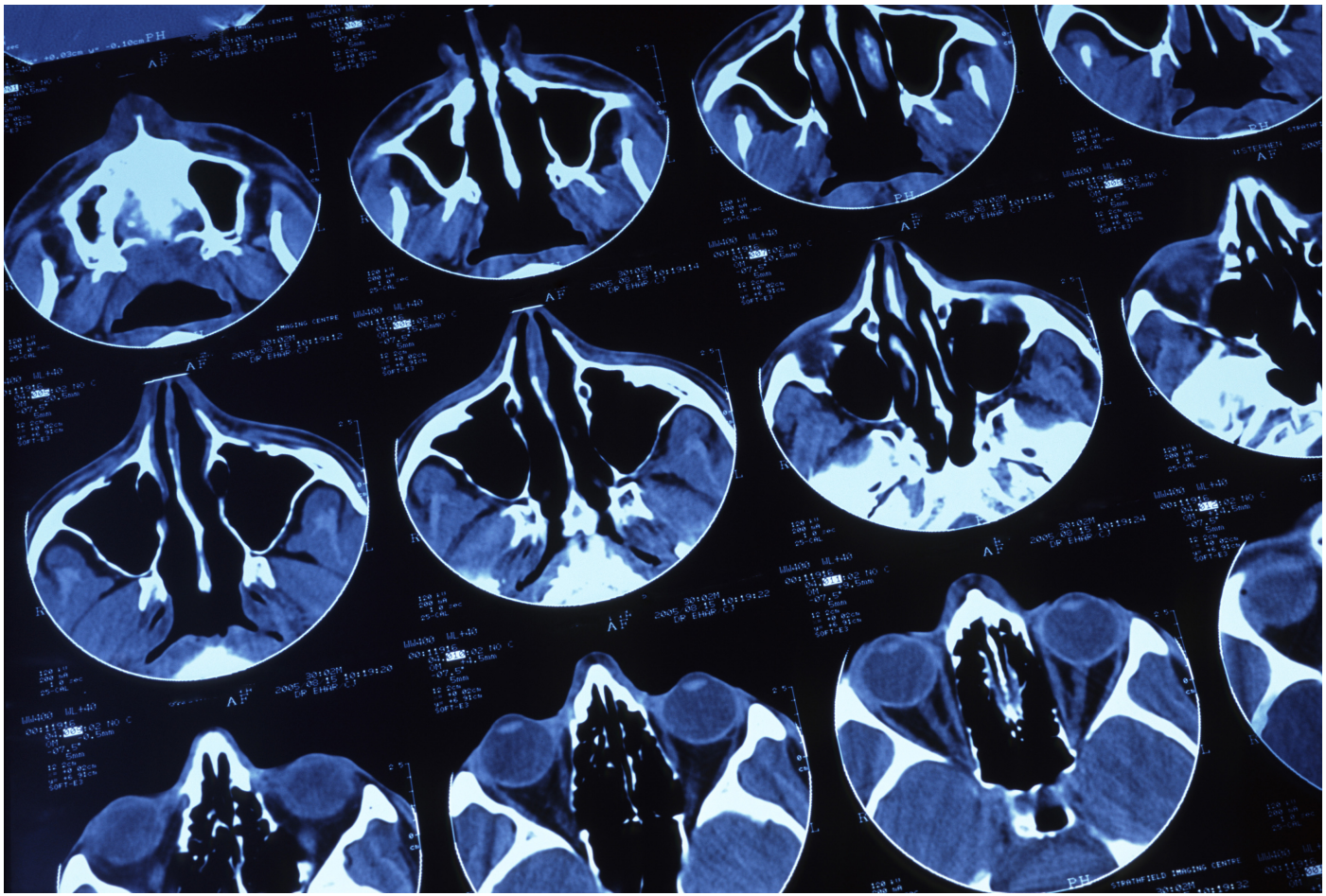
PR is used everywhere in daily lives

Speech Recognition

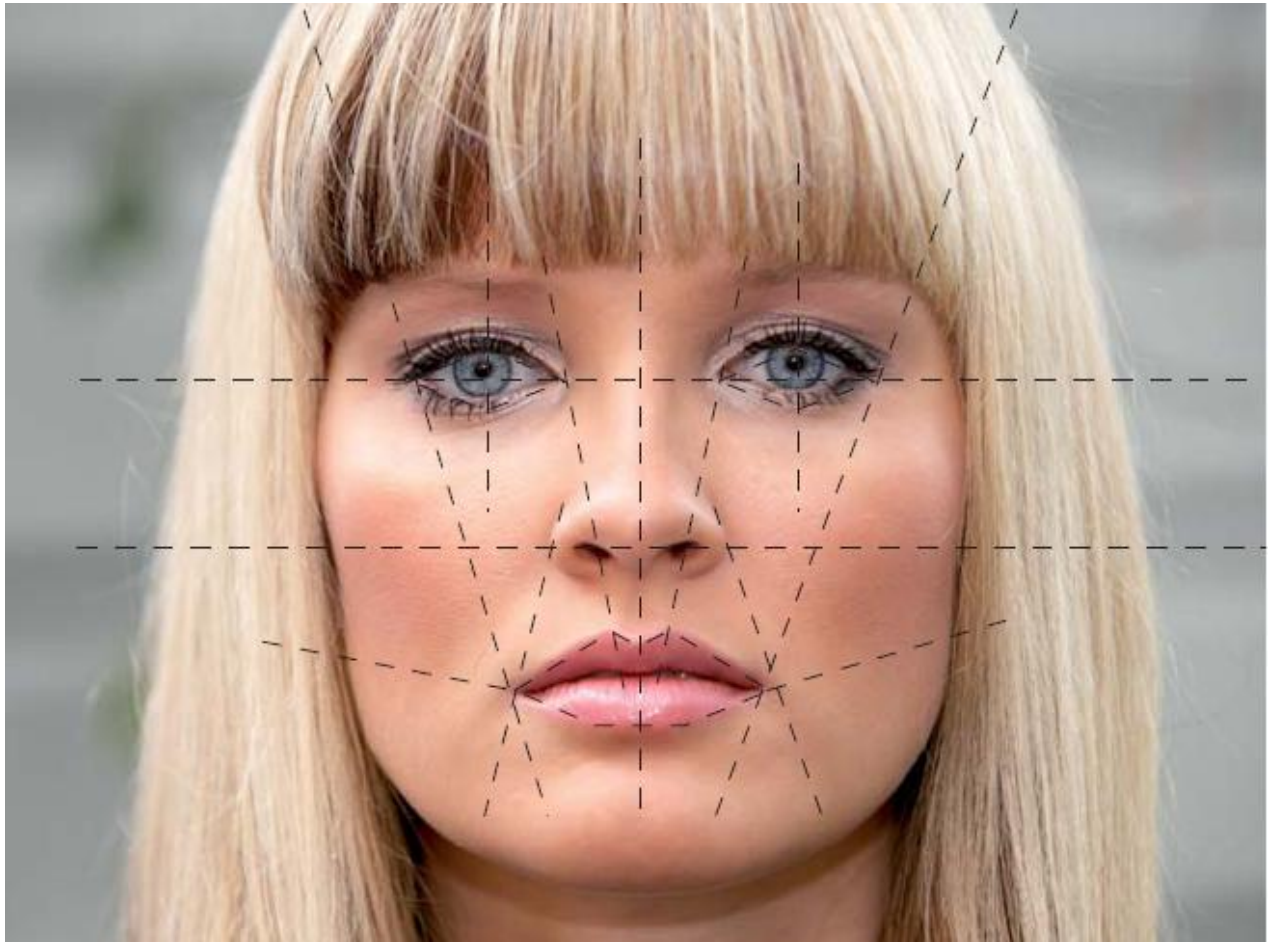


Financial trading

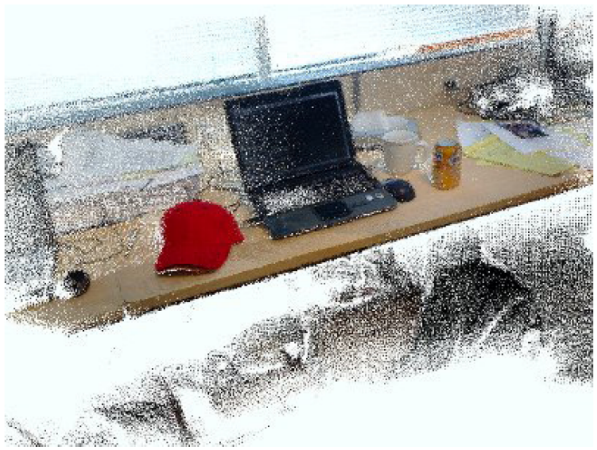
Medical Diagnostics

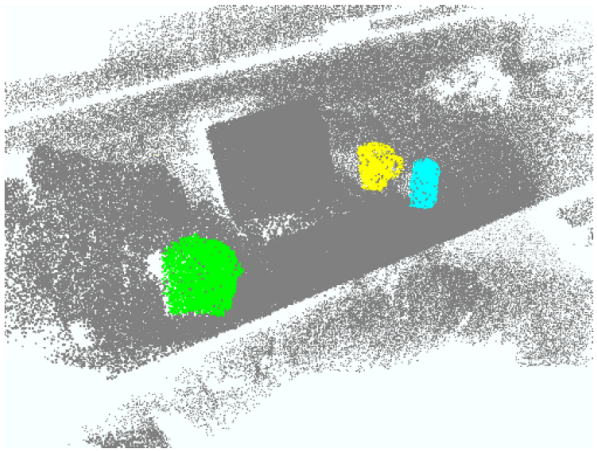
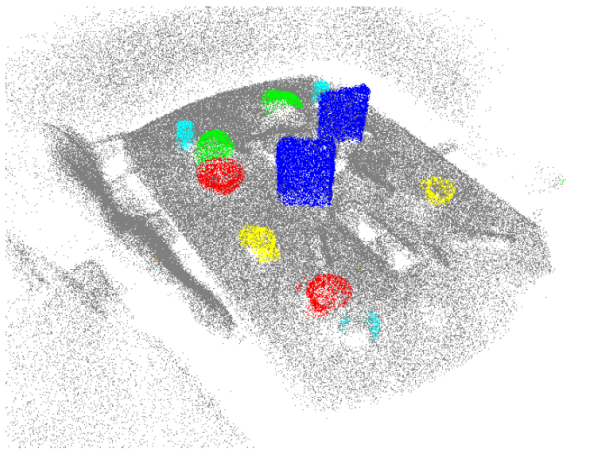
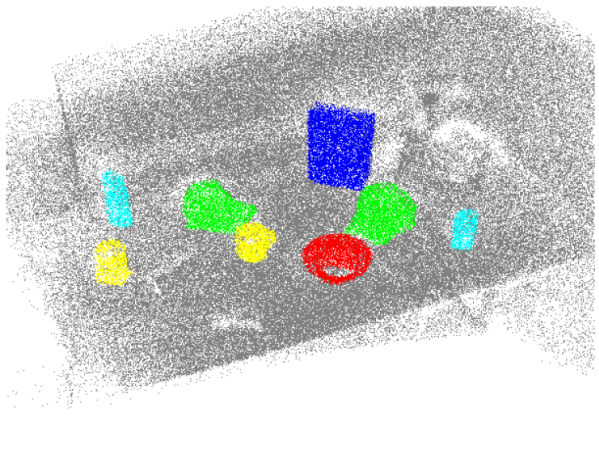


Face Recognition

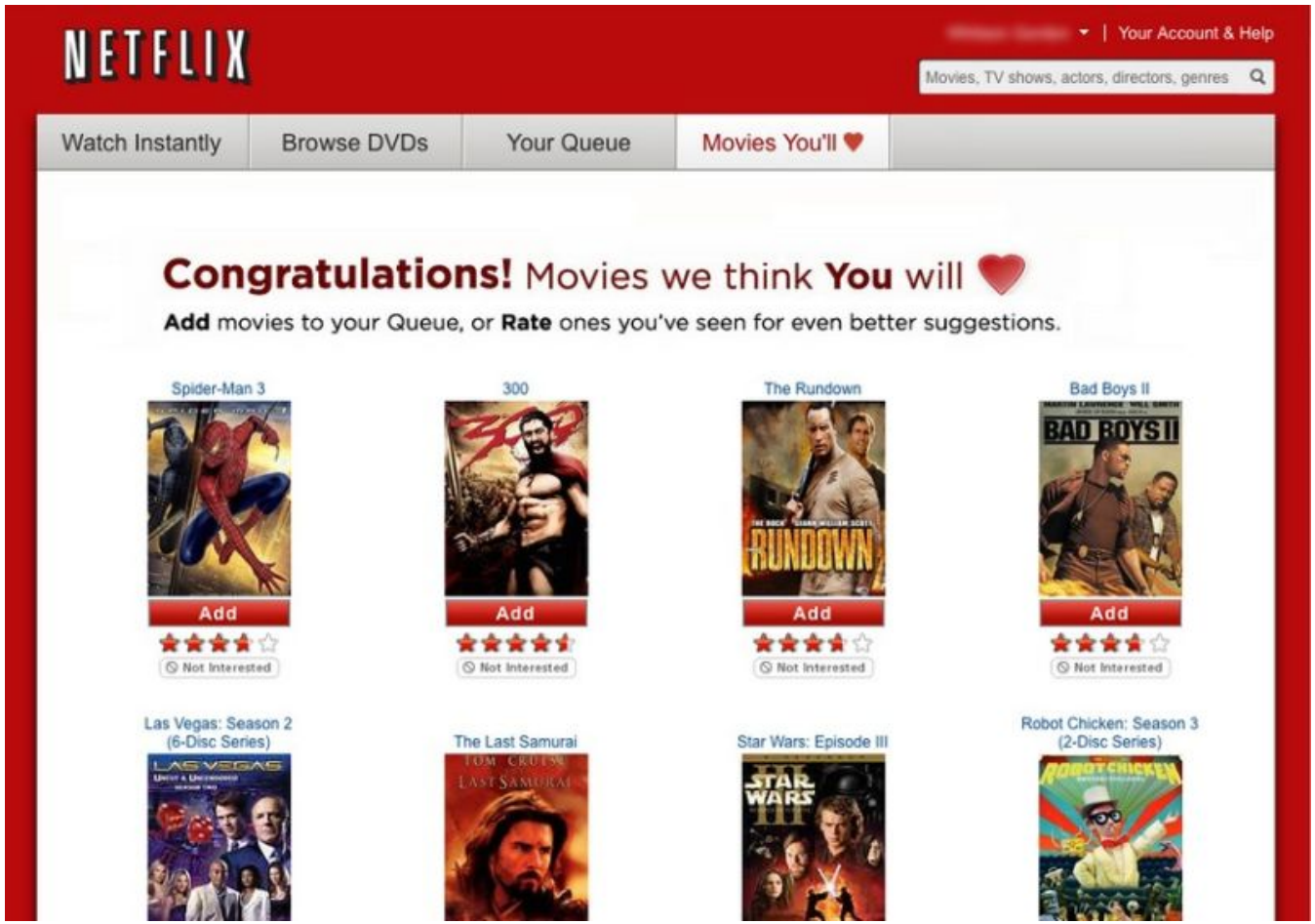


Scene Labeling



Netflix Movie Recommendation



Generic Problem Structure

Outline

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

Lecture topics

1. Bayes Decision Theory
2. Linear Methods for Classification
3. Sub-space Methods
4. Ensemble Methods
5. Hidden Markov Models
6. Prototype/memory based methods
7. Kernels and other tricks
8. Tree based techniques
9. Large Margin Classifiers
10. Deep Learning

Discussion Sessions

- Discuss two papers per class:
- Each paper:
  - 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

Outline

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

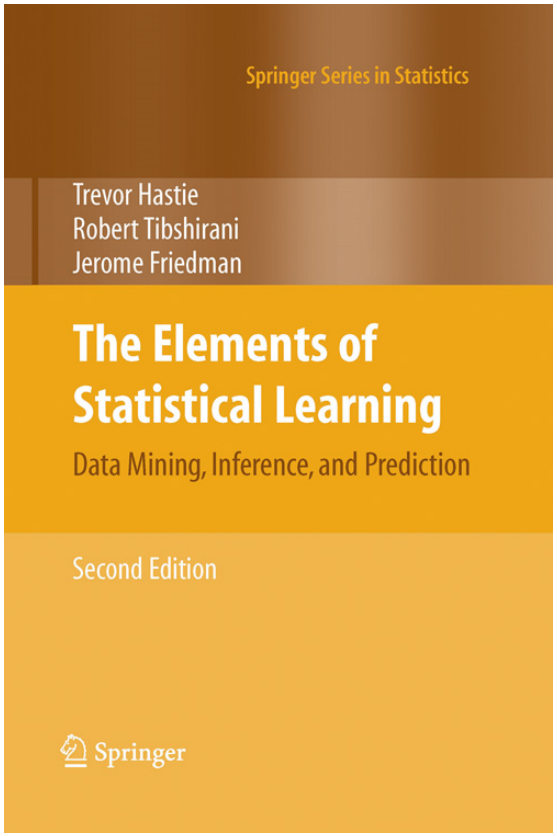
- 45% Homeworks 1-3
- 25% Homework 4
- 25% Class Presentation / Discussions
- 5% Class participation
- There will no final exam!

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.

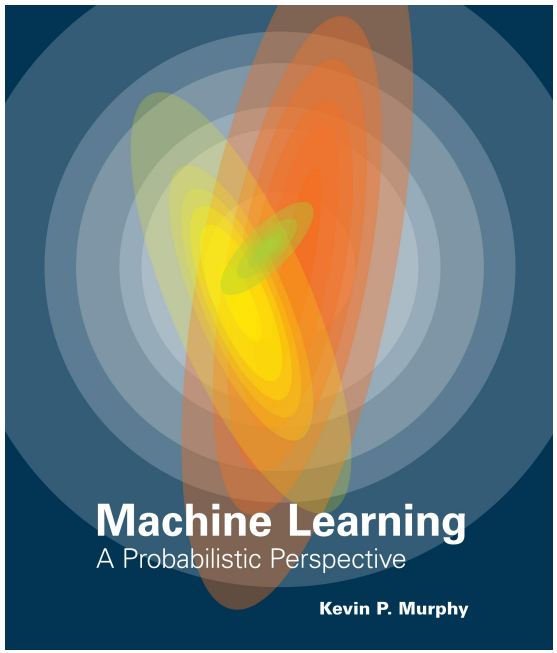
Outline

Book 1: Elements of Statistical Learning



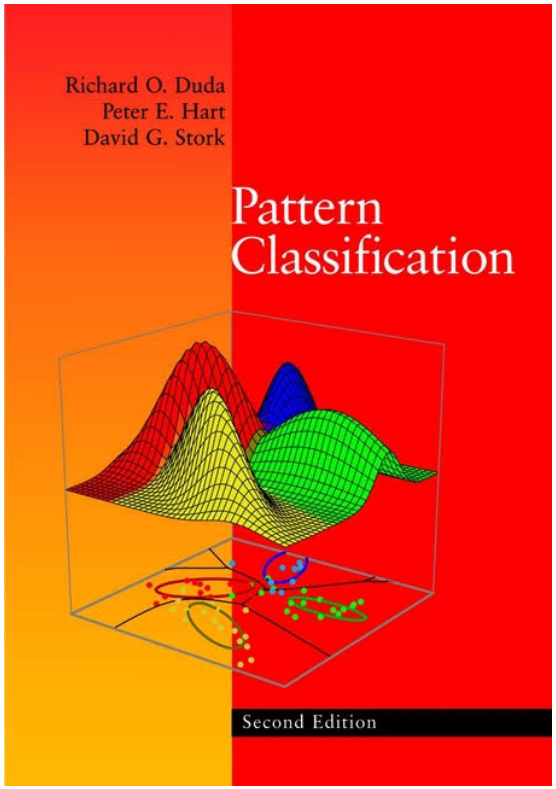
- Main textbook
  Elements of Statistical Learning
  T. Hastie, R. Tibshirani & J. Freiedman
  Springer Verlag, 2nd Edition, 2009
  `http://www-stat.stanford.edu/~tibs/ElemStatLearn`

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

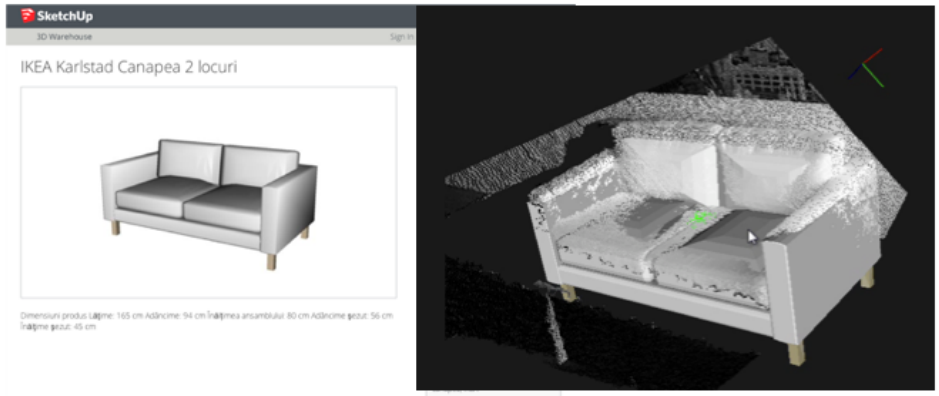
Software

- 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

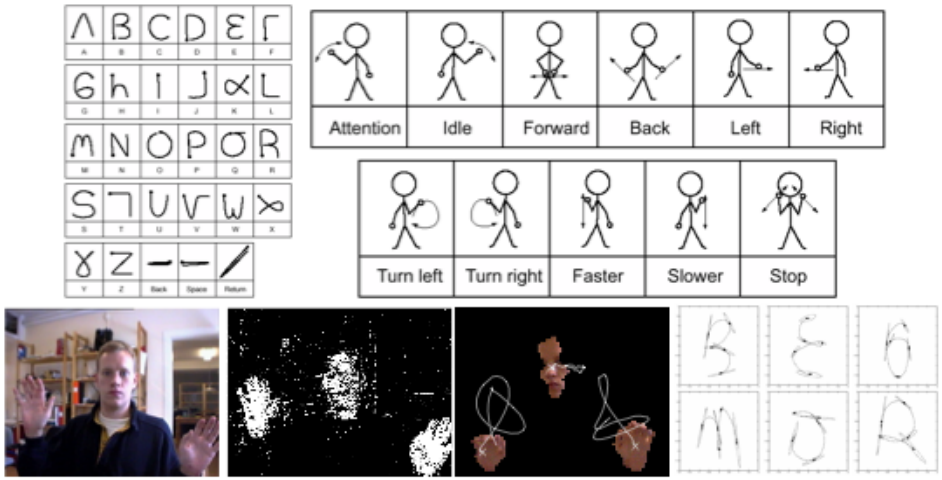
Outline

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?



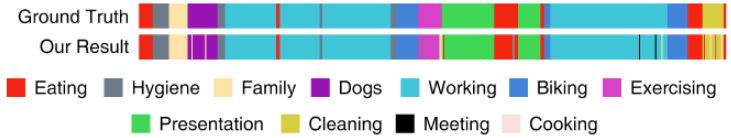
Gesture based recognition



- 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



Outline

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?