Machine Visual Perception

Cengiz Öztireli
Course format

• 12 + 4 hours
• One practical exercise (20%)
• One course project (80%)
  – We will release a list of suggested projects
  – You may propose others, to be confirmed by us
  – In groups of 2-3, we will assign
  – More information will be on the webpage soon
Contributors

• Fangcheng Zhong (fz261)
• Param Hanji (pmh64)
• Chris Town (cpt23)
Our goal is to enable a computer to “see” and “understand” the environment.

- Computer vision
- Machine/ deep learning
Assisted Diagnosis
Machine Learning

**Model 1...**
- **on Training data.**
  - 30 10 error: 22.5%
  - 32 8 acc.: 77.5%
- **on Test data.**
  - 32 8 error: 23.8%
  - 29 11 acc.: 76.2%

**Model 2...**
- **on Training data.**
  - 37 3 error: 7.5%
  - 37 3 acc.: 92.5%
- **on Test data.**
  - 37 3 error: 11.3%
  - 34 6 acc.: 88.7%

**Model 3...**
- **on Training data.**
  - 37 0 error: 0%
  - 37 0 acc.: 100%
- **on Test data.**
  - 34 6 error: 21.3%
  - 29 11 acc.: 78.7%

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“I’ve narrowed it to two hypotheses: it grew or we shrunk.”

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Paradigms of Machine Learning

- Supervised learning
  - Given a training set of N examples
    \[(x_1, y_1), (x_2, y_2), \ldots, (x_N, y_N)\]
  - Minimize the discrepancy between the predicted output and the given output (ground truth)
Paradigms of Machine Learning

• Supervised learning

Given the pixels of a hand-written number, identify the number.
Paradigms of Machine Learning

• Un-supervised learning
  – Learning patterns without specific target output values
  – Example: clustering
Paradigms of Machine Learning

- Un-supervised learning
Paradigms of Machine Learning

• Un-supervised learning
Paradigms of Machine Learning

• Semi-supervised
  – Learning in the case of sparse labeled (supervised) data
  – Use accessible data to improve decision boundaries and better classify unlabeled data
Paradigms of Machine Learning

• Self-supervised learning

Learn data representations via auxiliary tasks.
Paradigms of Machine Learning

• Reinforcement Learning
  – Learning what actions to take in order to maximise some reward
Paradigms of Machine Learning

• Reinforcement Learning
  – Learning what actions to take in order to maximise some reward
Input type

• What can a machine “see”?
  – Image: an array of pixels
  – Video: a list of images
  – Point clouds
Input type

• What can a machine “see”?
  – Image: an array of pixels
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Output type

Classification

Regression
Regression
Classification

Bird

Flamingo

Cock

Cat

Egyptian cat

Persian cat
Practical Exercise

- Two parts: classification & regression
- Details will be on the course web page and Moodle
- Any questions? Please ask Param, Fangcheng, myself.
- Release: 19 October 2022, 12:00 PM
- Deadline: 11 November 2022, 12:00 PM
Course Project

• Main task:
  • implementing a paper or,
  • extending an existing implementation or,
  • applying an implementation to a new task and dataset.

• Project deliverables:
  • A project plan
  • Project presentation
  • Project report
  • Implementation

• Project deadline: 1 December 2022, 12:00 PM
Course Project

• Timeline:
  • This week on Friday we will release project proposals
  • By this week Friday
    • send names and CRSids of group members to aco41
    • only one email per group
  • By next Friday
    • send a short project proposal (template, also on Moodle)

• All announcements are on Moodle!