Course introduction 2020

Mitko Veta, Federica Eduati

Eindhoven University of Technology
Department of Biomedical Engineering

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Why machine learning?

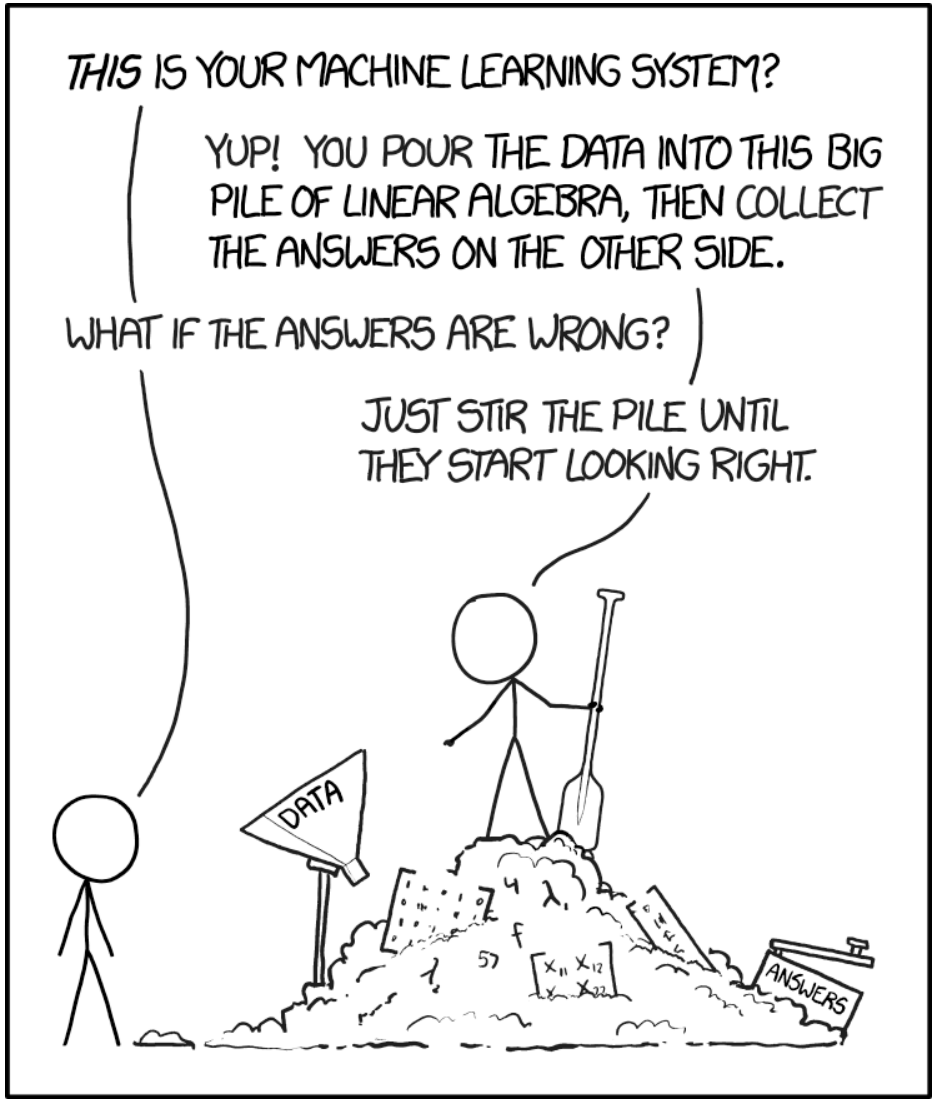
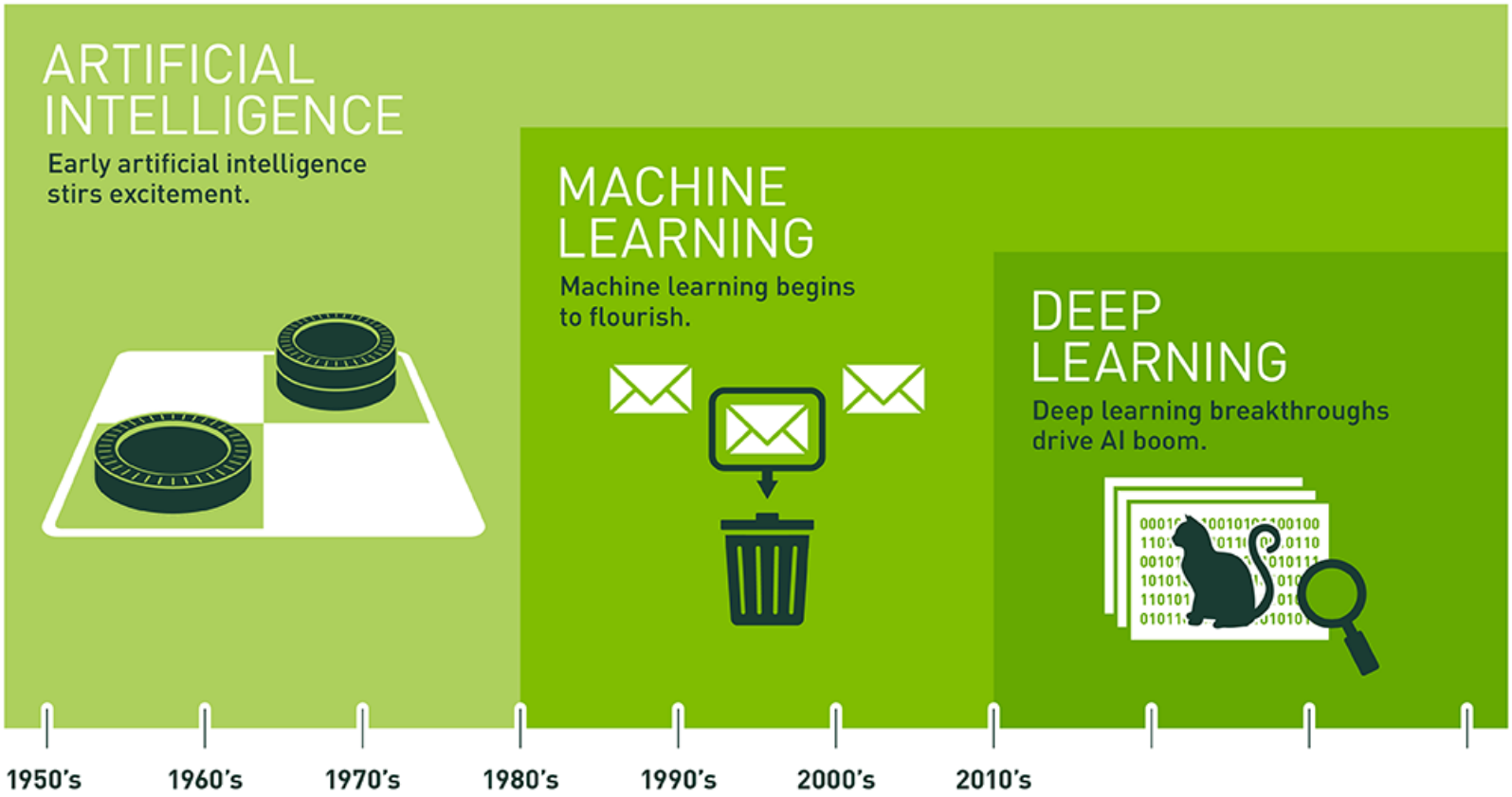


Figure source: xkcd.com

Historical perspective



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Figure source: nvidia.com

Topics covered in the course

- Week 1: Machine learning fundamentals I (Mitko Veta)
- Week 2: Machine learning fundamentals II (Mitko Veta)
- Week 3: Linear models (Federica Eduati)
- Week 4: Deep learning I (Mitko Veta)
- Week 5: Deep learning II (Jelmer Wolterink, U Twente)
- Week 6: SVM, random forests (Federica Eduati)
- Week 7: Unsupervised machine learning (Federica Eduati)

Weeks 1-6 lecture and practical. Week 7 only lecture.

The course in a nutshell

- Assessment
  - 65% written exam
  - 25% practicals
  - 10% reading assignment
  - 0% **mandatory** Python self-assessment quiz in the first week
- GitHub repository used for material dissemination
- Canvas used for communication and submissions/grading
- Lectures, time: Mondays 13.30 - 15.30, location: Atlas - 1.210 and on-line
- Guided self-study, time: Mondays 15.30 - 17.30, location: on-line via Microsoft Teams

Study materials

- Main: lecture slides and practicals
- Books
  - **Deep Learning**, Ian Goodfellow and Yoshua Bengio and Aaron Courville
  - **The elements of Statistical Learning**, Trevor Hastie, Robert Tibshirani, Jerome Friedman
- Specific chapters and additional material (such as papers) are referenced in the lecture slides

Practicals

- Distributed as Python notebooks
- Deliverables
  - Python functions and/or classes (.py files) that implement basic functionalities (e.g. a k-NN classifier)
  - A **single** Python notebook that contains the experiments, visualization and answer to the questions and math problems.
- The assessment rubric for the practicals can be found in the handouts for week 1
- Instructions to setup the environment are in GitHub
- Each group has a teaching assistant that can be contacted via Teams during the practical sessions
- You are encouraged to use Canvas Discussion to ask general questions

Reading assignment

- Select a paper per group with following criteria
  - Describes an application of Machine Learning to a Medical Imaging or Computational Biology problem
  - Recently published (after 2015)
  - Published in a high-quality journal (reference list in GitHub)
  - On a topic that you find interesting and want to learn more about
- Use the 'paper selection' assignment to discuss paper selection with us (propose a list)
- Write a review (800 words) with:
  - Summary of the application domain of the paper
  - Summary of the used (Machine Learning) methodology and evaluation metrics
  - Discussion of strong and weak points of the methodology and evaluation metrics
  - Suggestion of alternative methodology, evaluation metrics and ideas for improvement