Artificial Intelligence

Corso di Laurea in Computational Finance
2nd semester - 9 CFU

Luca Pajola, Luca Pasa, Elisa Tosetti

Course Logistics

- Resources (available online):
  - Bishop
  - Mitchell
  - Deep Learning Book
  - Mathematics for Machine Learning (math concepts)
  - Other resources on Moodle: slides, lecture notes, cheat sheets

Course Logistics

- The course is a 9 CFU
- Two distinct MSc courses
  - Computational Finance
  - Economics
- Structure
  - General ML (6 CFU)
    - Common in both degree
    - Ref: Luca Pajola, Luca Pasa
  - Applied ML (3 CFU)
    - Computational Finance
      - Ref: prof. Luca Pajola, prof. Luca Pasa
    - Economics
      - Ref: prof. Elisa Tosetti

Course Logistics

- Course Examination
  - Evaluated two aspects
    - Theory (21 points)
    - Practice (11 points)

  - To be sufficient, you have:
    - at least 12 in the theory
    - at least 18 in the sum of theory and practice

Course Logistics

- Two exam modalities
  - Regular Exam
    - Both Theory and Practical Aspects of ML
      - Standard Examination with Q&A
      - It covers the entire 9 CFU
  - Regular Attendant Exam
    - The Practical Examination through (11 points)
    - A Theoretical part (21 points)
      - ⅓ shorter compared to the regular exam

Course Logistics

- The practical project
  - LAB Project + Report + Presentation
    - **ONLY** last week of the course: (dates to be announced ~second week of June)
    - Group of 3 people
  - You can keep the grade for all the theoretical examinations
  - We plan to give you more details about the project at 29/04

- There will be in total 5 theoretical examinations
  - 2 during the summer session (june - july)
  - 2 during the autumn session (september)
  - 1 during the winter session (january - february)

Course Logistics

- Office hours:
  - To schedule with an appointment (3 days in advance)
- Any communication with email
  - Start the object with: [ML4FIN]

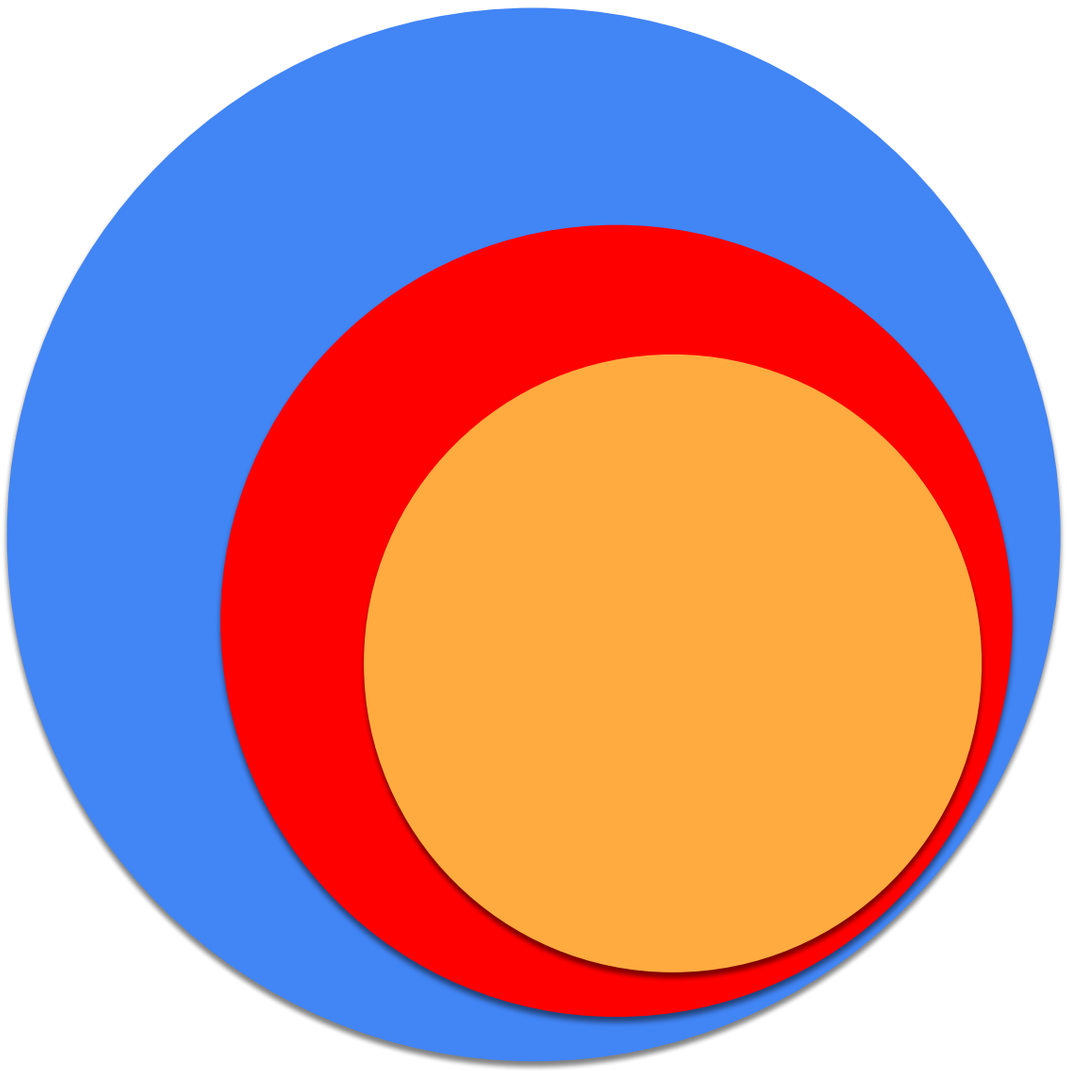
Course Goal

- You are a ML end-user

- Goal 1: learn to understand the AI engineer pipeline
- Goal 2: understand ML algorithms properties
  - and when / how to apply different ML algorithms in different contexts
- Goal 3: critical thinking in the problem resolution
  - and spot potential problems
- Goal 4: being able to develop a correct AI pipeline

Introduction to Machine Learning

Artificial Intelligence and Deep Learning



Artificial Intelligence

- The science that make things smart

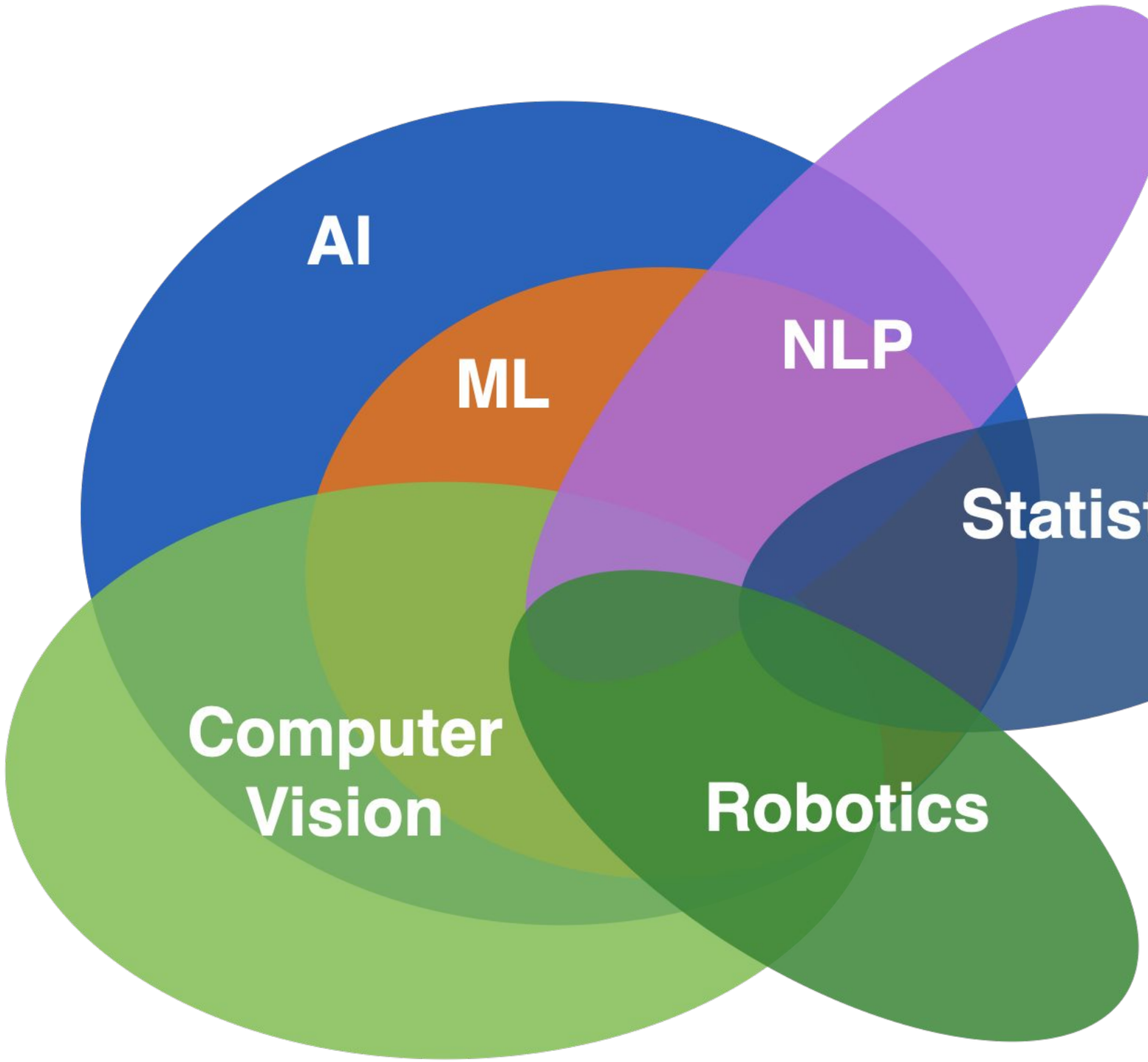
Machine Learning

- Building machines that can learn from experience

Neural Networks/Deep Learning

- A type of algorithms in machine learning

AI, Machine Learning and Beyond



And more:

- Biology
- Neuroscience
- Medicine
- Physics
- …

What Is Machine Learning?

- What is an algorithm?

What Is Machine Learning?

- What is an algorithm?
  - A list of instruction to solve a task
    - like a food recipe
  - What do you need to design an algorithm for a complex problem?

What Is Machine Learning?

- What is an algorithm?
  - A list of instruction (procedure) to solve a task
    - like a food recipe
  - What do you need to design an algorithm for a complex problem?
    - You need to be kind of an expert in the field of the problem
  - And … you must find a valid procedure

What Is Machine Learning?

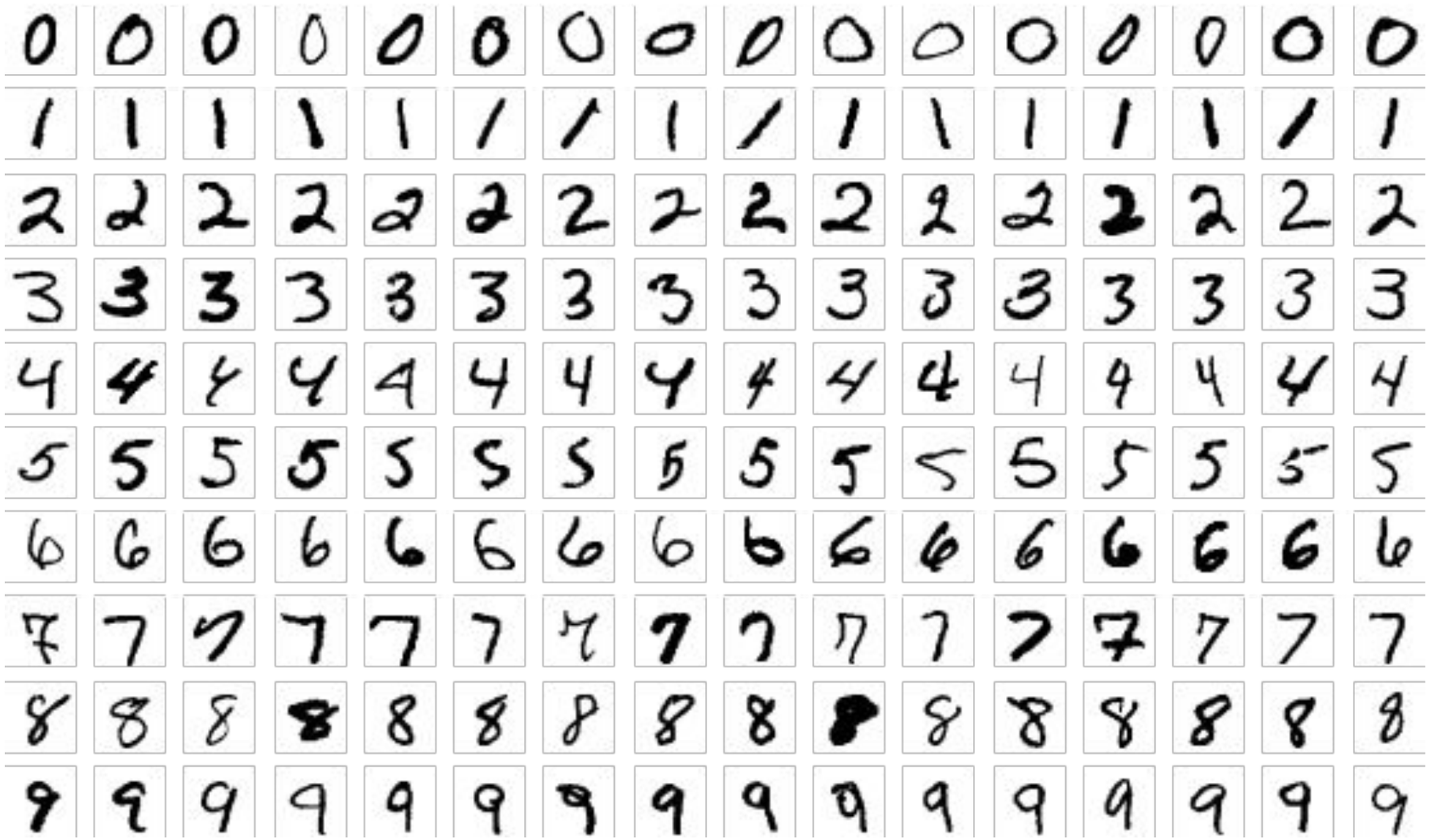
- Let’s change the paradigm
  - we derive our solution from the data that represents the problem

What Is Machine Learning?

- Example: Letter recognition

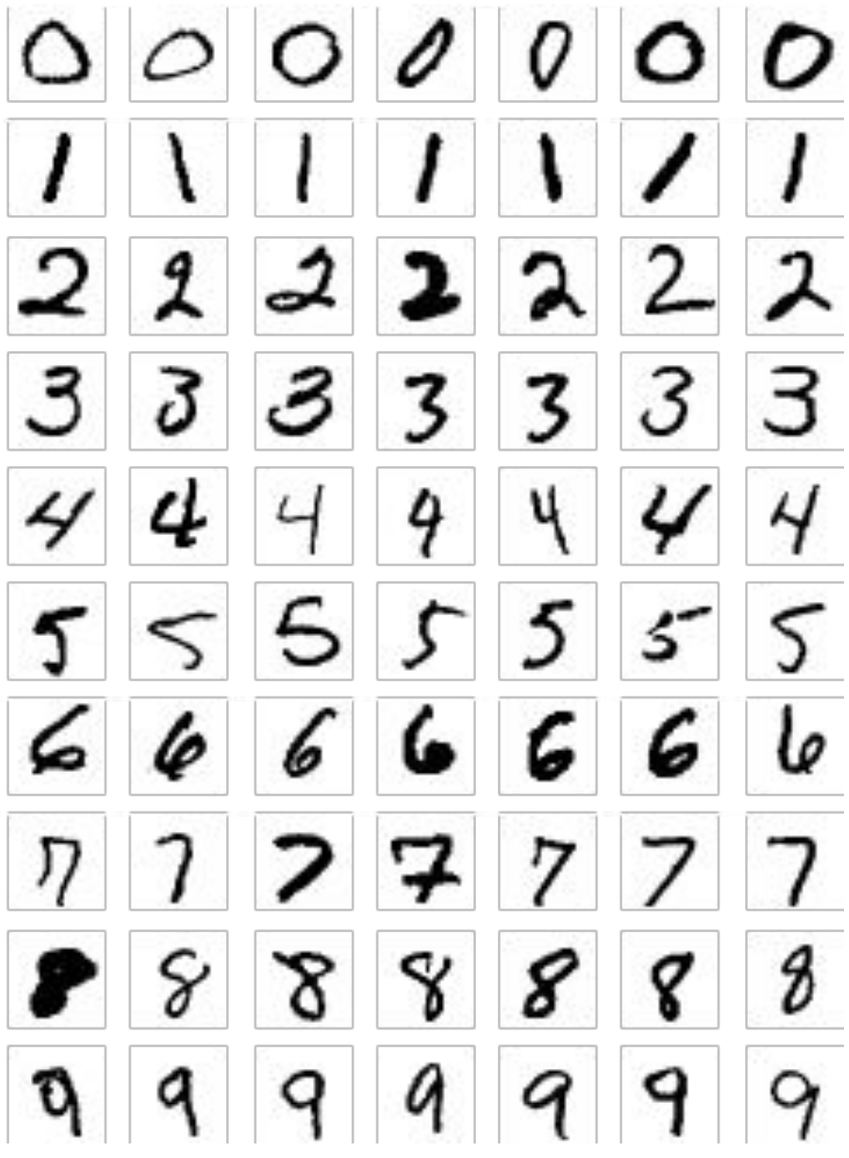
What Is Machine Learning?

- Example: Handwritten recognition



What Is Machine Learning?

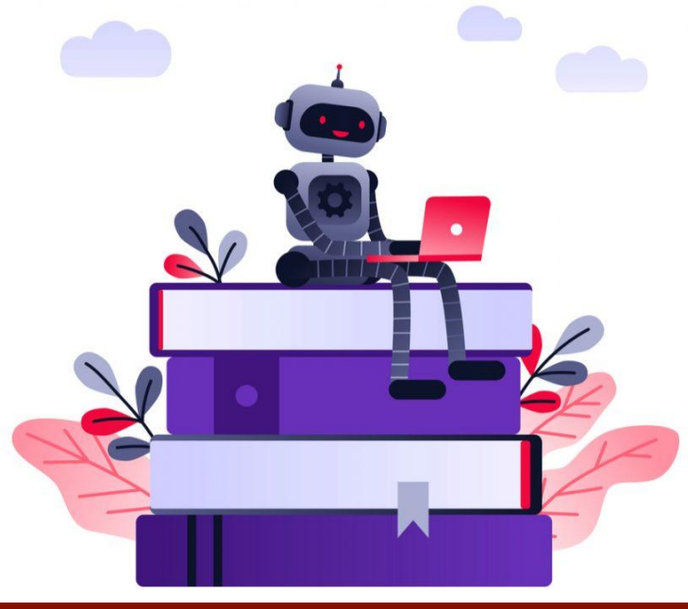
- Example: Handwritten recognition
- A data driven approach
  - Rather than a fixed predetermined templates
  - We start from a series of data
- The new “algorithm” **finds** automatically “**traits**” that links to a specific number



What Is Machine Learning?

"Machine learning is a field of inquiry devoted to understanding and building methods that 'learn', that is, methods that leverage data to improve performance on some set of tasks"

"**Machine learning** is an application of AI that enables systems to learn and improve from experience without being explicitly programmed."



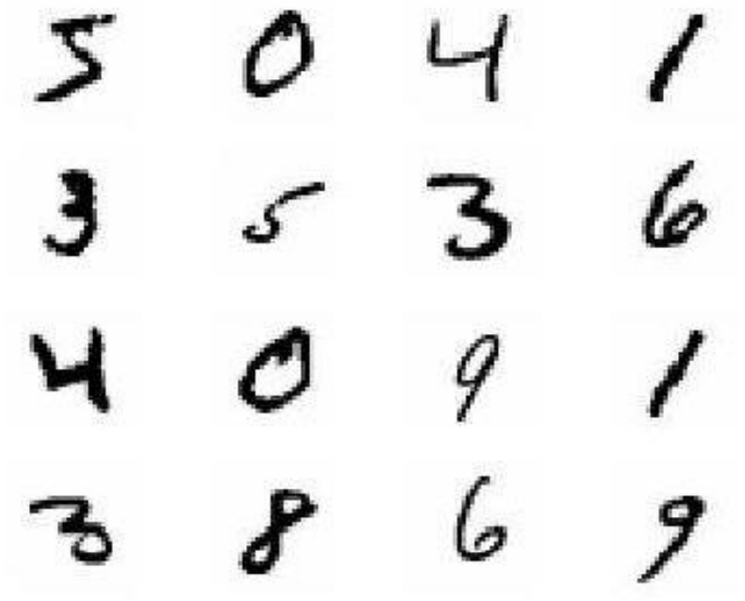
"**Machine learning** is a branch of Artificial Intelligence and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy"

"A computer program is said to learn from **experience E** with respect to some class of **tasks T** and **performance measure P** if its performance at tasks in T, as measured by P, improves with experience E"

Some examples

A **checkers** learning problem:

- Task **T**: playing checkers
- Performance measure **P**: percent of games won against opponents
- Experience **E**: playing practice games against itself

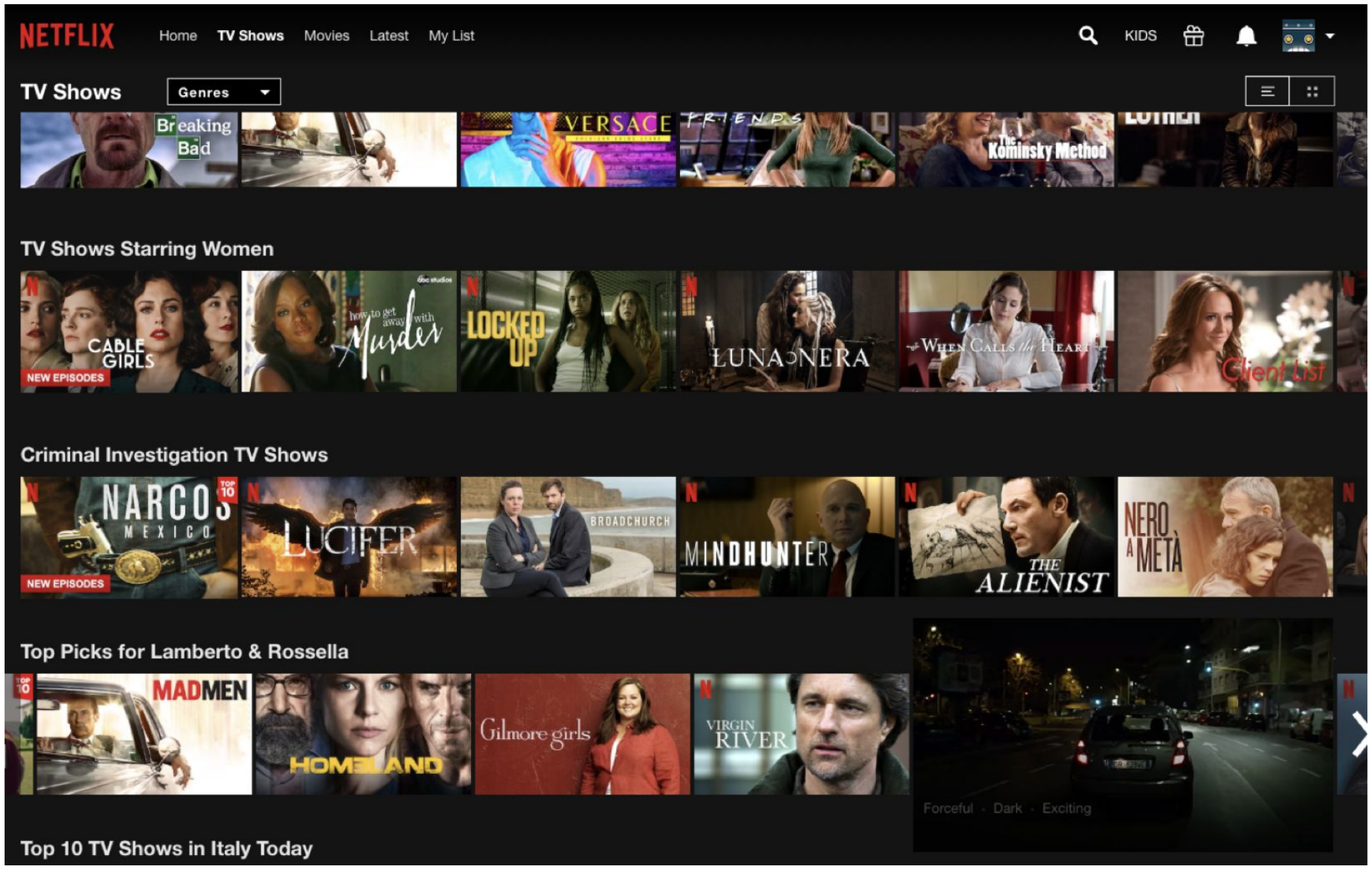


A **handwriting recognition** learning problem:

- Task **T**: recognizing and classifying handwritten words within images
- Performance measure ***P :*** percent of words correctly classified
- Experience **E**: a database of handwritten words with given classifications

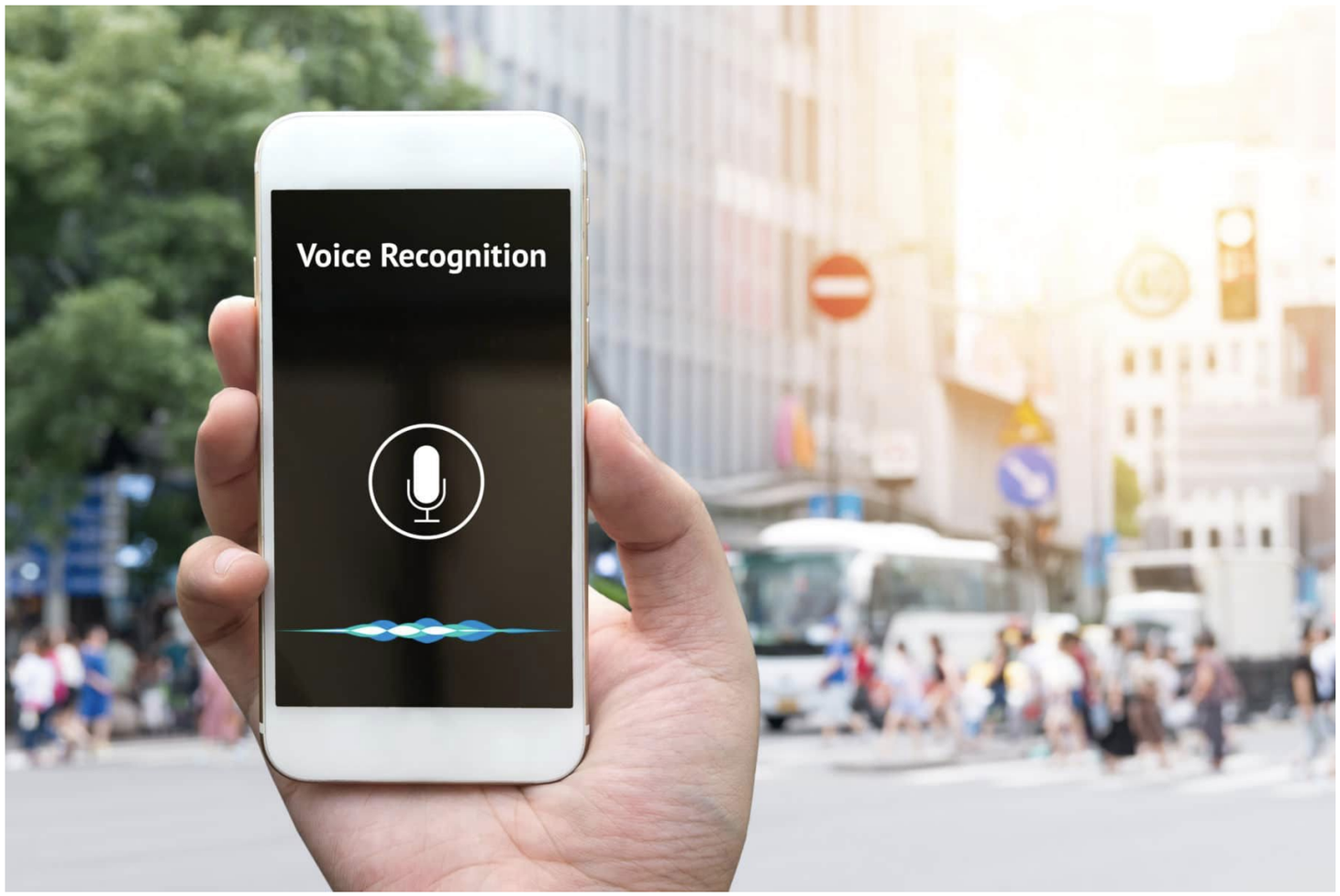
Learning is useful in many tasks

- **Recommender systems:** commercial platforms, advertisement… tiny improvements might have a large impact on global markets



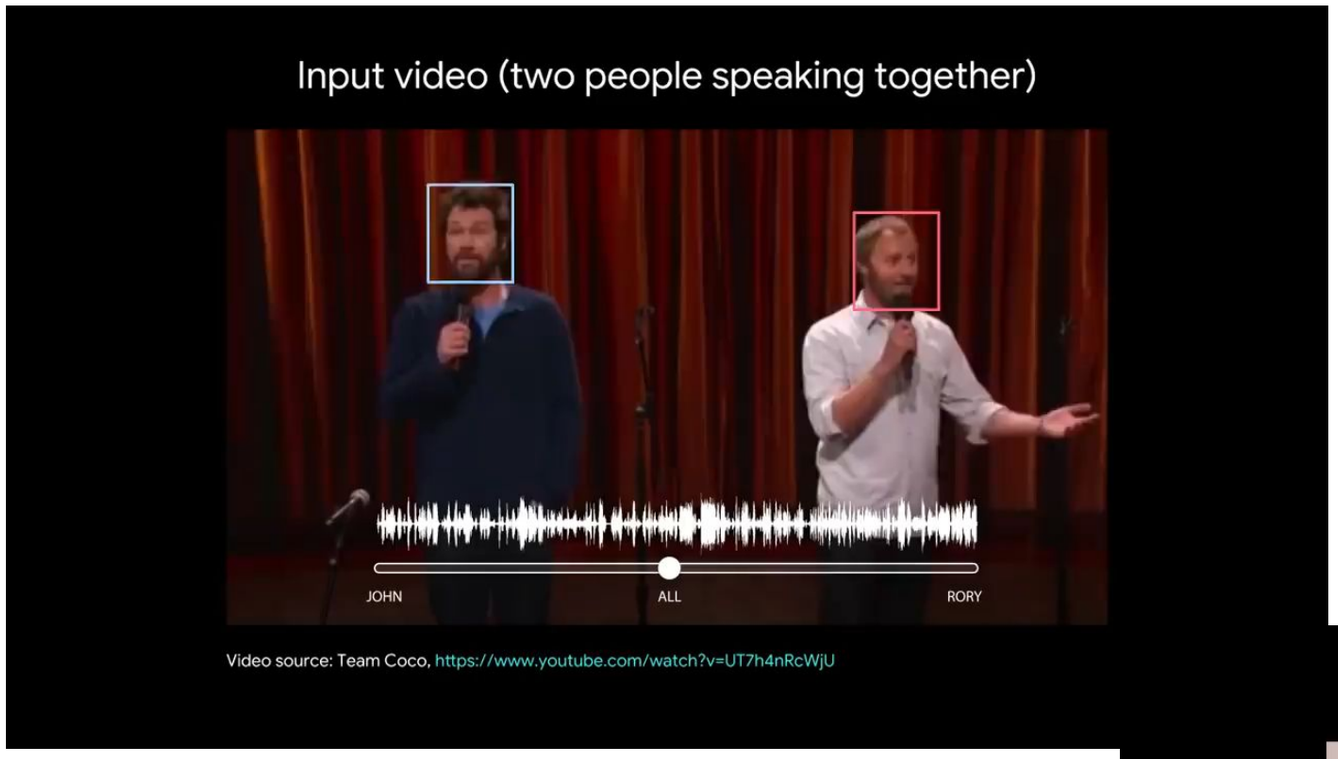
Learning is useful in many tasks

- **Recognising patterns:** the automated recognition of patterns and regularities in data



Speech recognition

Looking to Listen



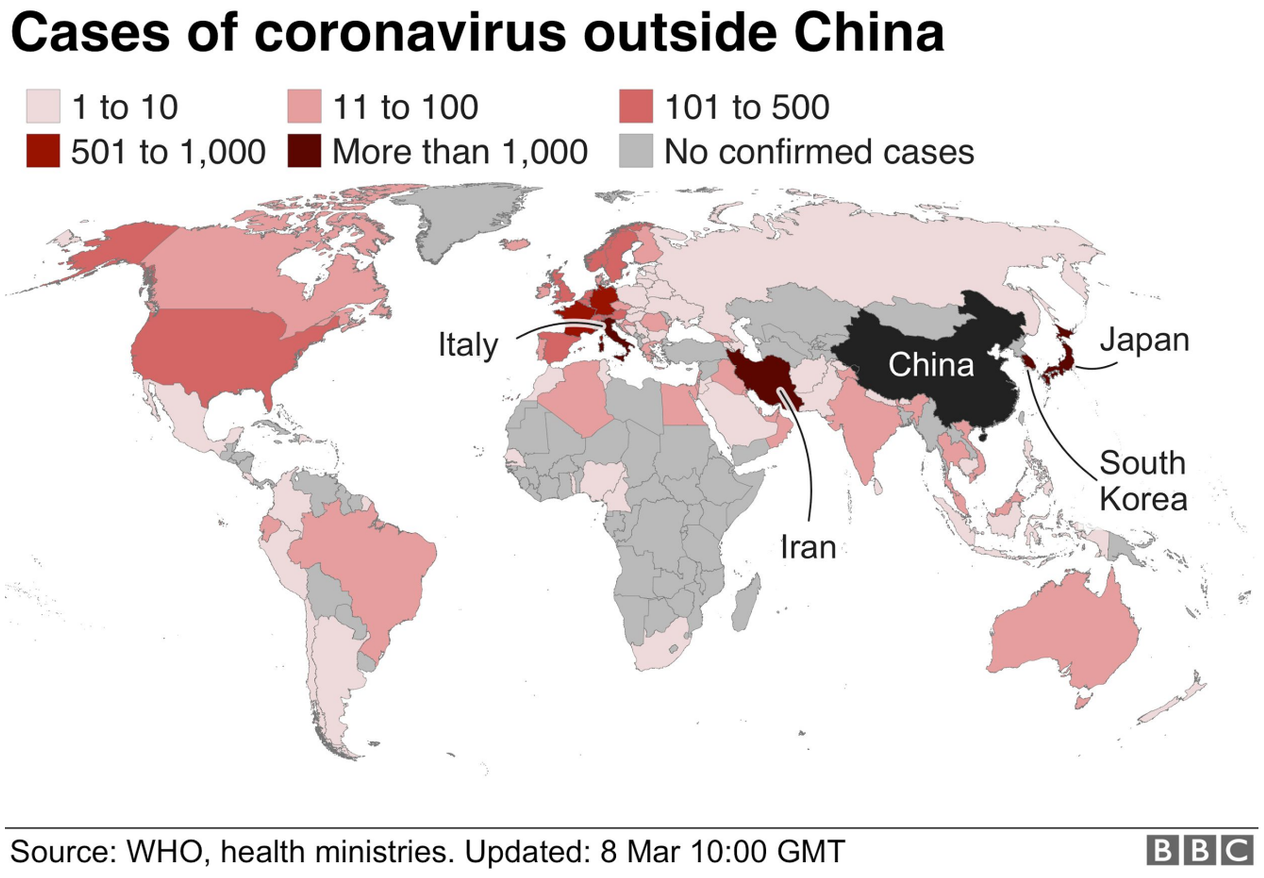
Learning is useful in many tasks

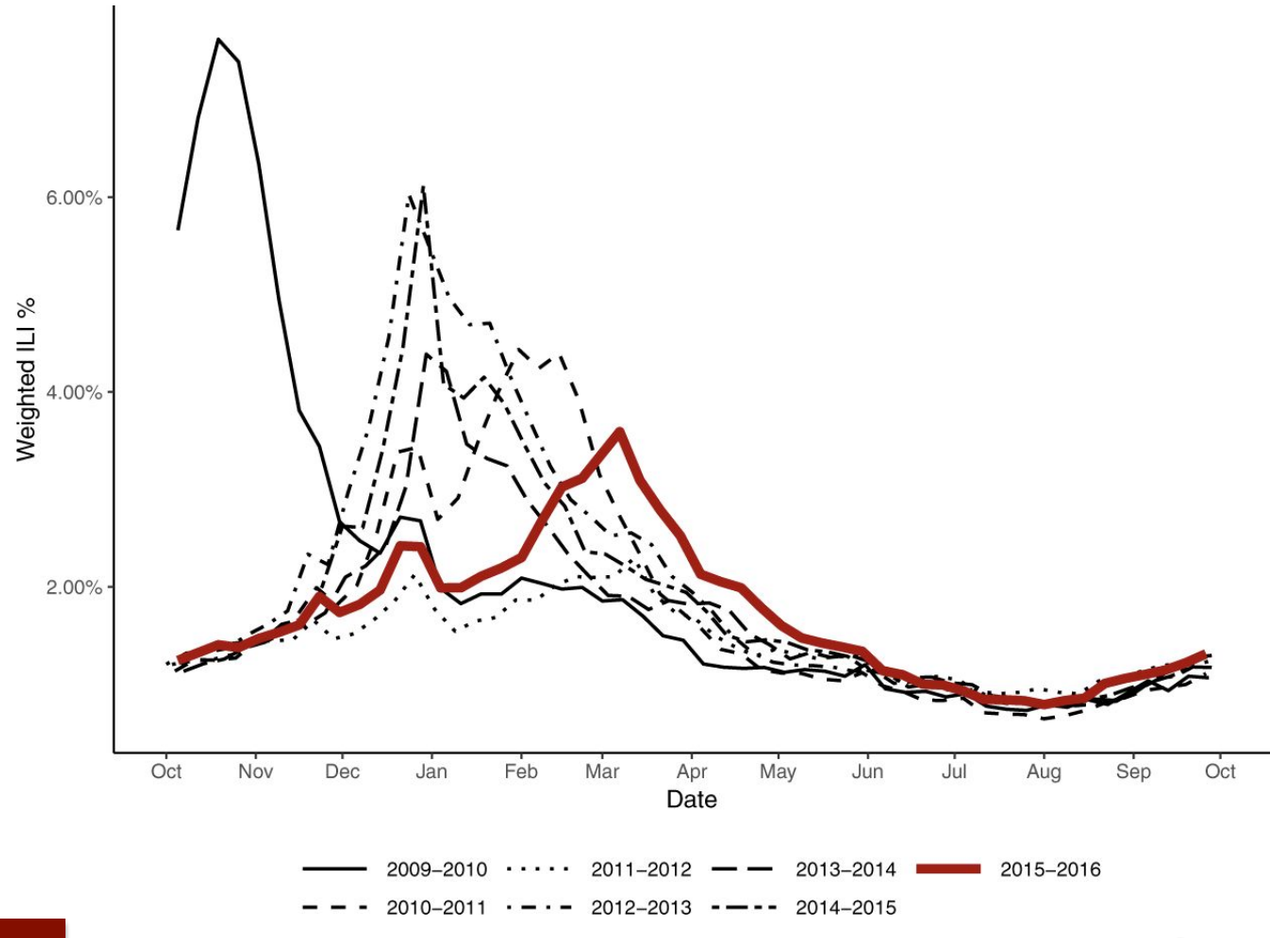
- **Predicting events:** models capable of predicting events are especially valued by decision makers

Finance: Stock Price Prediction

Learning is useful in many tasks

- **Predicting events:** models capable of predicting events are especially valued by decision makers

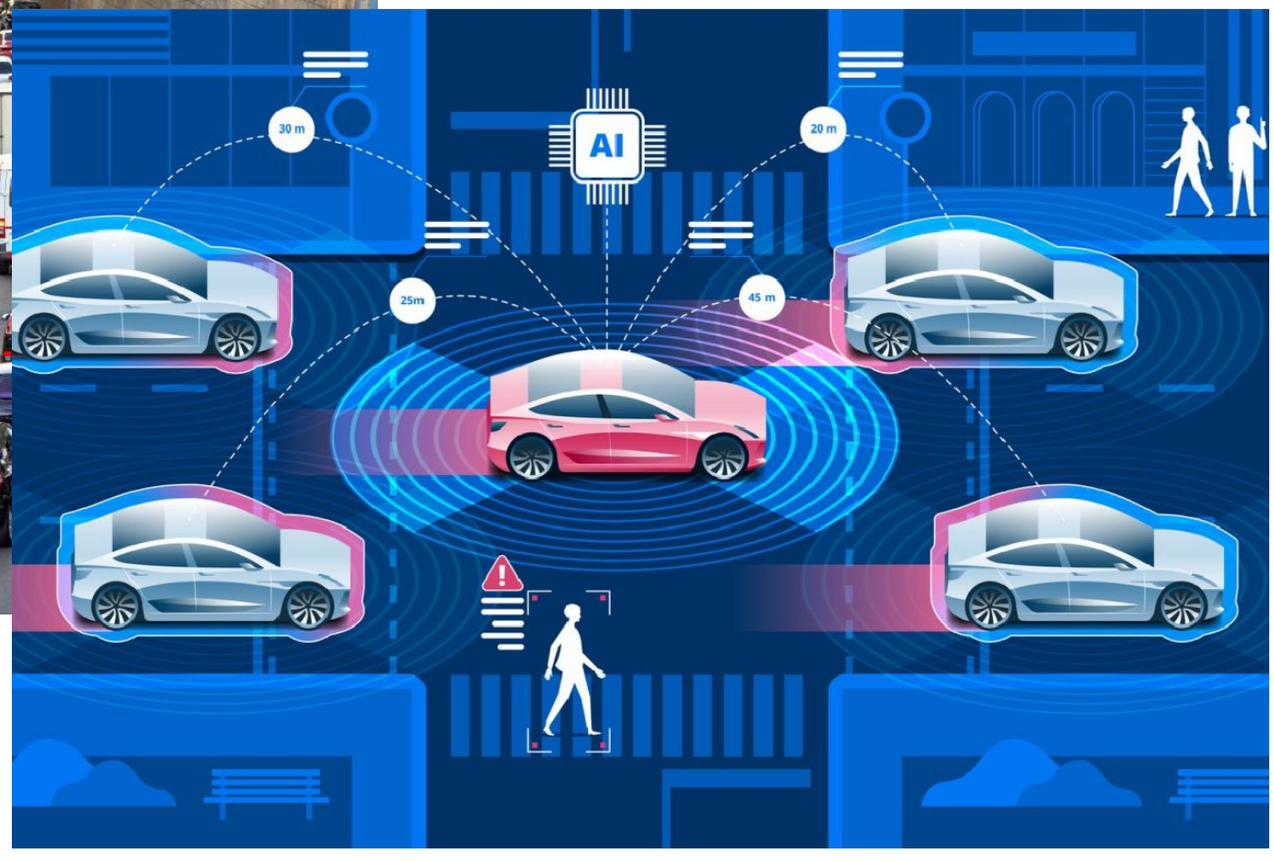




Pandemic grow rates (flu, coronavirus, …)

Learning is useful in many tasks

- **Predicting events:** models capable of predicting events are especially valued by decision makers



COVID-19

New #DeepLearning model detects #coronavirus pneumonia from #CT scans with comparable performance to expert radiologists #COVID19 This #AI could help improve evaluation efficiency & diagnosis. Preprint: lnkd.in/gNyYURD #TechForGood #artificialintelligence #healthcare

medRxiv
THE PREPRINT SERVER FOR HEALTH SCIENCES

Cold Spring Harbor Laboratory BMJ Yale

HOME | ABOUT | SUBMIT | ALERTS/RSS

Search

Advanced Search

Comment on this paper

Deep learning-based model for detecting 2019 novel coronavirus pneumonia on high-resolution computed tomography: a prospective study

Jun Chen, Lianlian Wu, Jun Zhang, Liang Zhang, Dexin Gong, Yilin Zhao, Shan Hu, Yonggui Wang, Xiao Hu, Biqing Zheng, Kuo Zhang, Huiling Wu, Zehua Dong, Youming Xu, Yijie Zhu, Xi Chen, Lilei Yu, Honggang Yu

doi: https://doi.org/10.1101/2020.02.25.20021568

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should *not* be used to guide clinical practice.

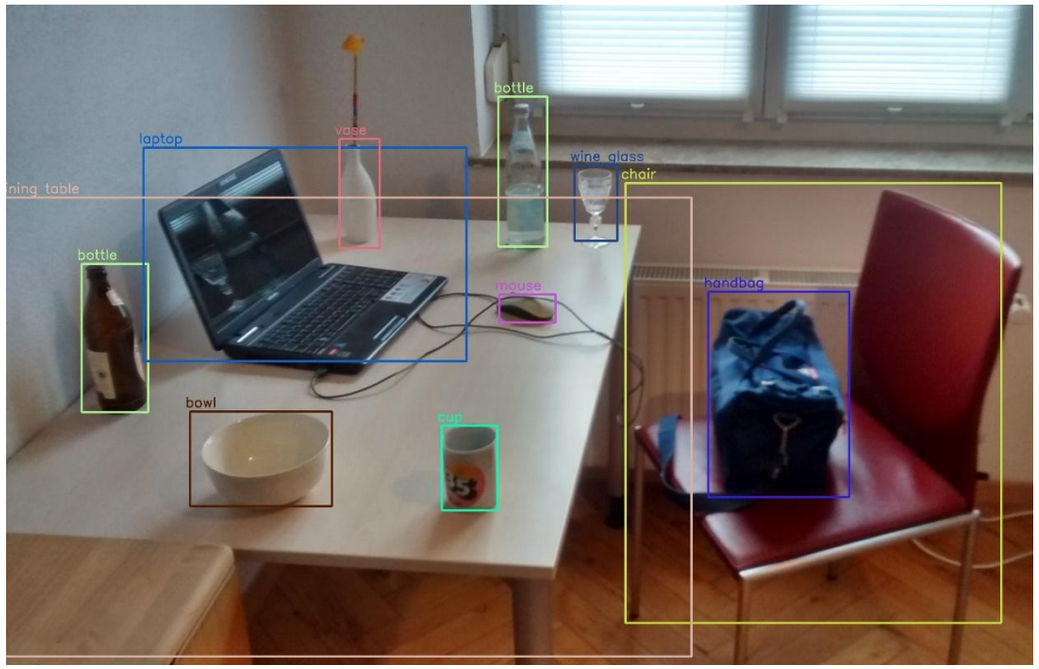
Abstract | Info/History | Metrics

Preview PDF

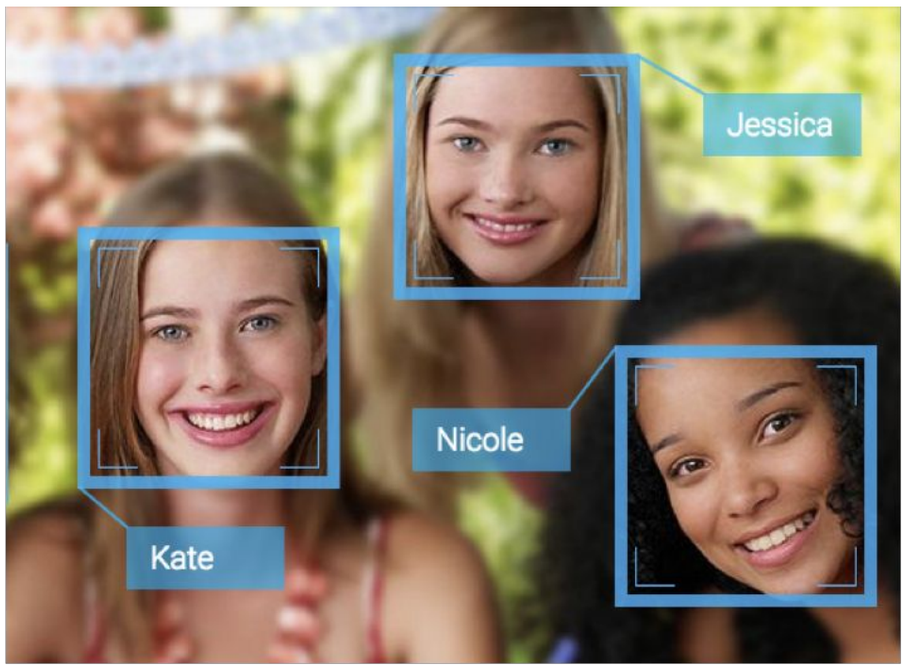
Abstract

Background: Computed tomography (CT) is the preferred imaging method for diagnosing 2019 novel coronavirus (COVID19) pneumonia. Our research aimed to construct a system based on deep learning for detecting COVID-19 pneumonia on high resolution CT, relieve working pressure of radiologists and contribute to the control of the epidemic. Methods: For model development and validation,

Computer Vision



Object Recognition



Face Recognition

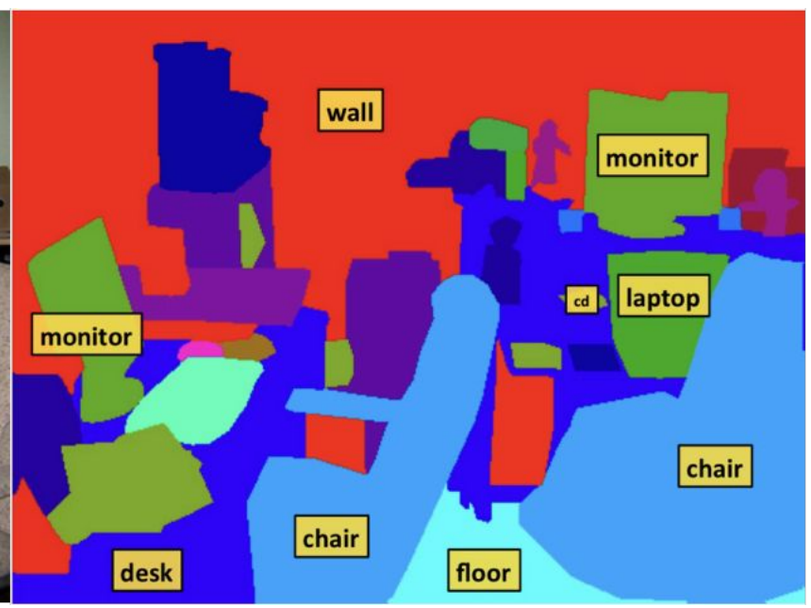


Image Segmentation