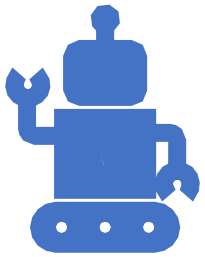
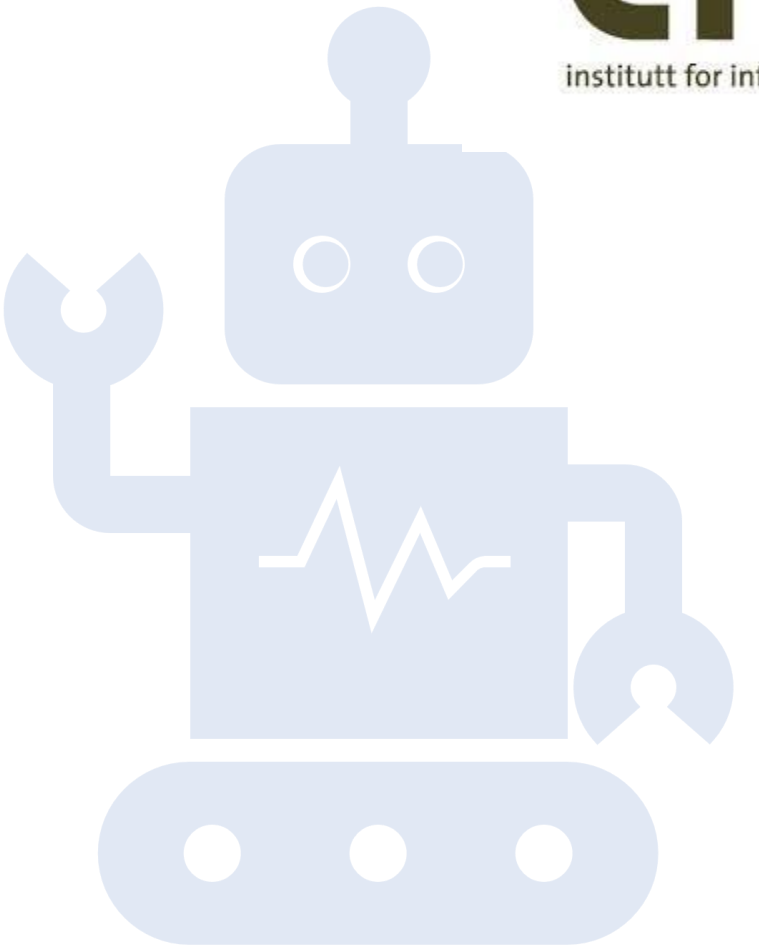
UiO : University of Oslo

institutt for informatikk



IN3050/IN4050 - Introduction to Artificial Intelligence and Machine Learning



Lecture 1 – 2021

Course Introduction

Jan Tore Lønning and Tønnes Nygaard

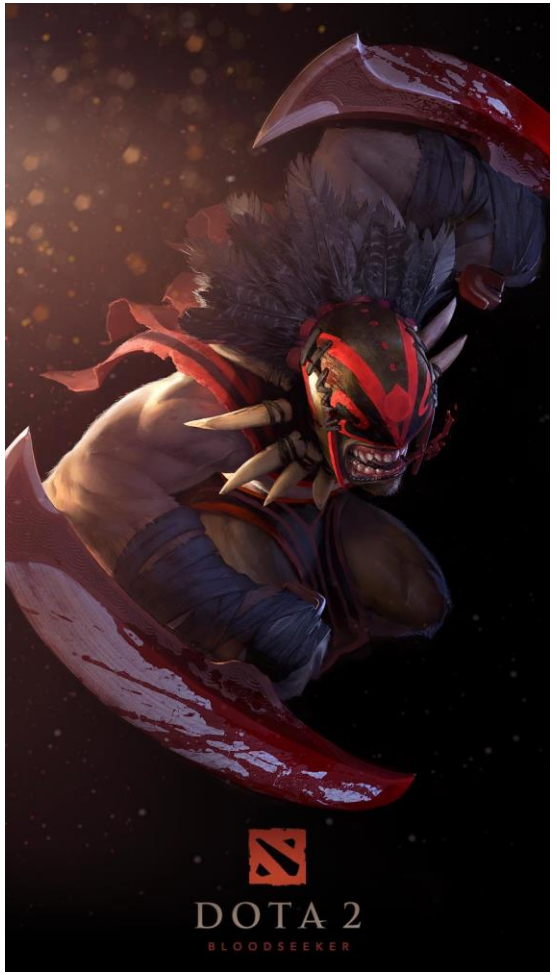
Motivation/State-of-the-art

What can we achieve with State-of-the-art AI / ML?

- **Teach a robot to interact with complex objects**

What can we achieve with State-of-the-art AI / ML?

- Teach a robot to interact with complex objects
- **Teach a computer to play complex games**



What can we achieve with State-of-the-art AI / ML?

- Teach a robot to interact with complex objects
- Teach a computer to play complex games
- **Teach a computer the relationship between images and text**

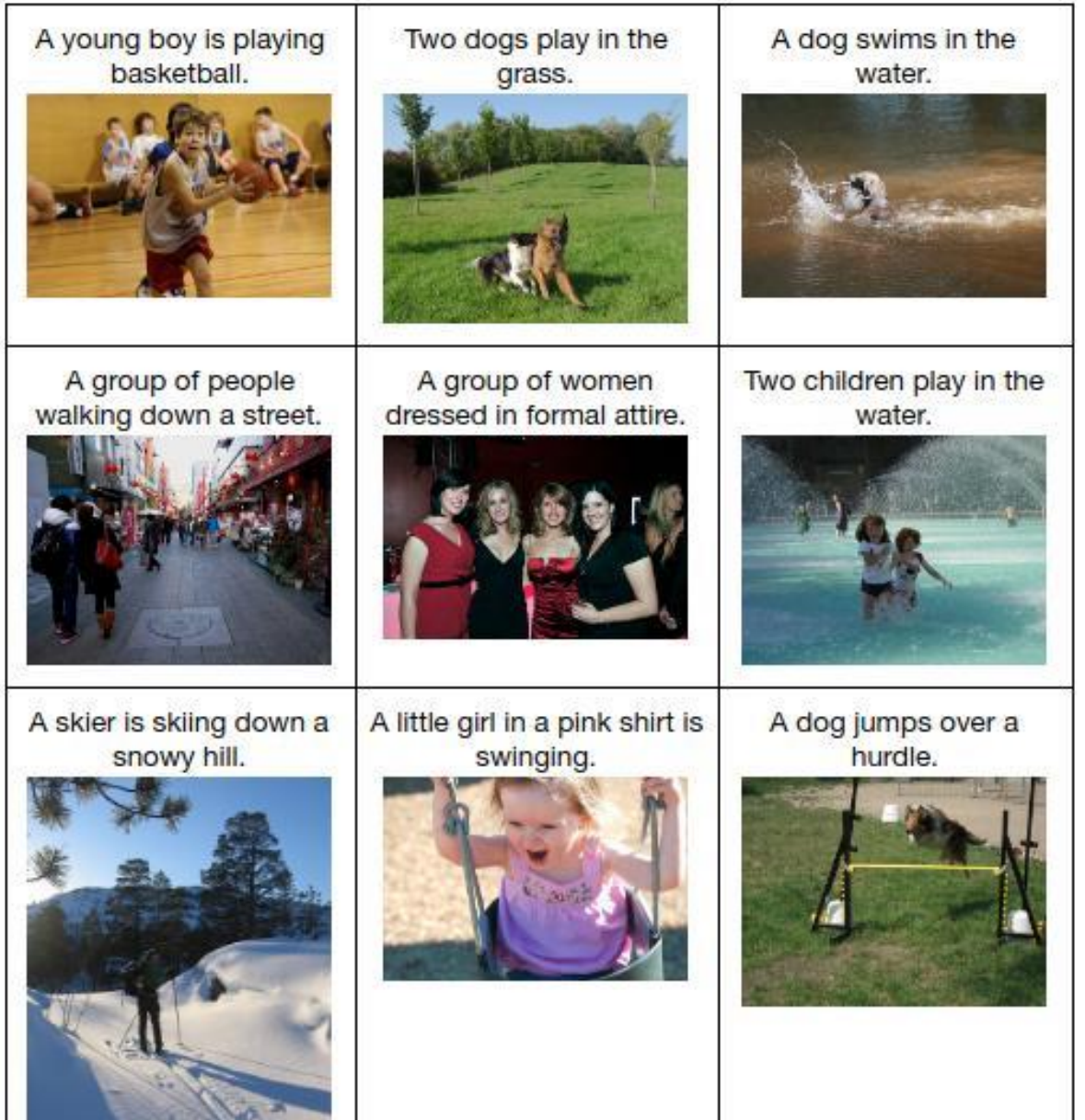


Image from:https://github.com/danieljl/keras-image-captioning

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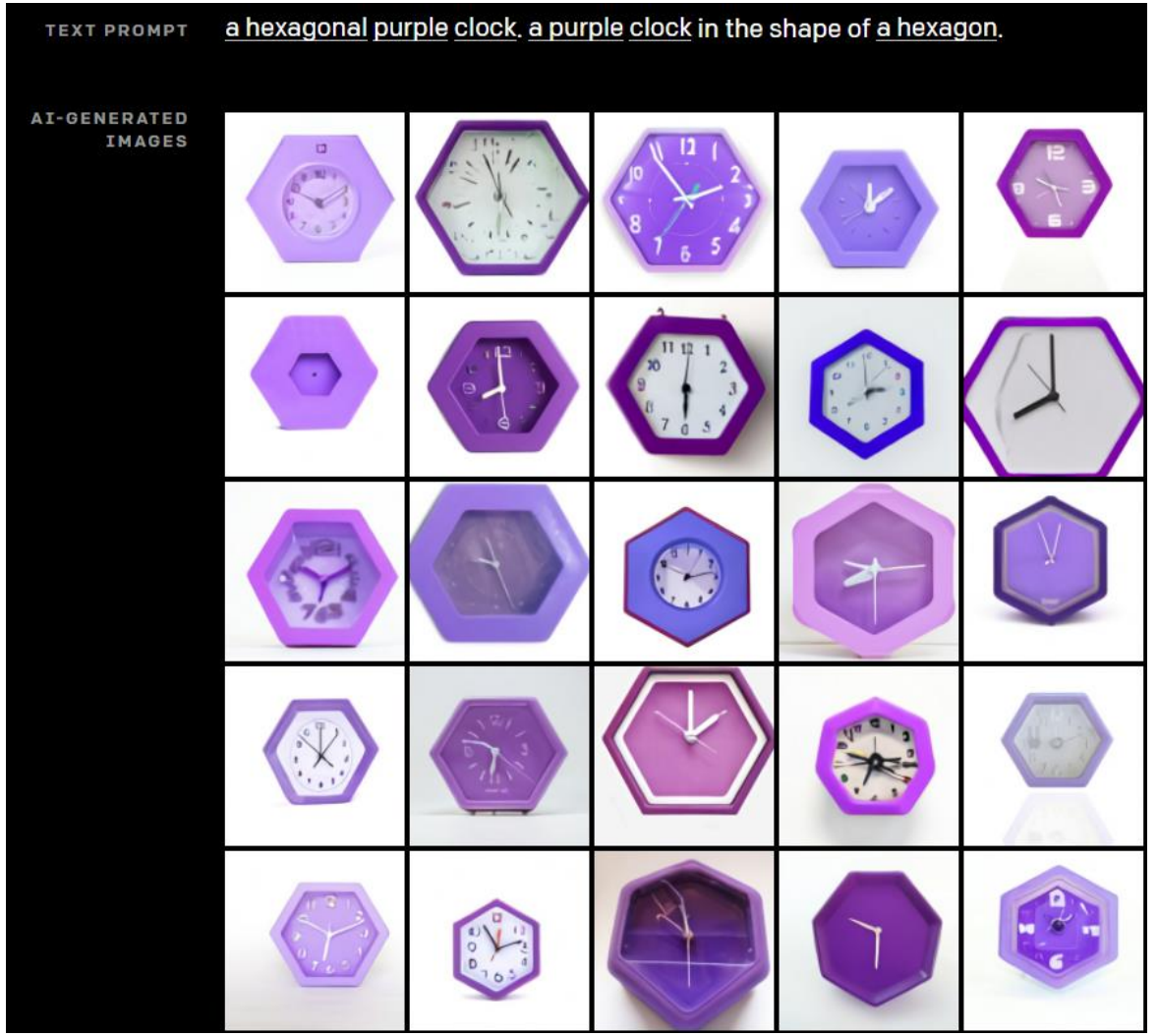
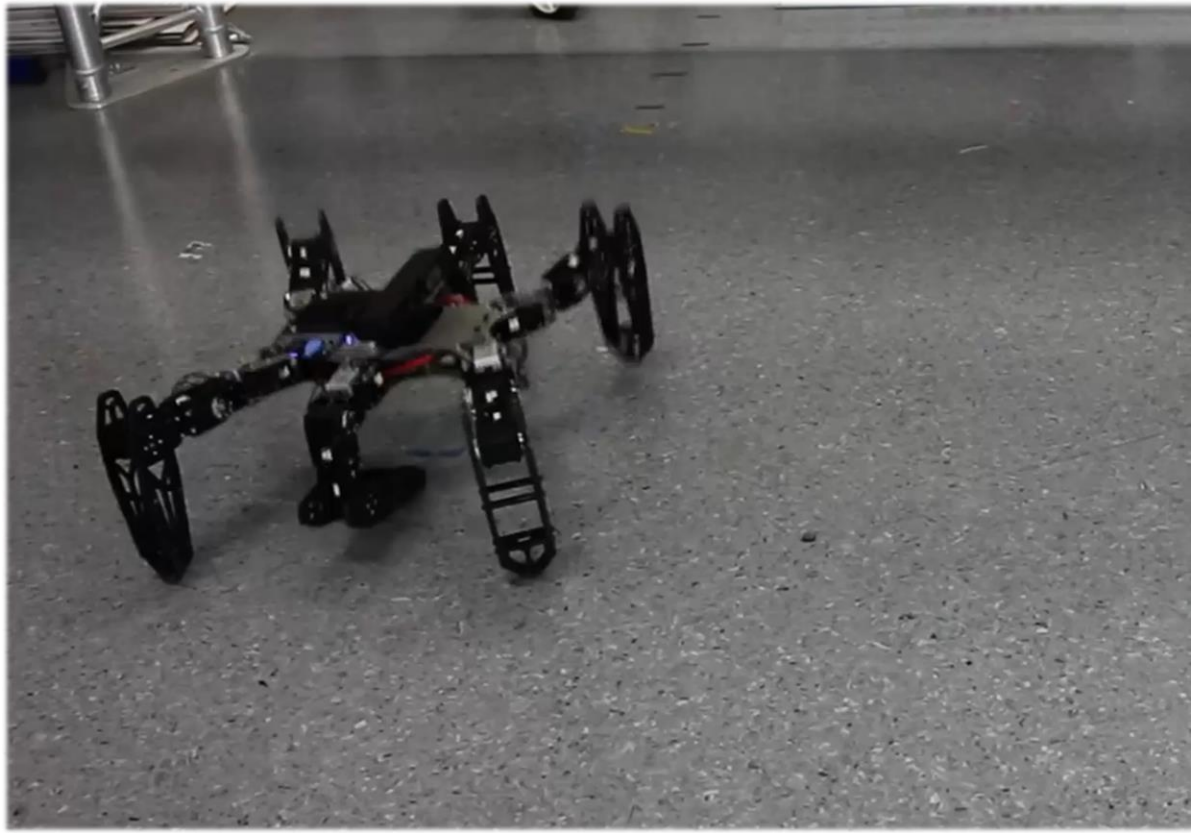


Image from: https://openai.com/blog/dall-e/

What can we achieve with State-of-the-art AI / ML?

- Teach a robot to interact with complex objects
- Teach a computer to play complex games
- Teach a computer to describe images
- **Robots that adapt**



Self-driving cars

Source: Wikipedia

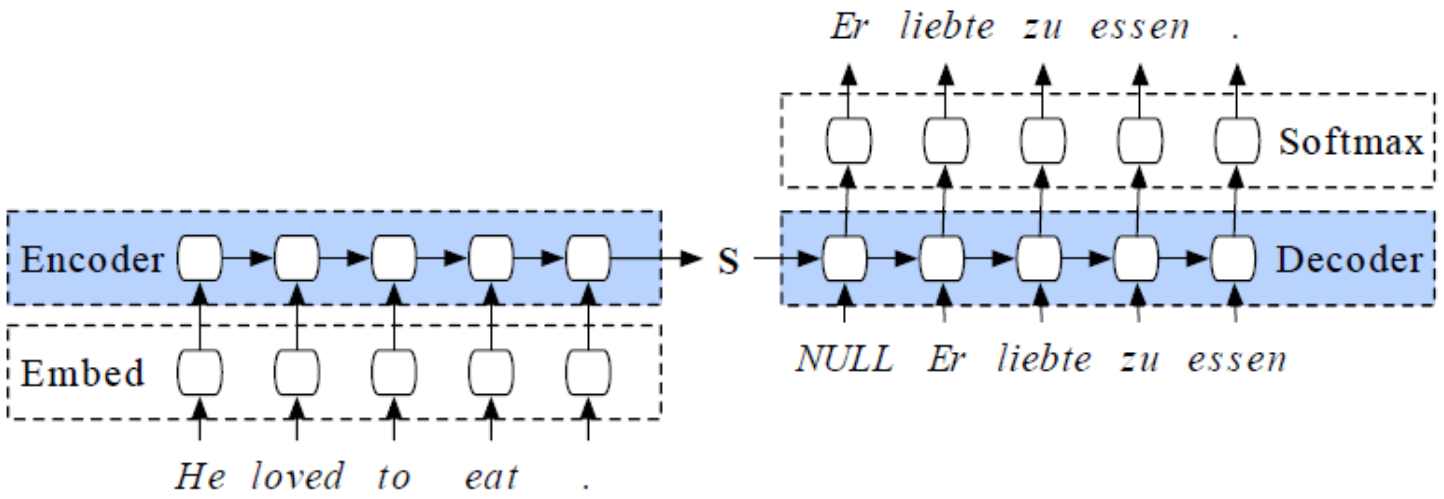
Speech ⟷ text

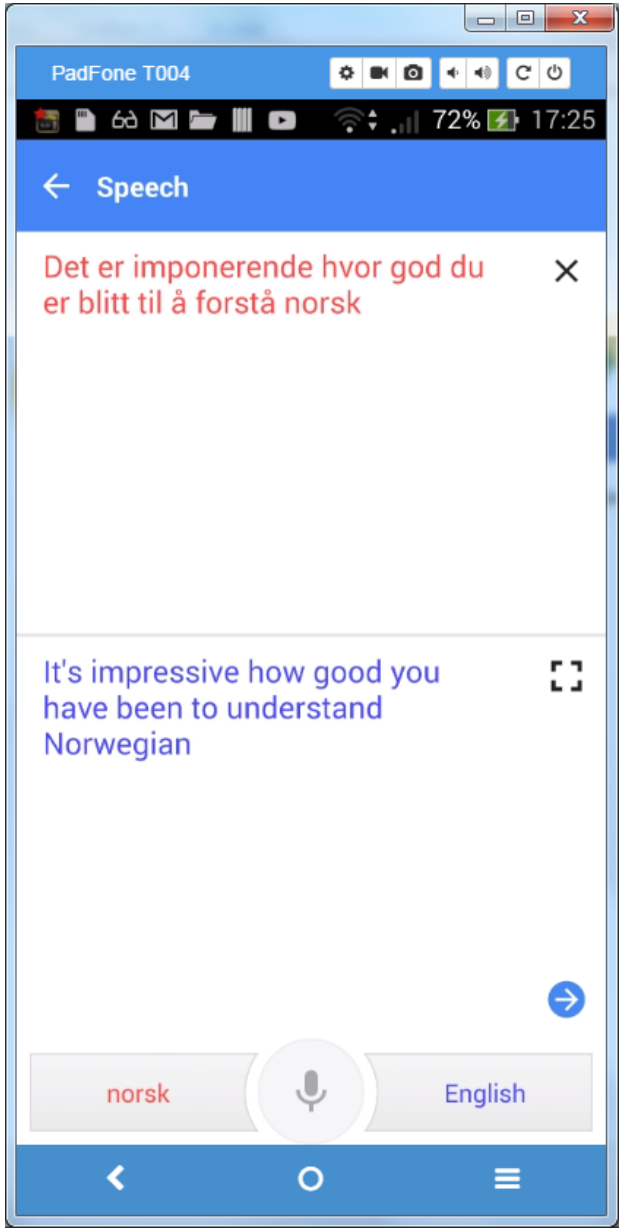
und Polarisation des Lichtes in den sogenannten kolloidalen Metallösungen. Zieht man die Folgerungen aus der elektromagnetischen Lichttheorie auf das Verhalten der trüben Medien, so kommt man zu verschiedenen Resultaten, je nachdem die trübenden Teilchen Isolatoren oder Leiter der Elektrizität sind. Die bezüglichen Rechnungen sind durchgeführt worden von Lord Rayleigh[1]) für Isolatoren und von J. J. Thomson[2]) für Leiter der Elektrizität. Dabei machen beide die Annahme, daß die kleinen Teilchen Kugeln mit gegen die Lichtwellenlänge kleinem Durchmesser sind. Beide Autoren behandeln das Problem der Zerstreuung des Lichtes durch eine solche kleine Kugel, wenn diese von einer Welle natürlichen Lichtes getroffen wird. Während nun die Rechnung ergab, daß das von einer isolierenden Kugel in einer Ebene senkrecht zum einfallenden Strahl zerstreute Licht vollkommen linear polarisiert ist, und zwar in der durch die betrachtete Zerstreuungsrichtung

Demo

Machine translation

10/31/2018 https://smeritycom/media/images/articles/2016/gnmt_arch_1_enc_dec.svg





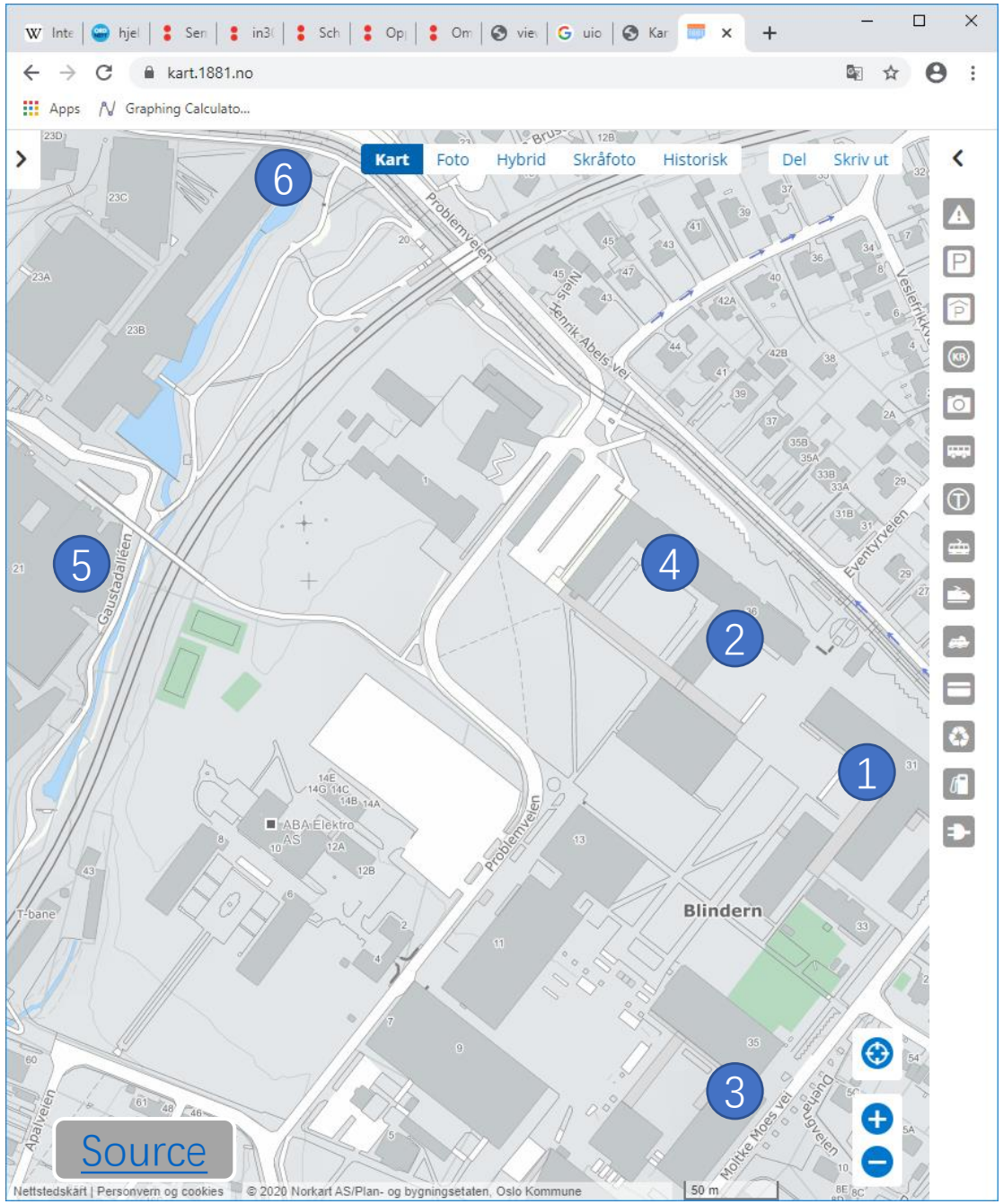
Who are we?

Jan Tore Lønning

background

Studied

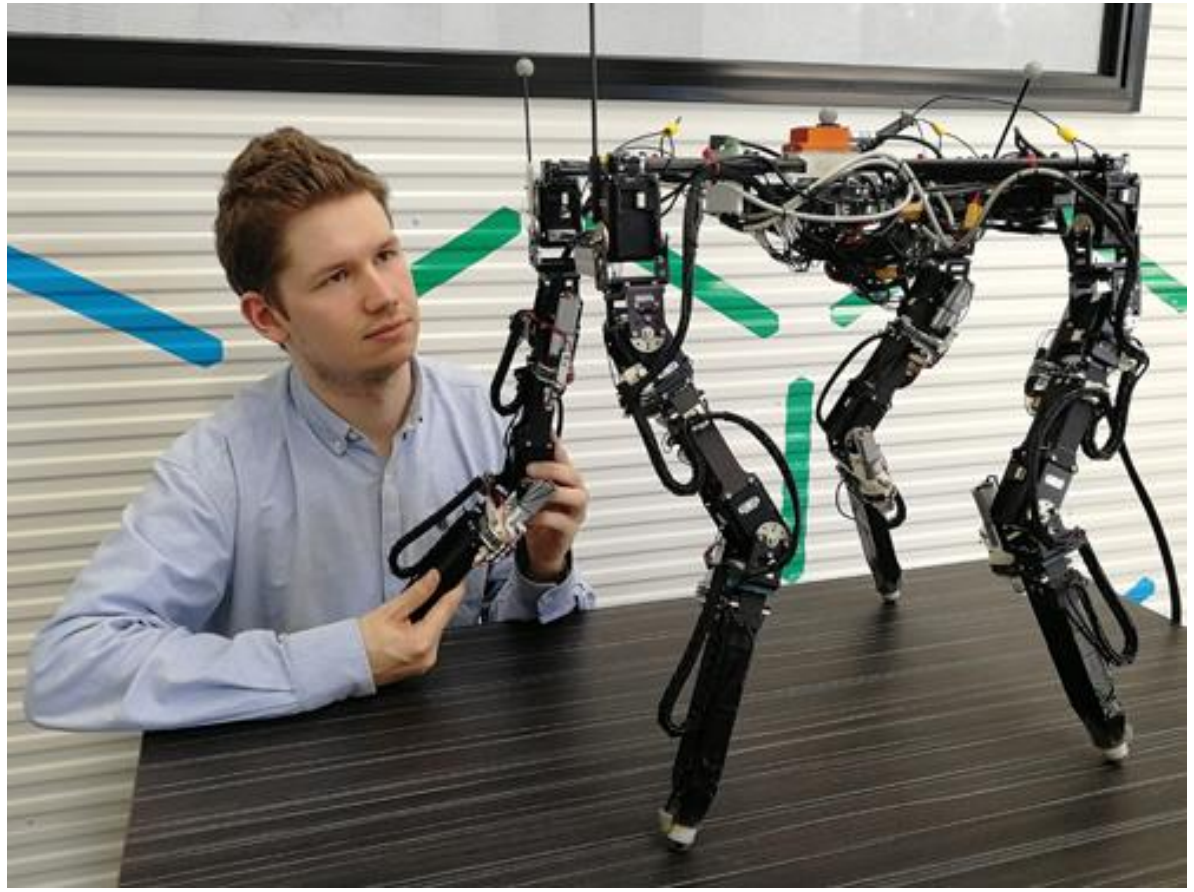
1. Psychology
2. Philosophy
3. Mathematics
   - Master's
   - PhD
   - Logic in natural languages



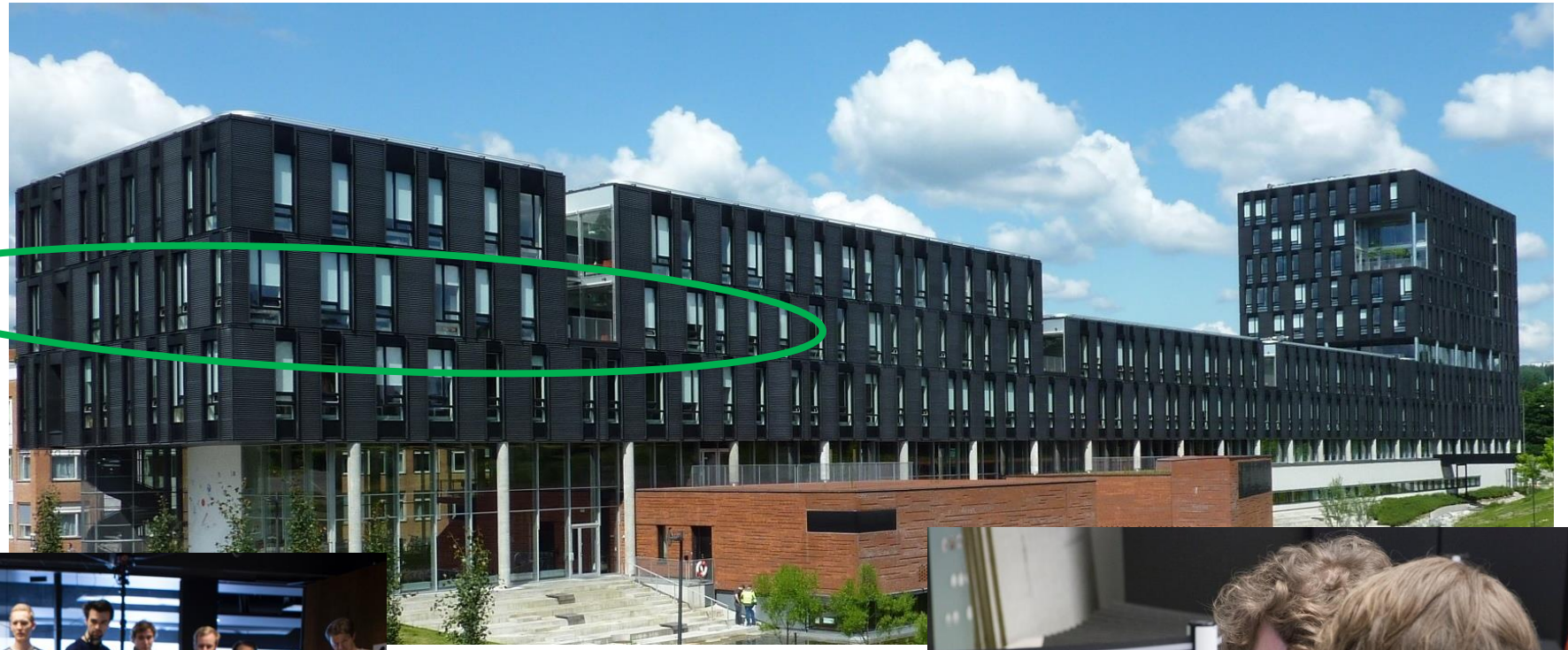
Work

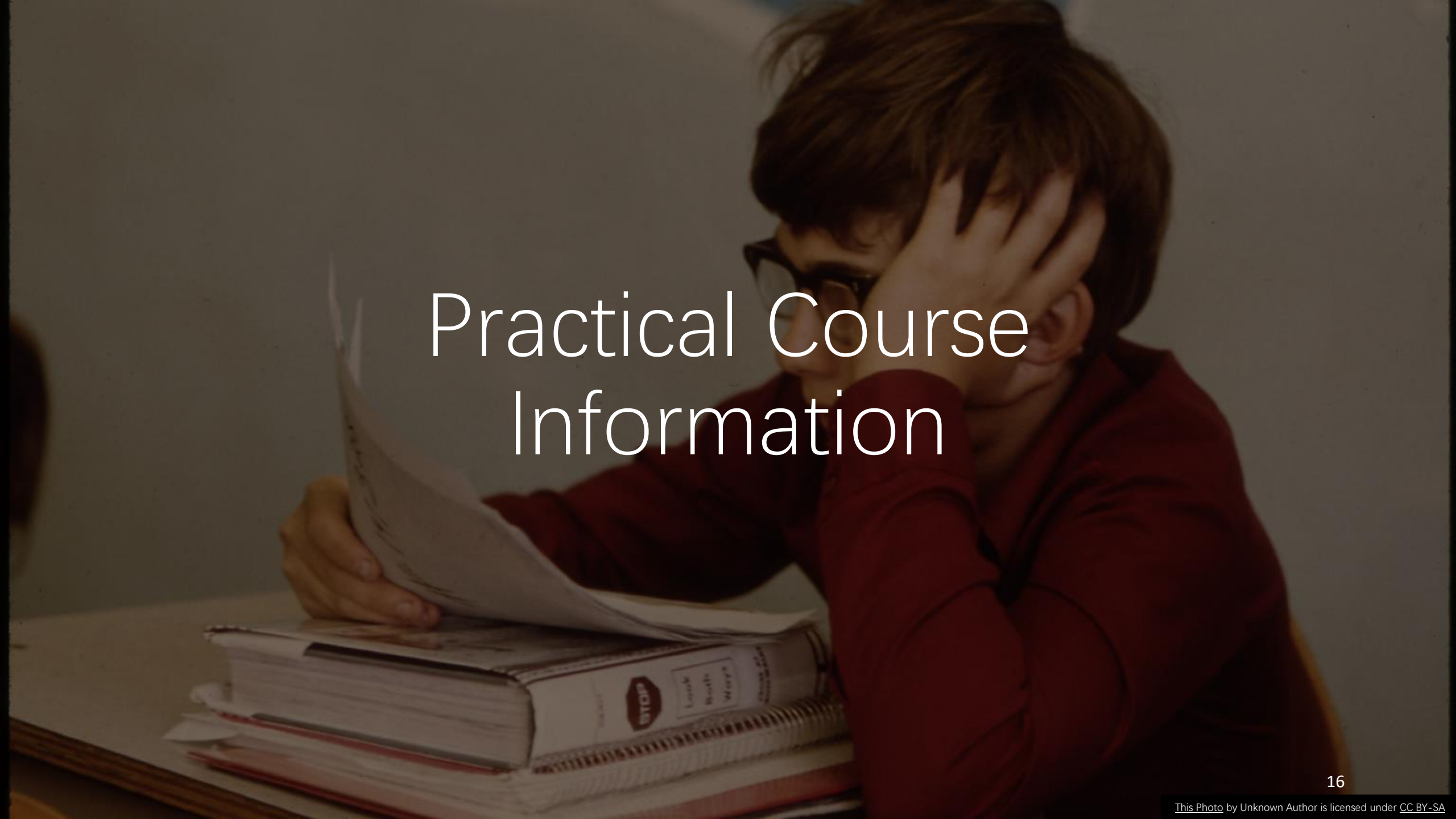
4. HF: Language, logic, information
   - NLP
5. Moved to IFI 2006
   - Language technology group
   - Informatics: LT-program
6. IFI-II, 2011

Tønnes Nygaard



Robotics and Intelligent Systems group (ROBIN)



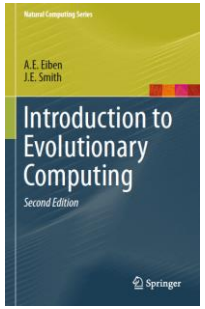


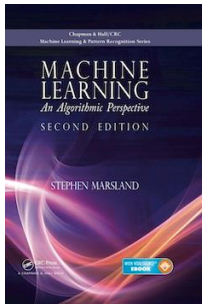
Practical Course Information

IN3050/4050 – Spring 2021

- **Lecturers:**
  - Jan Tore Lønning (jtl@ifi.uio.no)
  - Tønnes Nygaard (tonnesfn@ifi.uio.no)
  - Plus some guest lecturers
- **Pre-recorded video lectures:** Any time during the week
- **A weekly interactive Zoom-session:** Wednesdays 10.15
  - **Summary, Quiz / interactive element, Questions, and introduction of the next topic**
- **Group sessions (starting next week):**
  - https://www.uio.no/studier/emner/matnat/ifi/IN3050/v21/timeplan/index.html#2-1
- **Course web page:** https://www.uio.no/studier/emner/matnat/ifi/IN3050/
- **Mattermost channel:** Chat with each other and group teachers

IN3050/4050





Syllabus:

- Selected parts of the following books (details on course web page):
  - S. Marsland: Machine learning: An Algorithmic Perspective, Second Edition, ISBN: 978-1466583283
  - A.E. Eiben and J.E. Smith: Introduction to Evolutionary Computing, Second Edition (ISBN 978-3-662-44873-1). Springer.
  - On-line material (on the course web page).
- The lecture notes.

Mandatory Exercise:

- Three exercises: Search & Evolutionary Algorithms, Supervised Learning and Unsupervised Learning.
  - Tentative deadlines: February 19th, March 19th and April 23rd.
- Announced on the course web page (Messages) two weeks before the deadline.
- Supervision: Group sessions
- ***Students registered for IN4050 will be given additional tasks in the exercises.*** *This is the* ***only*** *difference compared to IN3050.*

Staying up to date

- Website: https://www.uio.no/studier/emner/matnat/ifi/IN3050/
- Lecture Plan Spring 2021: https://www.uio.no/studier/emner/matnat/ifi/IN3050/v21/timeplan/index.html

A course for third year students in informatics

- Focus on algorithms
- Assumed background:
  - 3 programming courses
    - recursion
- Use Python
  - Packages:
    - Jupyter notebooks
    - …

FYS-STK4155 Applied data analysis and machine learning
3 st.p. overlap

- Machine learning uses mathematics:
  - Vectors, matrices
  - Derivatives
  - Probabilities
- Goal:
  - Not more maths than necessary
  - Try to adapt to your background
- But:
  - You must be willing to learn

WHAT IS A.I.?

Source: Wikipedia

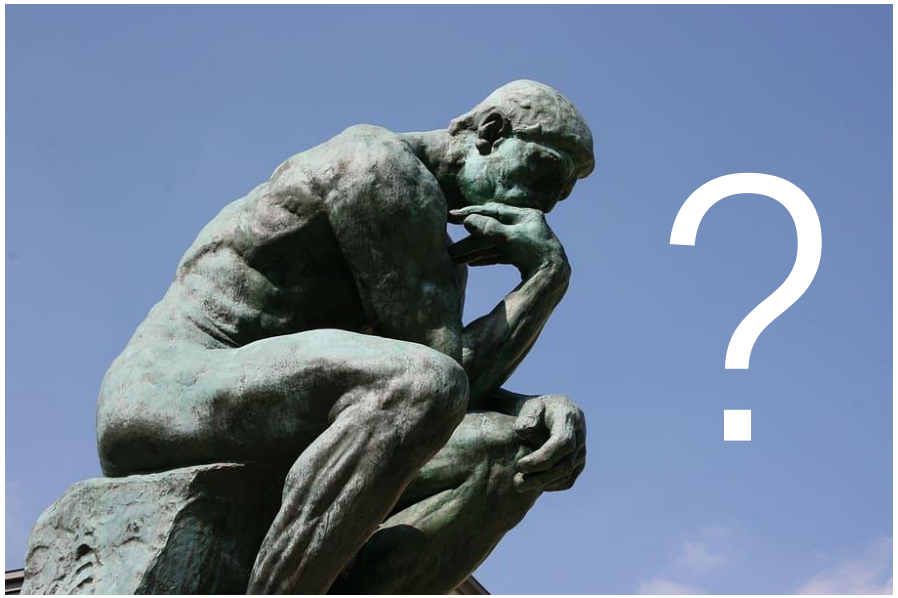
What is (human) intelligence?

Example of a definition:
A very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience…
(https://en.wikipedia.org/wiki/Intelligence)

- No agreement regarding definition
  - Various lists of what to include
- "Mental abilities"
  - Aptitude – not acquired knowledge
- Emphasis on differences:
  - Between man and animal
  - Between humans (IQ)
- Questions:
  - Are animals intelligent?
  - Can machines be intelligent?

What is Artificial Intelligence?

"A machine is considered intelligent if it can perform tasks which are considered intelligent when carried out by a human being." (Definition?)



But, one necessary condition for considering a task intelligent is that it is genuinely human – and cannot be carried out by an animal and even less a machine

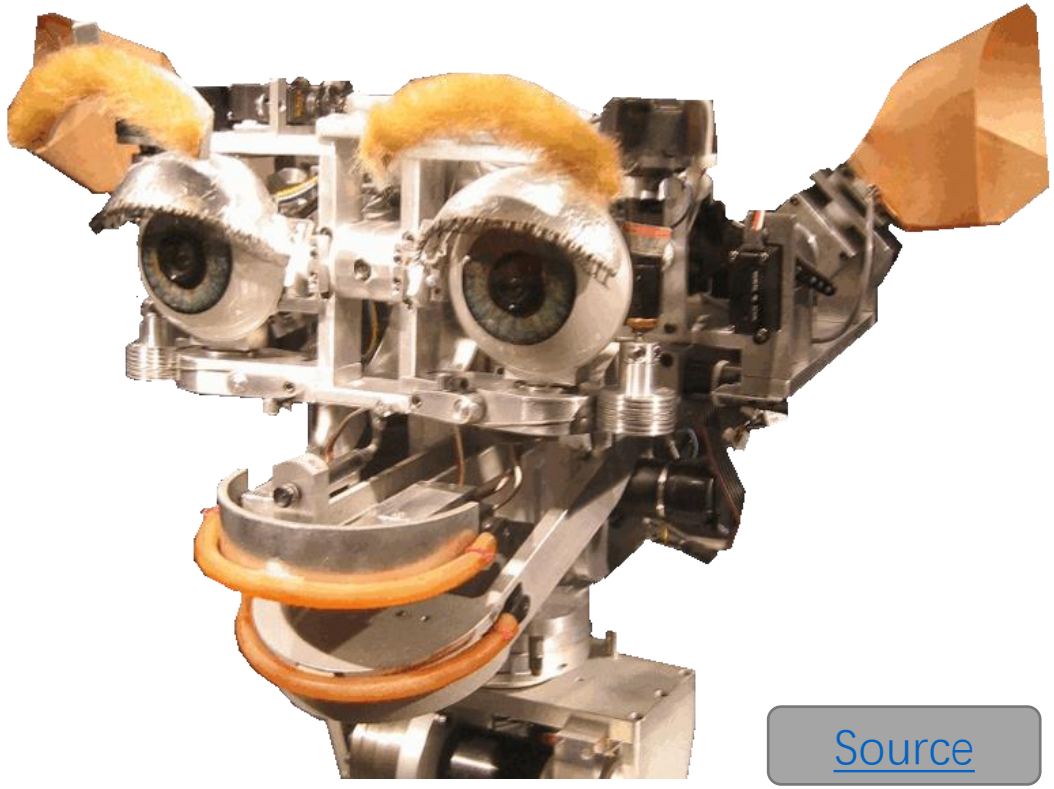
The birth of (the term) Artificial Intelligence, 1956

- The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.
- An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.
- We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer. (2-month, 10 man)

- Call for The Darthmouth Summer Research Projects, Summer of 1956
- Arranged by *John McCarthy, Marvin Minsky, Nathaniel Rochester, Claude Shannon*

Traditional areas of AI

- Problem solving
  - Search
  - Game playing
- Knowledge and Reasoning
  - Logic
  - Theorem proving
  - Knowledge representation
- Planning
- Learning
- Natural language understanding
- Perception
- Motion and manipulation



Source

Main approaches to AI

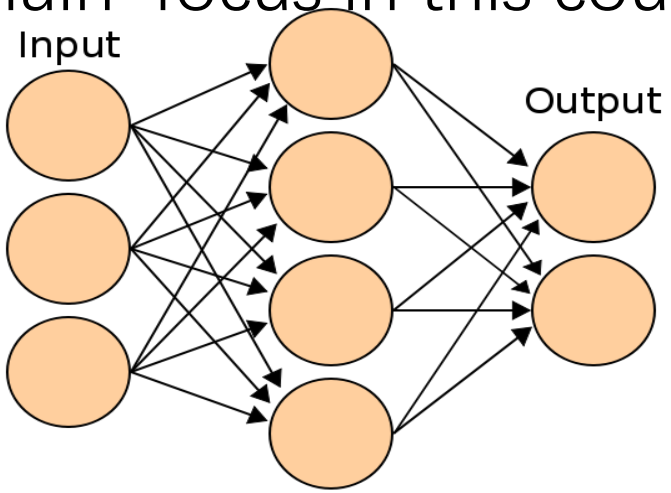
Rule-based

- Logic, deduction
- Explicit coding of knowledge as formulas or rules
- Expert systems
- Dominated AI-books until the end of the last century

∀x(human(x)→

Machine learning

- Induction rather than deduction
- Adapt to the environment
- Main-focus in this course



Source

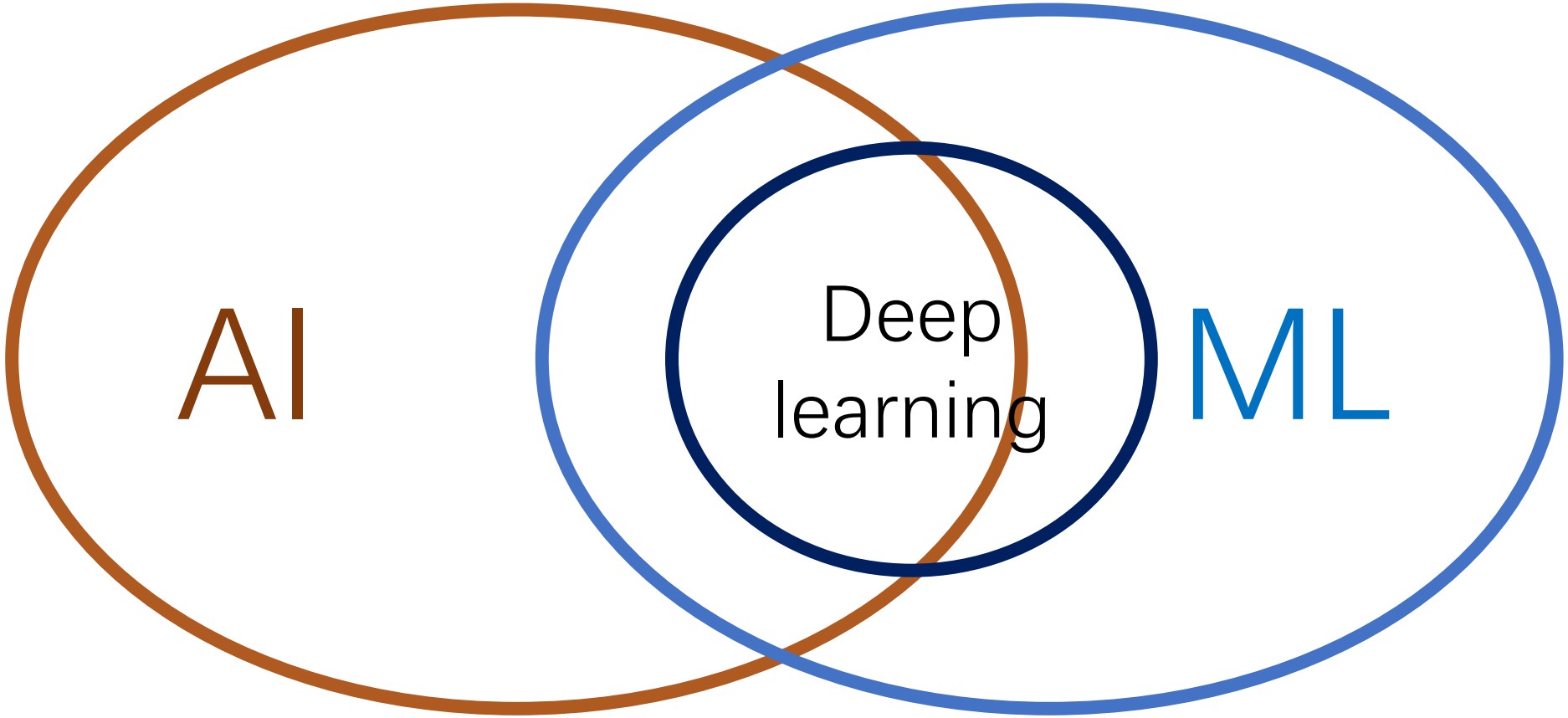
Machine Learning

Machine learning (**ML**) is the study of computer algorithms that improve automatically through experience.

- …used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks. (Wikipedia)

- A variety of algorithms
- Large improvements on many tasks the last 10 years driven by deep neural networks

AI, Machine learning, Deep learning



Human vs Machine – Who is smartest?