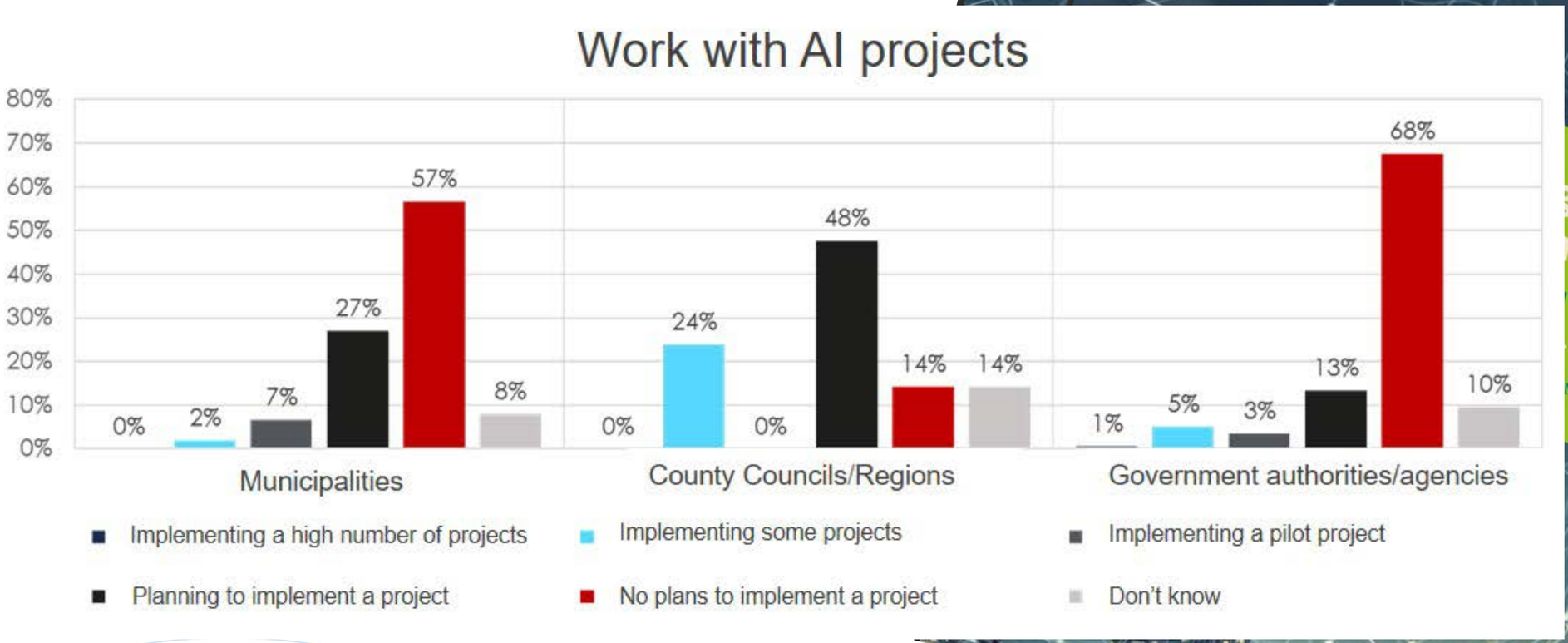
A Perspective on Artificial Intelligence in Finance, Accounting & Auditing

Erik Schaffernicht

Senior Lecturer, External Collaboration

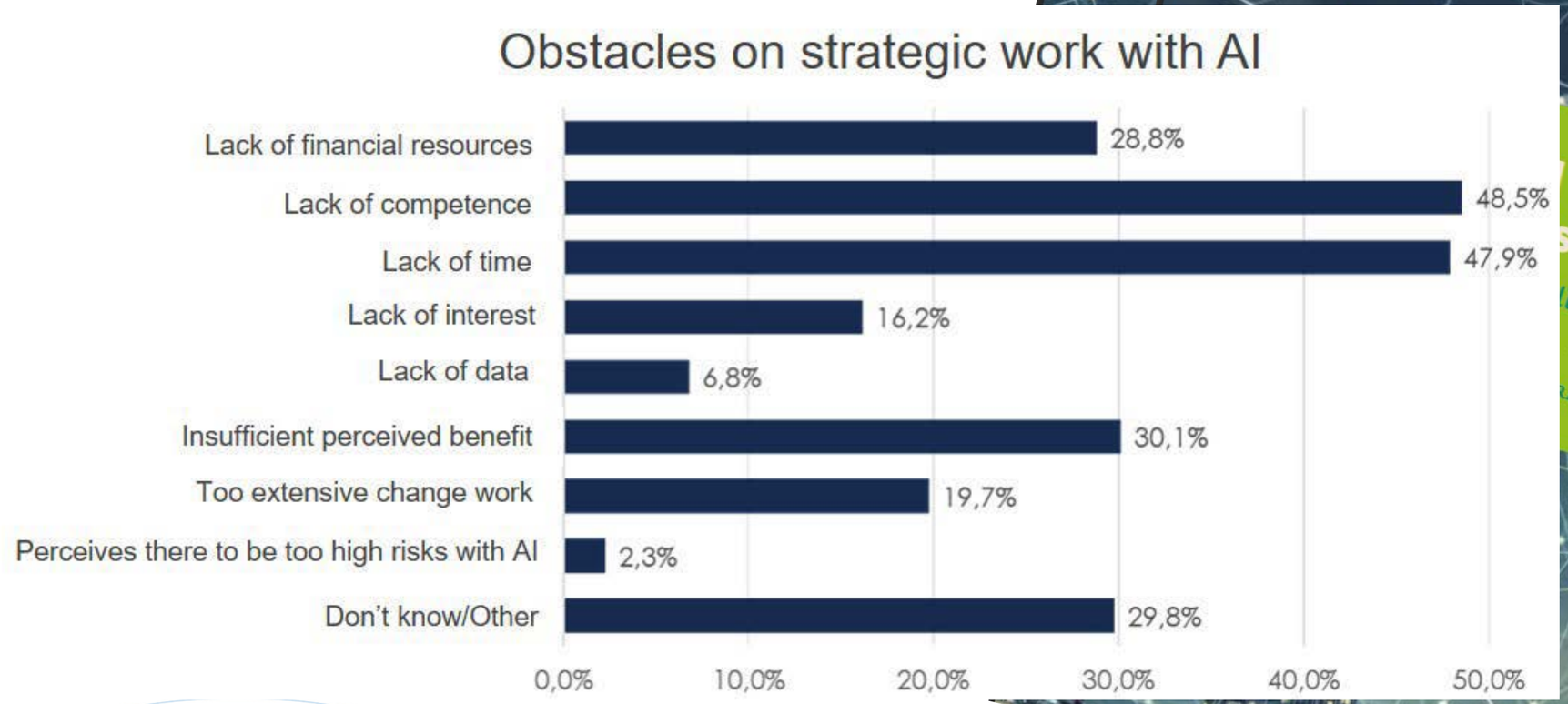
Center for Applied Autonomous Sensor Systems

AI & the public sector in Sweden



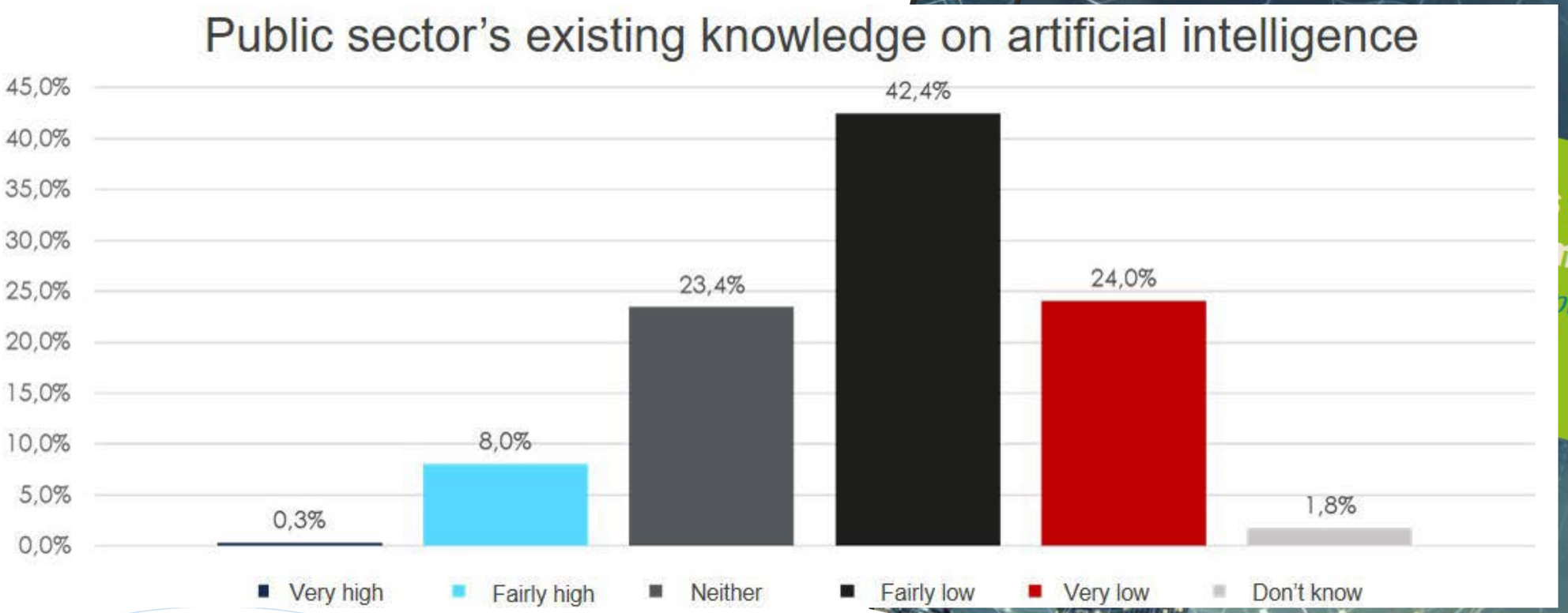
Source: **Artificial Intelligence in Swedish Business and Society**. Vinnova report 2018:12. p. 62

AI & the public sector in Sweden



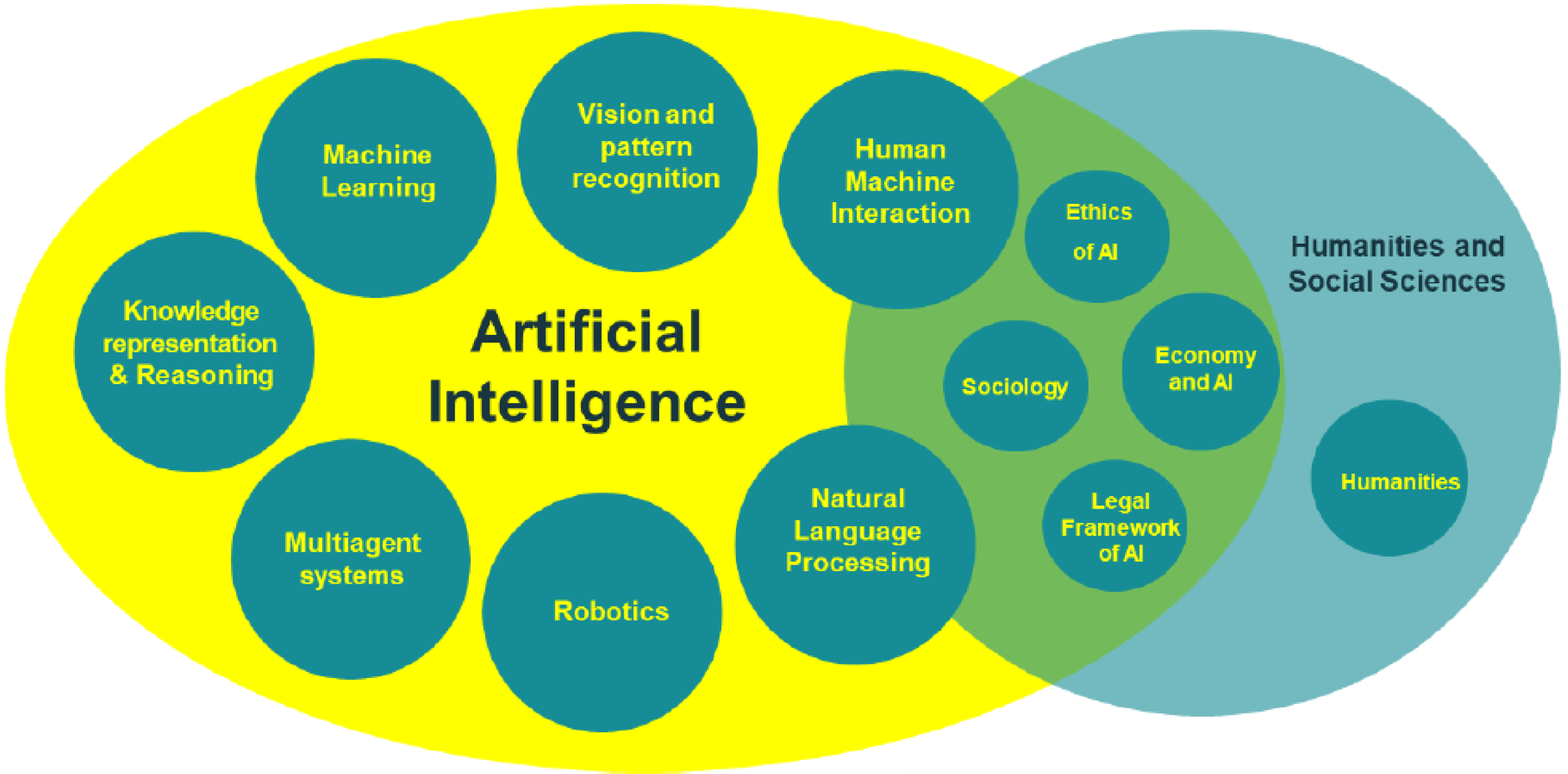
Source: **Artificial Intelligence in Swedish Business and Society**.
Vinnova report 2018:12. p. 58

AI & the public sector in Sweden



Source: **Artificial Intelligence in Swedish Business and Society**. Vinnova report 2018:12. p. 62

What is Artificial Intelligence?



"Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs." John McCarthy, Stanford

Source: Fredrik Heintz, President of the Swedish Artificial Intelligence Society (SAIS)

Two ways of making machines intelligent

- Bio-inspired: How do humans and animals learn and evolve?

➔ Artificial Neural Networks, Evolutionary Algorithms, ...

- Logic-based: How do humans apply reasoning and decision making, and how to formalize this for machines?

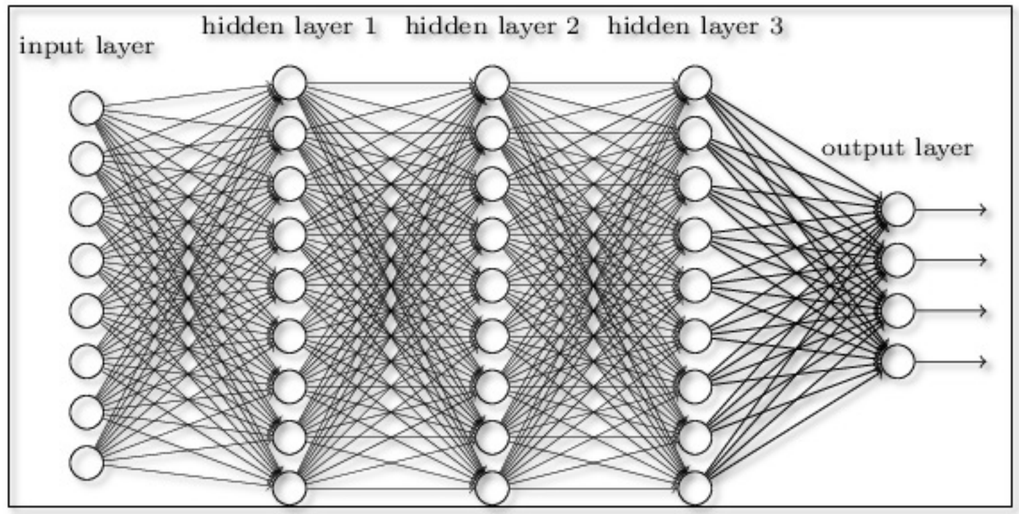
➔ Automated reasoning, first-order logic, planning, ...

Recent Trends in AI

- Autonomous Systems and Robotics
- Machine Learning
- XAI - Explainable AI
- Data driven decision making
- Natural language understanding
- Human-AI Collaboration / Cognitive Assista
- Ethical, Legal, Societal and Economic (E-LS

Source: Fredrik Heintz, President of the Swedish Artificial Intelligence Society (SAIS)

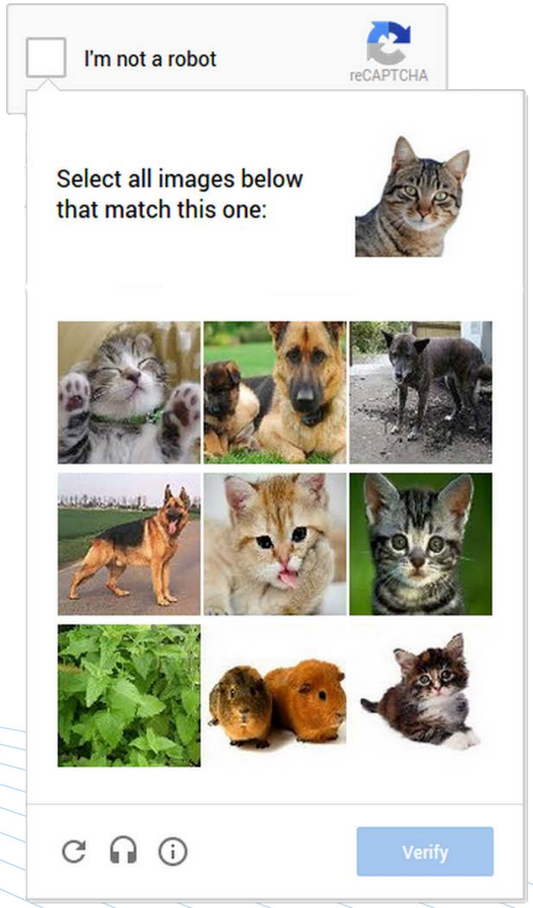
Most important trend: Deep Learning



Artificial Neural Networks:

Simplified mathematical model of the brain consisting of neurons in layers and their connections to each other

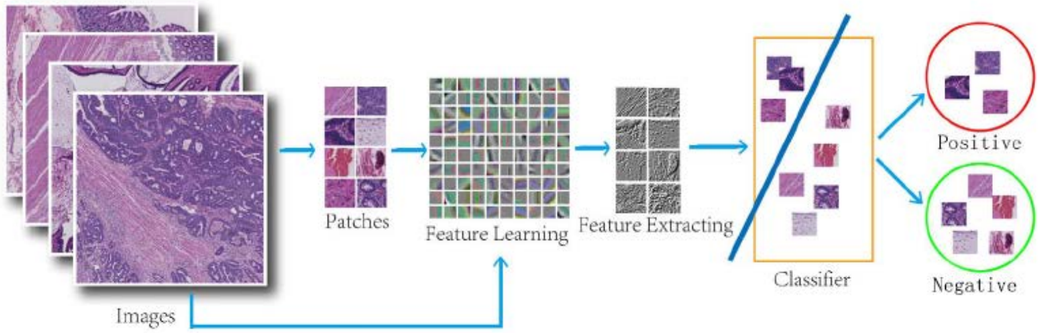
Developed in the 1980's, but only recent hardware allows to have many layers (deep architectures)



Two caveats

- Require huge amounts of data to train
- It is not a general AI → it won't solve all problems

Success of Deep Learning



- Medical image classifcation
- Semantic Segmentation / Scene Parsing
- Winning in Go
- Automated image description generation

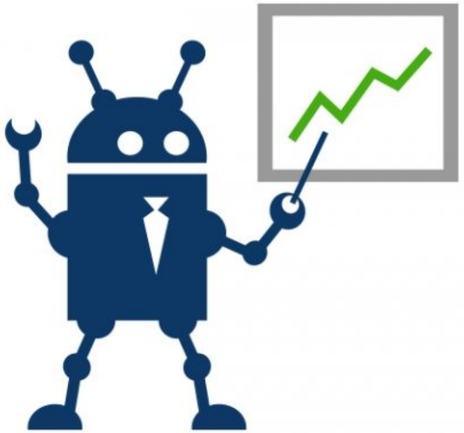
man in black shirt is playing guitar.

construction worker in orange safety vest is working on road.

two young girls are playing with lego toy.

boy is doing backflip on wakeboard.

Current applications of AI:
Portfolio Managment / Financial Planning



Robo-advisors

- Rule-based systems using data from questionnaires as input data
  - ➔ no personalized advice,
  - ➔ no or little adaptation to market situations,
  - ➔ little explanation of the recommendation,
  - ➔ no learning

Related applications:

- automated trading systems
- deep investing

Current applications of AI: Credit Scoring

automatic detemination of the financial situation of entities

- Complex models assigning each entity a score expressing the credit worthiness
    - Black Box problem

Related applications:

- forecast revenues
- predict amount of tax payments

Current applications of AI: Document Classification

Email spam classification

- Content filters using AI methods
- system assigns each mail a score expressing the likelihood that this is spam, based on learned examples

Related applications:

- Sorting of incoming documents: invoices, contracts, reminders, reports, etc.

Future applications of AI: Document Analysis

- Early attempts:
  keyword detection in financial reports

- natural language understanding to improve access to, and analysis of, unstructured data, such as contracts, reports and emails

➔ Deep Learning

Current applications of AI: Anomaly & Fraud Detection

- build machine learning models of ‘normal’ activities / reports
- measure deviation from the normal baseline

Of big interest for financial institutions to check regulatory compliance and perform supervision, and auditing

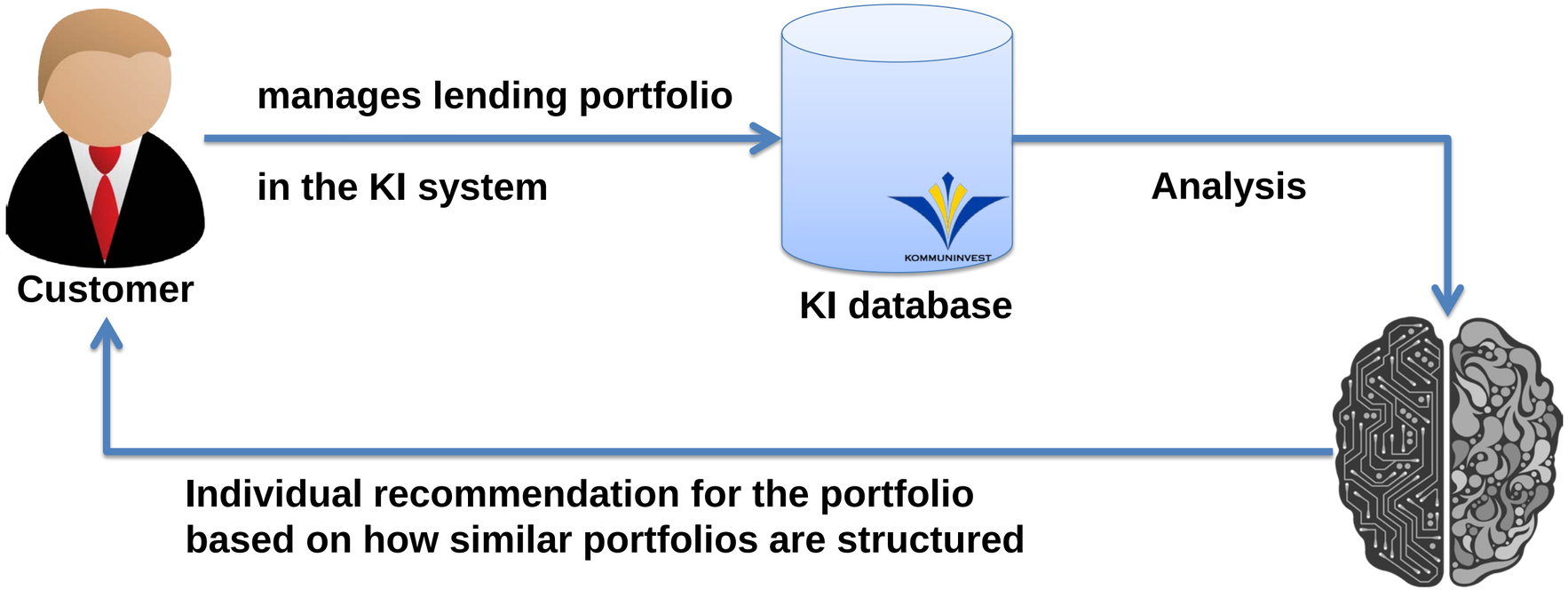
Future applications of AI:
Customer Service / Personal Assistants

Google I/O 2018 –
Google Duplex Demo

Google Assistant makes
a phone call to schedule
an appointment / make a
restaurant reservation

Combines Natural Language
Processing and Deep Learning

Current applications of AI: Recommender Systems



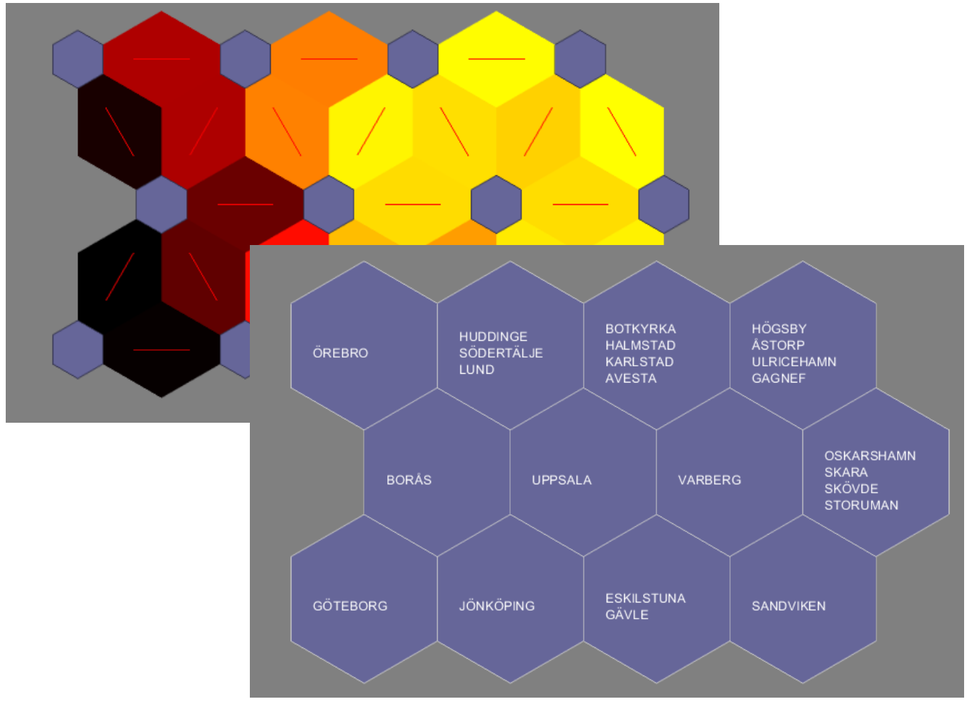
KOMMUNINVEST

ÖREBRO UNIVERSITY

First step – Identify clients with similar lending profiles

- every client is described by its portfolio features

- Clustering: looking for natural groups in the data according to similarity of features
  ➔ Self-organizing maps



Ongoing work: Deriving recommendations from those groups

KOMMUNINVEST

ÖREBRO UNIVERSITY

Hans - the clever horse

Only because it seems intelligent, it does not mean that it is really intelligent

Danger

Trusting the machine without understanding it! It have learned something different then expected!

BERLIN'S WONDERFUL HORSE

He Can Do Almost Everything but Talk—How He Was Taught.

Special Correspondence THE NEW YORK TIMES.

BERLIN, Aug. 23.—In an out-of-the-way part of the German capital a horse is now shown which has stirred up the scientific, military, and sporting world of the Fatherland. It should be said at the very outset that the facts in this article are not drawn from the imagination, but are based upon true observations and can be verified by Dr. Studt, Prussian Minister of Education; by the famous zoologist, Prof. Moebius, director of the Prussian Natural History Museum, and by other eminent scientific and military authorities. I had occasion to-day to see a performance of the animal which was given in the presence of the young Duke of Sachse-Coburg-Gotha.

Hans, the wonderful stallion, is nine years old and is the property of a Herr von Osten, a retired school teacher. The horse has never been used for riding or driving. For over four years Herr von Osten has given the animal systematic instruction such as he would give to a child. The illustrious pedagogue is the owner of a tenement house in the northern part of Berlin, and there he lives. The animal is quartered in a small shed adjoining a court where he is shown.

Some years ago the neighborhood was astonished by observing the training which Herr von Osten gave his animal. They beheld him and Hans at a certain hour of the day standing in the court before a blackboard and counting machine. Herr von Osten, undismayed by ridicule, (for by his method he had gained the reputation of being an old-crank,) instructed the stallion by showing him the balls on the machine, and influencing him to indicate a number by stamping down his right hoof. At the same time, while the horse was doing this, his instructor spoke the name of the number. Then every time Hans put down his foot correctly he would be rewarded by a carrot or a piece of sugar. All other things the intelligent animal learned by seeing certain objects and at the same time hearing their names. In this way words to him became signs for visible objects, and he used footsteps as signs for his perceptions, according to the same psychic laws as we use a language to make others understand.

After Herr von Osten had taught Hans this simple sign language, the foundation for further education was established. He put before him gold, silver, and copper coins, and taught him to indicate gold pieces by one movement of the foot, silver with two, and copper with three steps. When, for example, three coins were placed in a row, Hans stamped down his foot three times when asked the number. He is also able to distinguish coins according to signs. When asked to give the value of a one-mark piece touched by his teacher, he moves his foot once, for a two-mark piece twice, &c.

Hans is an expert in numbers, even being able to figure fractions. He answers correctly the number of 4's in 8, in 16, in 20, in 7 he stamps down his foot twice and for the fraction once. Then, when 5 and 9 are written under each other on the blackboard and he is asked to add the sum, he answers correctly.

Hans is also capable of distinguishing persons. He told the number of girls and officers standing in a line.

A remarkable thing happened yesterday. An officer was pointed out, and Hans was told, "That is Count Dohna." Half an hour later the same man was pointed out to him, and when asked for his name the horse picked out the letters D-o from the blackboard. Herr von Osten, however, having the name Doenhof in mind, wanted to help the animal by uttering "Do." Unconsciously, however, Hans spelt out correctly "Dohna." In the same manner to-day Hans was introduced to the Prince of Sachse-Coburg-Gotha, and also gave his name correctly.

The versatility of Hans in other directions is astonishing. He can distinguish between straw and felt hats, between canes and umbrellas. He knows the different colors. One beholds several colored rags fastened on a string. A cavalry officer places himself before the horse and Hans is asked to state the color of his cap. The horse answers by stamping his foot down three times, the colors of the third REG. which, like the cap, is red.

Hans has also been taught to distinguish tones. The various tones of the musical scale are numbered, and he recognizes their position by his usual method.

Hans can tell the time on a watch and can indicate the exact hour. At the test yesterday he recognized persons from photographs. Herr von Osten placed persons in a row who had given him their photographs; then put the picture before the horse and asked him to indicate the position of the person in the line. Again Hans recognized the gentleman in civilian clothes who the day before had been introduced to him in uniform. He knows the names of the months and indicates the day of the week by putting down his foot, Sunday once, Monday twice, &c.

Prof. Moebius, the eminent zoologist, has this to say about Hans:

"He possesses the ability to see sharply, to distinguish mental impressions from each other, to retain them in his memory, and to utter them by his hoof language. Of course, not by himself has he learned all this, but by methodical instruction of a human intelligence, who has developed the highly intelligent senses of the species horse. For wild horses, not trained, in the same manner utilize their physical and physchic faculties as does Hans, to satisfy their desire for food.

"Herr von Osten has succeeded in training Hans by cultivating in him a desire for delicacies. This desire is aroused by questions and finger signs, according to which the stallion acts, in order to satisfy his aroused desire, for as soon as he puts his foot down he snaps for the delicacy in the hand of his master. I doubt whether the horse really takes pleasure in his studies. He follows entirely mental impressions which he receives from the surroundings and which satisfy his wants."

Hans is the second horse Herr von Osten has trained. He claims that any horse of fair intelligence can be so taught. Herr von Osten's training is done purely from a scientific standpoint, and he told me that he greatly regretted the premature publicity given to his work. By the time this article is in print the Kaiser, who has heard with interest of this horse prodigy, will have seen the animal.

EDWARD T. HEYN.

HANS AND HIS OWNER, HERR VON OSTEN.

The New York Times
Published: September 4, 1904
Copyright © The New York Times

New York Times
Published: 4th of September, 1904

ÖREBRO UNIVERSITY

Another danger

- bias in the data

  <u>Microsoft's Tay debacle:</u>
  chatbot learning from interacting with human users on twitter, with the goal to appear like a human user

➔ In less than 24 hours Tay turned from a cheerful bot into a racist mysogynist

Optical Illusions for Man & Machine

“panda”

57.7% confidence

Goodfellow, Ian J., Jonathon Shlens, and Christian Szegedy. "E
harnessing adversarial examples." *arXiv preprint arXiv:1412.65*

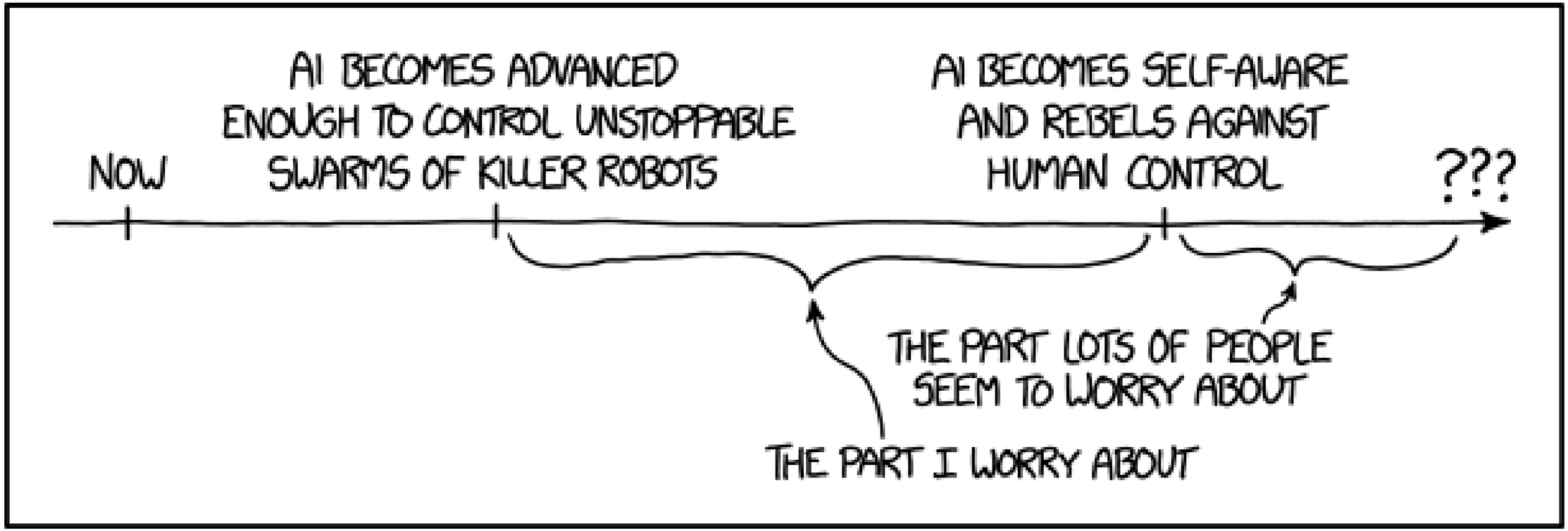
Take home message

- AI is a powerful tool to handle dull and computational heavy tasks

- Current AI systems are not general problem solvers and have many possible flaws

➔ Approach AI systems with a critical mind

An XKCD comic



Title text: I mean, we already live in a world of flying robots killing people. I don't worry about how powerful the machines are, I worry about who the machines give power to.

Source: https://xkcd.com/1968/