

AI - hype, verklighet & vad kommer sen

or: AI + Health = ?

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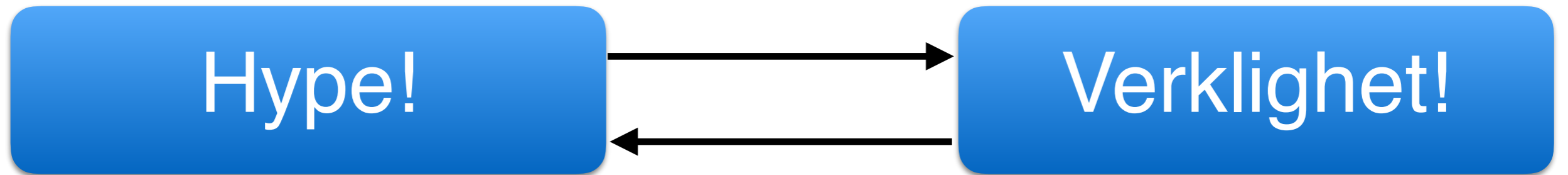
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AI - Hype eller Verklighet?



Youtube: Boston Dynamics



boston dynamics



Exempel: PicDescBot

<https://picdescbot.tumblr.com/>



picdescbot

I'm a bot that describes random pictures. [Abo](#)

Pinned Tweet

picdescbot @picdescbot · 24 Jun 2016

a dinosaur on top of a surfboard



12 782 1.6K

What is this AI thing?

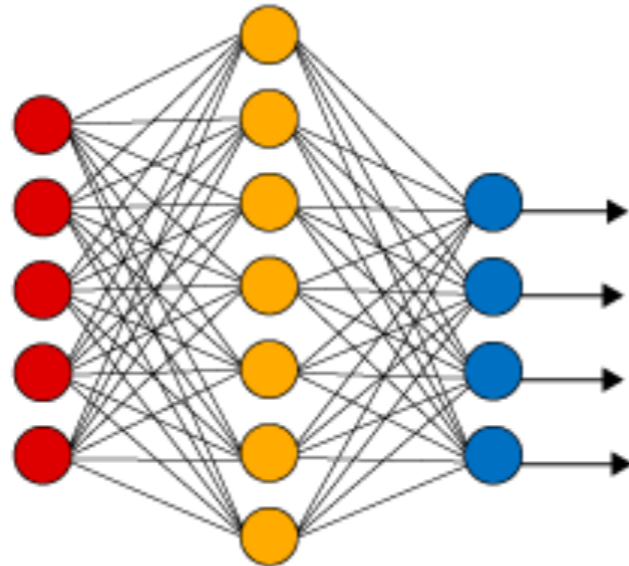
“Moving target” definition of AI:

***“How to make computers do things which,
at the moment, people do better”***

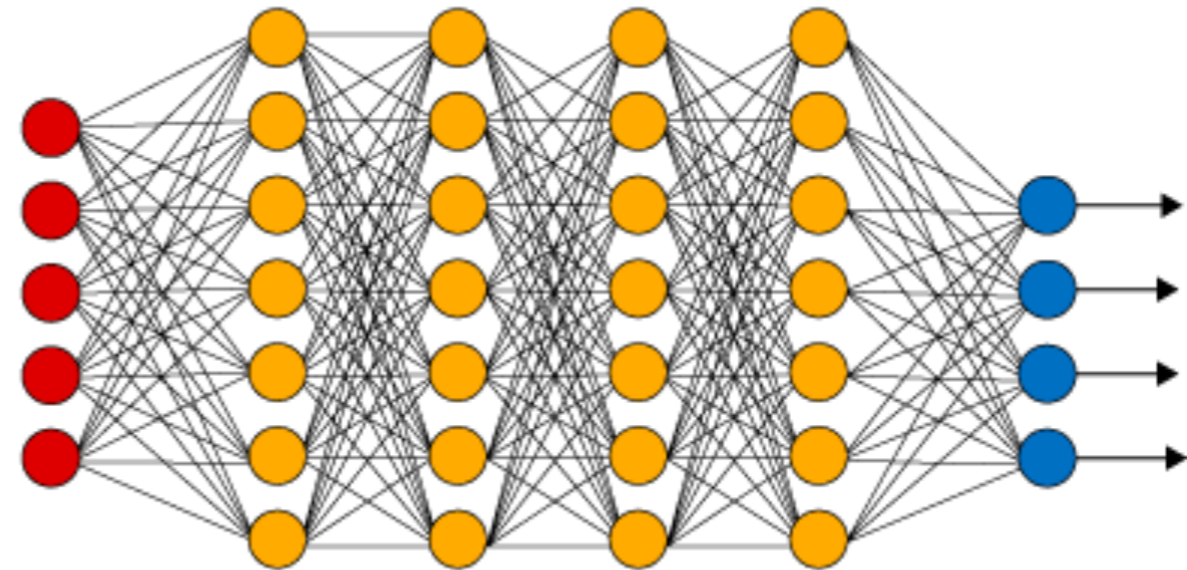
— Elaine Rich & Kevin Knight

Current AI hype: Deep Learning & ML

Simple Neural Network



Deep Learning Neural Network



● Input Layer ● Hidden Layer ● Output Layer

Developed in 1980/90's but now "works" since:

- 1. Computers are VERY, VERY fast**
- 2. We have LOTS and LOTS of data**

Is AI just Deep Learning / Neural Nets?

The Five Tribes of Machine Learning

Tribe	Origins	Master Algorithm
Symbolists	Logic, philosophy	Inverse deduction
Connectionists	Neuroscience	Backpropagation
Evolutionaries	Evolutionary biology	Genetic programming
Bayesians	Statistics	Probabilistic inference
Analogizers	Psychology	Kernel machines

[Domingos2015 “The Master Algorithm”]

Supporting technologies:

Advanced Statistics + Search/Optimisation

Machine learning \subseteq artificial intelligence

ARTIFICIAL INTELLIGENCE

Design an intelligent agent that perceives its environment and makes decisions to maximize chances of achieving its goal.
Subfields: vision, robotics, machine learning, natural language processing, planning, ...

MACHINE LEARNING

Gives "computers the ability to learn without being explicitly programmed" (Arthur Samuel, 1959)

SUPERVISED LEARNING

Classification, regression

UNSUPERVISED LEARNING

Clustering, dimensionality
reduction, recommendation

REINFORCEMENT LEARNING

Reward maximization

Machine Learning for Humans 🤖🧠

But...

**How many machine learning experts does it
take to change a lightbulb?**

One and 500 billion well-labeled examples

***“At Google we say that you typically need a billions examples
for DL to work well” — Kurzweil, Google Brain***

Is this really different from Statistics?

Yes and No:

Statistical Models have:

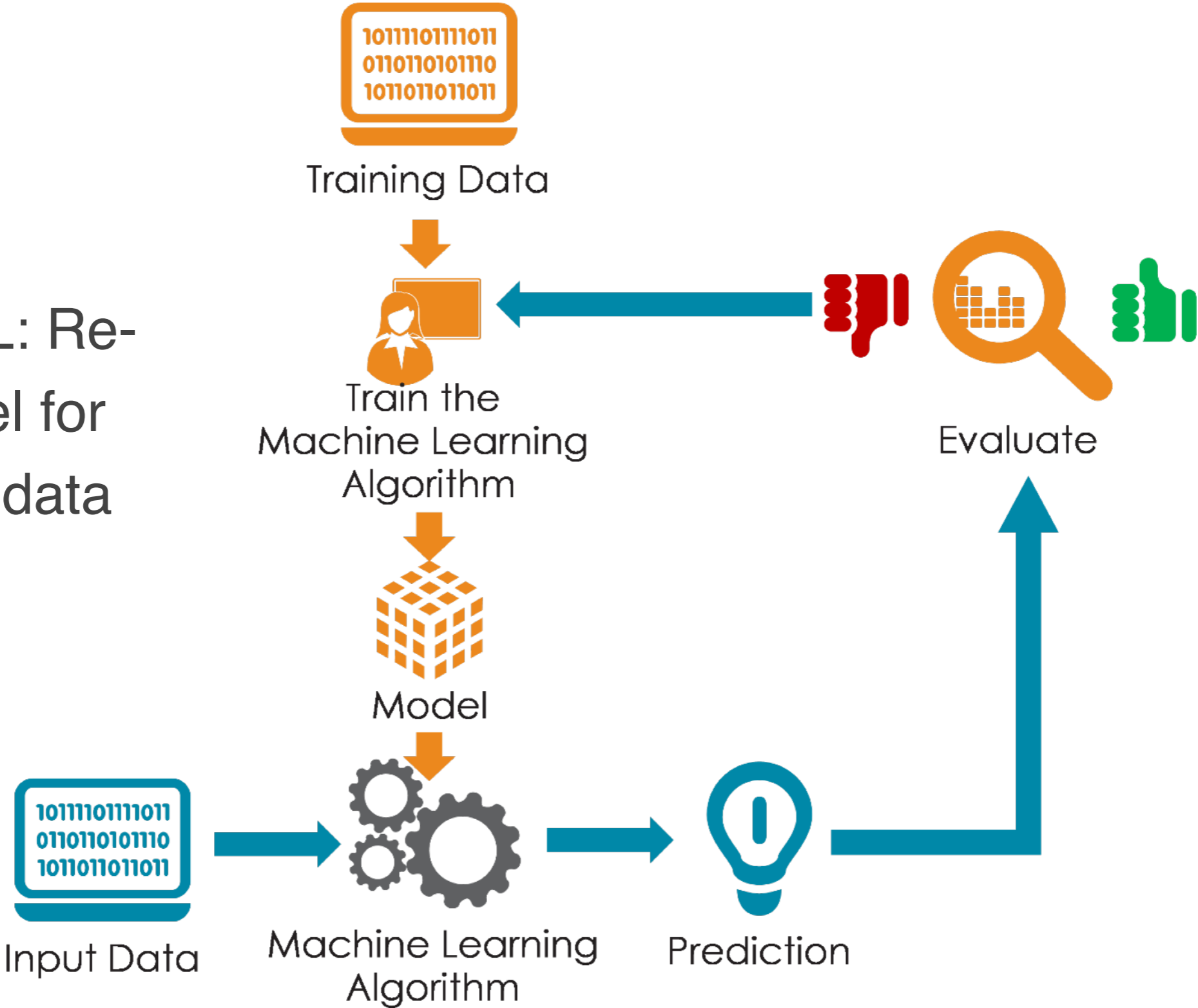
- **more structure**
- **focus on mathematical “proofs”/arguments**
- **are more “lean” and CPU efficient**
- **traditionally applied to column-/Excel-data**

Machine Learning have:

- **less structure, a more “open” set of models**
- **care less about proofs, “just tries things”**
- **are often “wasteful” and CPU IN-efficient**
- **dare to use any type of data**

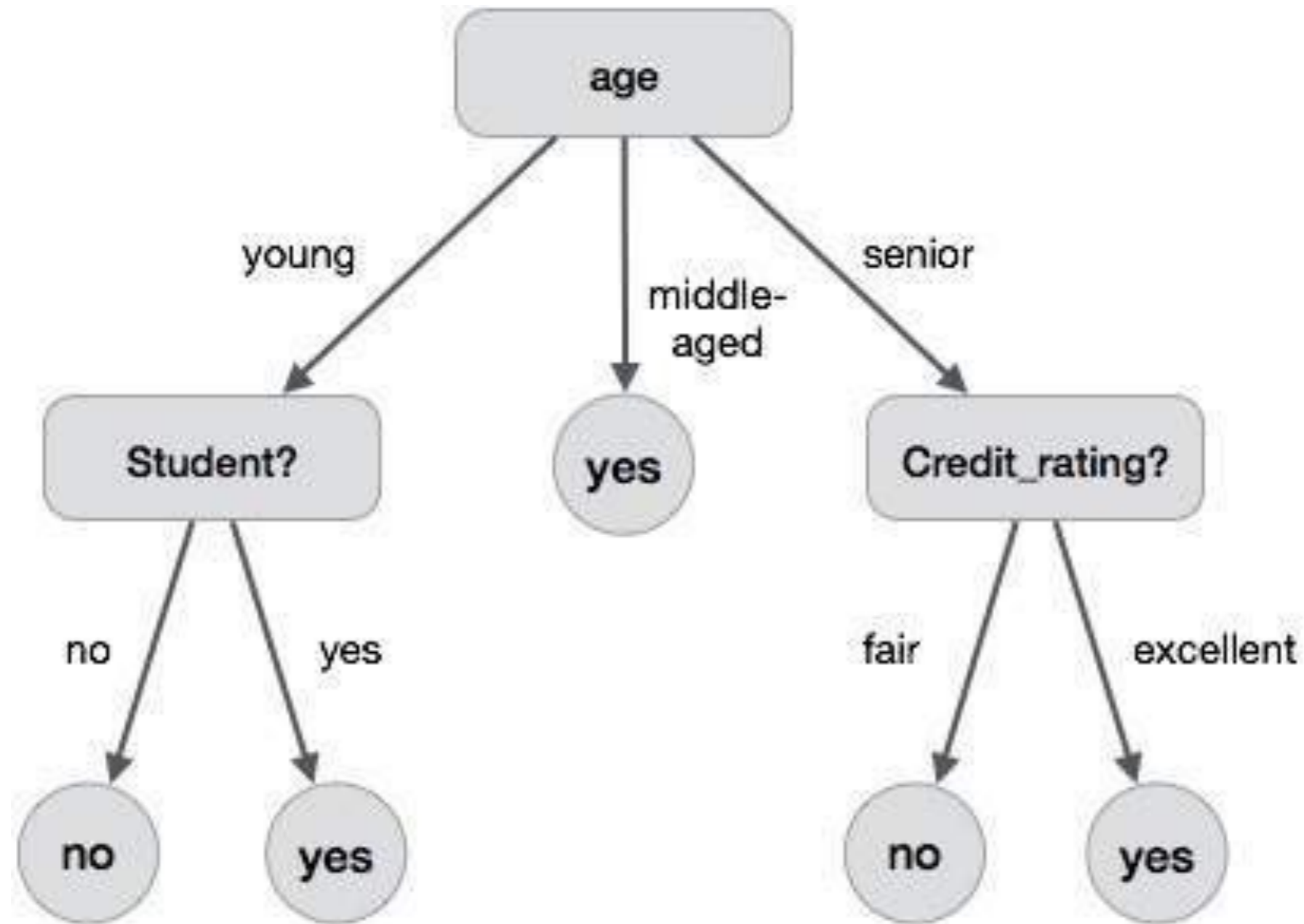
Basic Machine Learning Loop

Online ML: Re-train model for each new data point.



[<http://blogs.teradata.com/data-points/building-machine-learning-infrastructure-2/>]

Decision Tree example

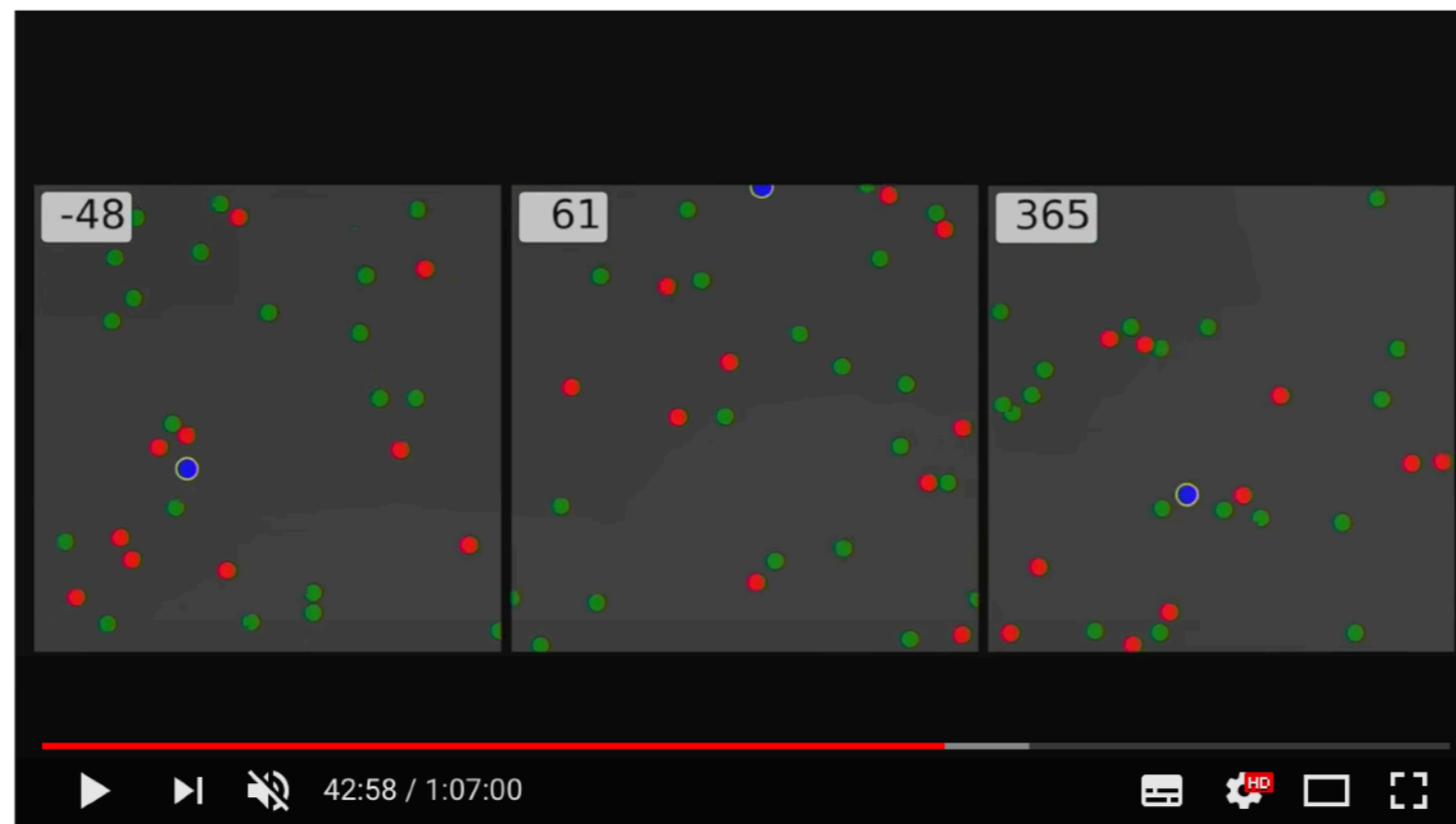
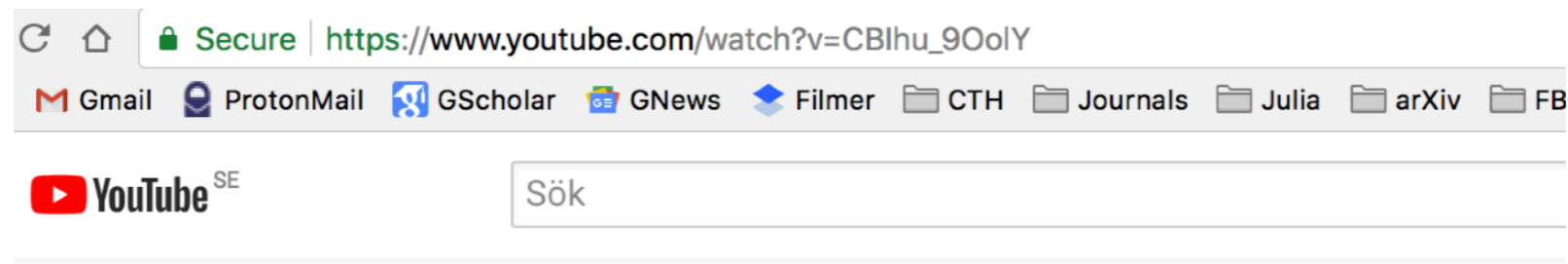


[https://www.tutorialspoint.com/data_mining/dm_dti.htm]

Reinforcement Learning example

DICE game researchers using RL for playing and testing their games:

RL example starts 42:00 minutes into the video
https://www.youtube.com/watch?v=CBIhu_9OoIY



But is it fun? Software Testing in the Video Game Industry (ICST 2018)

Decision-support

Flight code changes [about](#)

 Range from few to many line changes

* No matching module found



Test executions [about](#)

 Range from more failed to more successful

Row numbers: Total number of executions.



What we learned from applying “AI” at large scale?

- Quality of data more important than advanced AI/ML
 - How much data do you have? Enough?
 - Do the data represent all important aspects?
- Simple statistical models often almost as good as advanced AI/ML
 - Data often unreliable => simple models give (at least) 80% of value for 20% of complexity
 - Statistical models easier to understand => robust
- Online algorithms almost always worth it => scalability
- Visualising results important for impact, Human + AI > AI
- An AI system is not enough, people need training + understanding to change their behaviour
- Interval prediction better than point estimates

Vision



“Continuous, automatic decision support to doctors in diagnosing infectious diseases”

Multi-diagnosis situation (not just sepsis...)

2 starting cases: Viral Gastroenteritis & Sepsis

Who are we?



JÖNKÖPING UNIVERSITY



Niklas



VÄSTRA
GÖTALANDSREGIONEN
SAHLGRENKA UNIVERSITETSSJUKHUSET



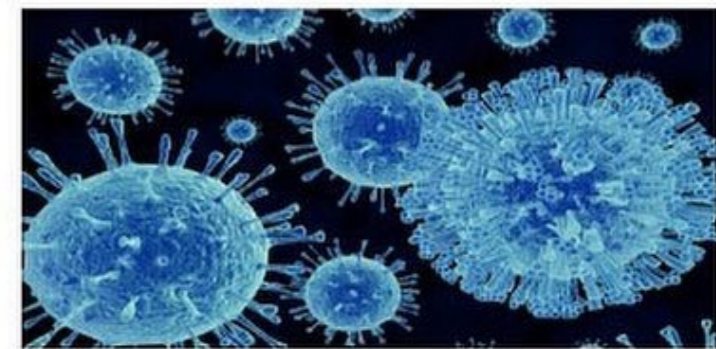
INFEKTION



Johan



Lars-Magnus



Some results of applying AI in Sepsis

- Mani et al 2013
 - Data: 299 toddlers, 3 variables based on blood samples
 - Tech: 9 different “off the shelf” ML algorithms
 - Result: 8 of 9 algorithms gave better predictions than doctors
- Gultepe et al 2013
 - Data: 741 adults, E-journals & many different variables
 - Tech: 4 ML algorithms of very different styles
 - Result: Lactate levels predict very well, Mortality well
 - Key: Data over time (time series data) was key to success
- Horng et al 2017
 - Data: All 230,936 patients during 5 years, vital signs & text from E-journals (Doctors’ and Nurses’ notes)
 - Tech: Traditional ML (SVM) + Topic models (for text analysis)
 - Result: Better results if text included

Horng 2017: Data sources

Table 1. Data types used in models and amount of missing or out of range data.

Feature	Data Type	Missing or Out of Range Data
Age	Continuous	0%
Gender	Binary	0%
Acuity	5-level ordinal	2.7%
Systolic blood pressure	Continuous	4.9%
Diastolic blood pressure	Continuous	5.2%
Heart rate	Continuous	4.6%
Pain scale	Continuous	6.6%
Respiratory rate	Continuous	6.5%
Oxygen saturation	Continuous	5.6%
Temperature	Continuous	6.7%
Free text chief complaint	Text	0%
Free text nursing assessment	Text	2.9%

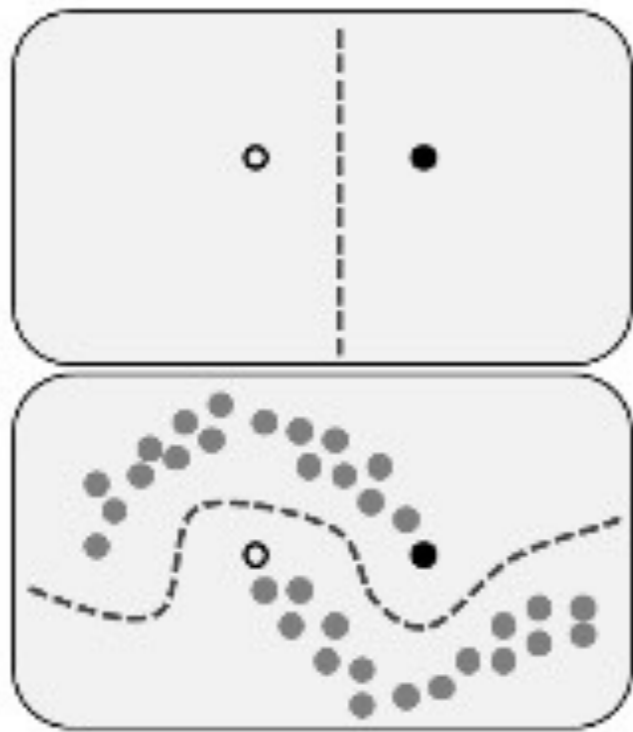
<https://doi.org/10.1371/journal.pone.0174708.t001>

Keywords for our project

- Multiple diagnosis situation (not only one diagnosis)
- General method for AI/ML solutions for different diagnoses
- Handle “missing” & unstructured information (journals/text)
- Key according to doctors:
 - Dynamical processes / changes over time
 - Medical history (“Anamnes”)
 - Understand confidence in system results
- Presentation/interface/visualisation often key to success
- Education & iteration with feedback from clinical trials
- New data sources over time:
 - Spectroscopy (Raman?)
 - Voice/emotion-recognition during patient talks?

Now/next: Semi-supervised Learning & Clustering

Semi-Supervised Learning

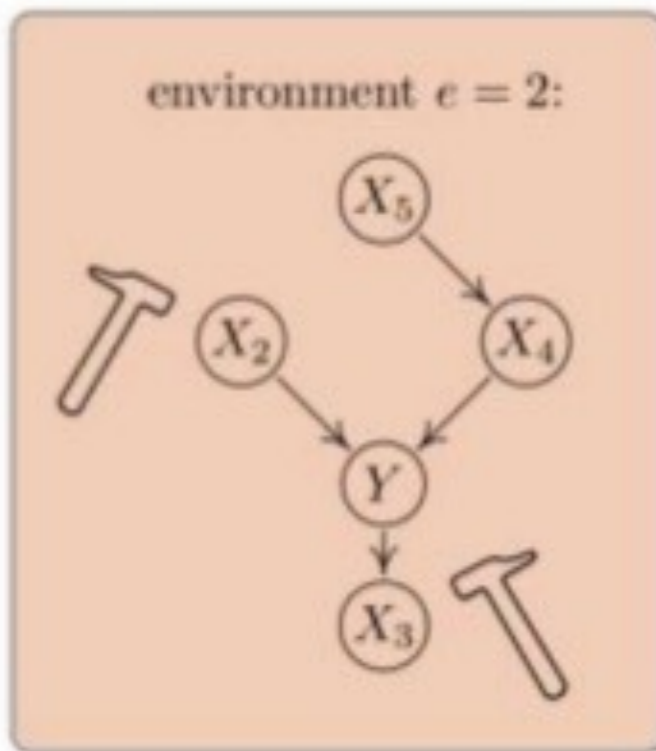
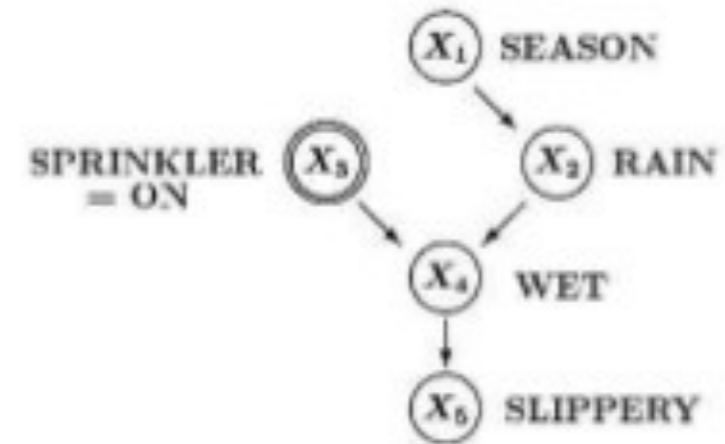


Classification

U B E R

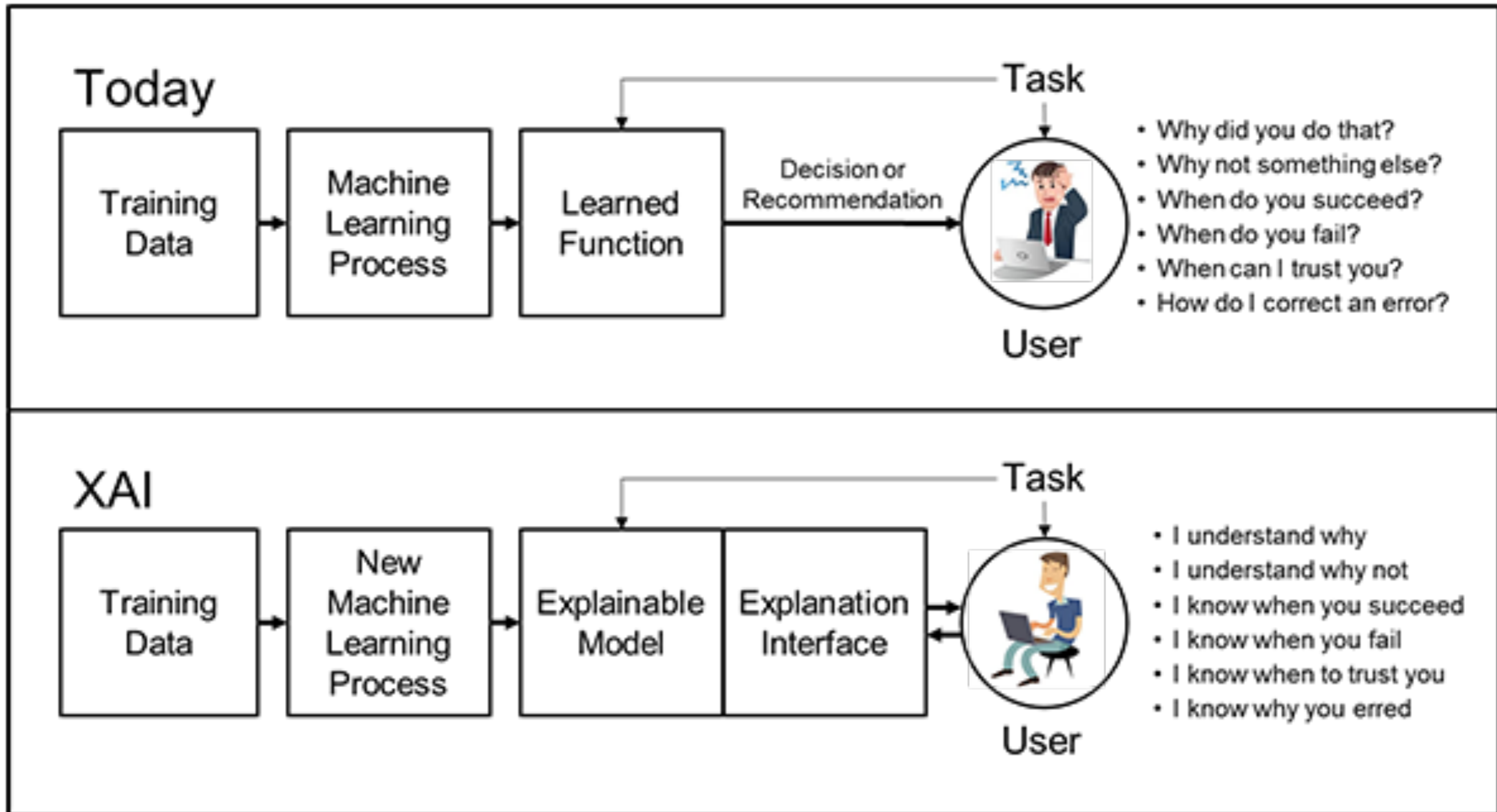
Now/next: Causality instead of Correlations

Causality



- Example:
 - Insurance fees for black cars are higher...
 - Mental disabilities in babies cause difficult births...
- Challenge: discovering causal relations without interventions

Now/next: Explainable AI



[Darpa]

Now/Next: How support humans?

TABLE I
LEVELS OF AUTOMATION OF DECISION
AND ACTION SELECTION

- | | |
|------|--|
| HIGH | 10. The computer decides everything, acts autonomously, ignoring the human. |
| | 9. informs the human only if it, the computer, decides to |
| | 8. informs the human only if asked, or |
| | 7. executes automatically, then necessarily informs the human, and |
| | 6. allows the human a restricted time to veto before automatic execution, or |
| | 5. executes that suggestion if the human approves, or |
| | 4. suggests one alternative |
| | 3. narrows the selection down to a few, or |
| | 2. The computer offers a complete set of decision/action alternatives, or |
| LOW | 1. The computer offers no assistance: human must take all decisions and actions. |

Sheridan1980 from [Frohm2008]

Om jag hade fria händer och “oändliga” resurser

Vad skulle jag göra?

1. **Skriva korta guidelines** gentemot läkare/vårdpersonal samt forskare för hur de kan komma åt data (etiskt, lagligt etc men också praktiskt) för att förbättra vården / er verksamhet. Forskare kan hjälpa er förbättra er om de får tillgång till data och system (på ett enkelt och kontrollerat sätt).
2. **Sätta en kontaktperson/resurs** som kan stötta forskare/vårdpersonal och svara på frågor kring data access.
3. **Bjuda in forskare** att jobba med era data, system, person.
4. **Skapa ett center** med Chalmers+GU, VGR som jobbar med AI/ML/
Förbättringar på VGR-data.
5. **Vara en rollmodell för hela nationen** i hur man får detta att fungera bra. “Exportera” det till alla län.
6. **Få loss och erbjuda pengar** för ny och riskfylld forskning till folk som i tidigare projekt visat de kan förbättra.

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Links, recommended reading/viewing

If you want to understand basics of ML & Current AI hype:

Maini2017, “Machine Learning for Humans”: <https://medium.com/machine-learning-for-humans/why-machine-learning-matters-6164faf1df12>

Possibilities and Limitations of AGI (Artificial General Intelligence):

MIT AGI course lectures are online, start from:

https://www.youtube.com/watch?v=-GV_A9Js2nM

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