



Digital Systems
From Sensor to Decision

ITS Norway
24/4

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AI: the hype, the trust, and the potential

Why listen?

- IFE has worked and applied AI to safety critical systems like nuclear plants and oil industry already in the 1980.
- We are involved in numerous AI projects and have a track record of algorithmic design that is estimated saved Norway 200-250 Billion NOK
- Me, I am a research director at IFE (with a PhD in AI, long before it became cool), responsible for 7 departments and have worked as a AI researcher for many years.

35 years of AI



V.C. Summer Nuclear Station USA	A large Oil and Gas company	ConocoPhillips Norway	Loviisa Nuclear Power Plant Finland	Orskarshamn Nuclear Power Plant Sweden	Kjeller Nuclear Reaktor Norway
Fault Diagnosis through Transient Classification using recurrent neural networks VC Summer Nuclear Power Plant in the USA (2002)	Analysis and prognostics Calculate technical index and remaining useful life for process equipment	Neural Network to Estimation of NOx emission of gas turbines on offshore platforms ConocoPhillips Norway (2009)	Fault identification ability of physical models Fortum - Loviisa Nuclear Power Plant in Finland (2000)	Feed Water Flow, Use of AI-model, Detect 3 kg/s drift, Safety margin, ±3.5 MNOK/y income recovery (2000)	Remaining Useful Life estimation of air filters (2013)



Tomas Eric Nordlander
Research Director at Institute for Energy Technology

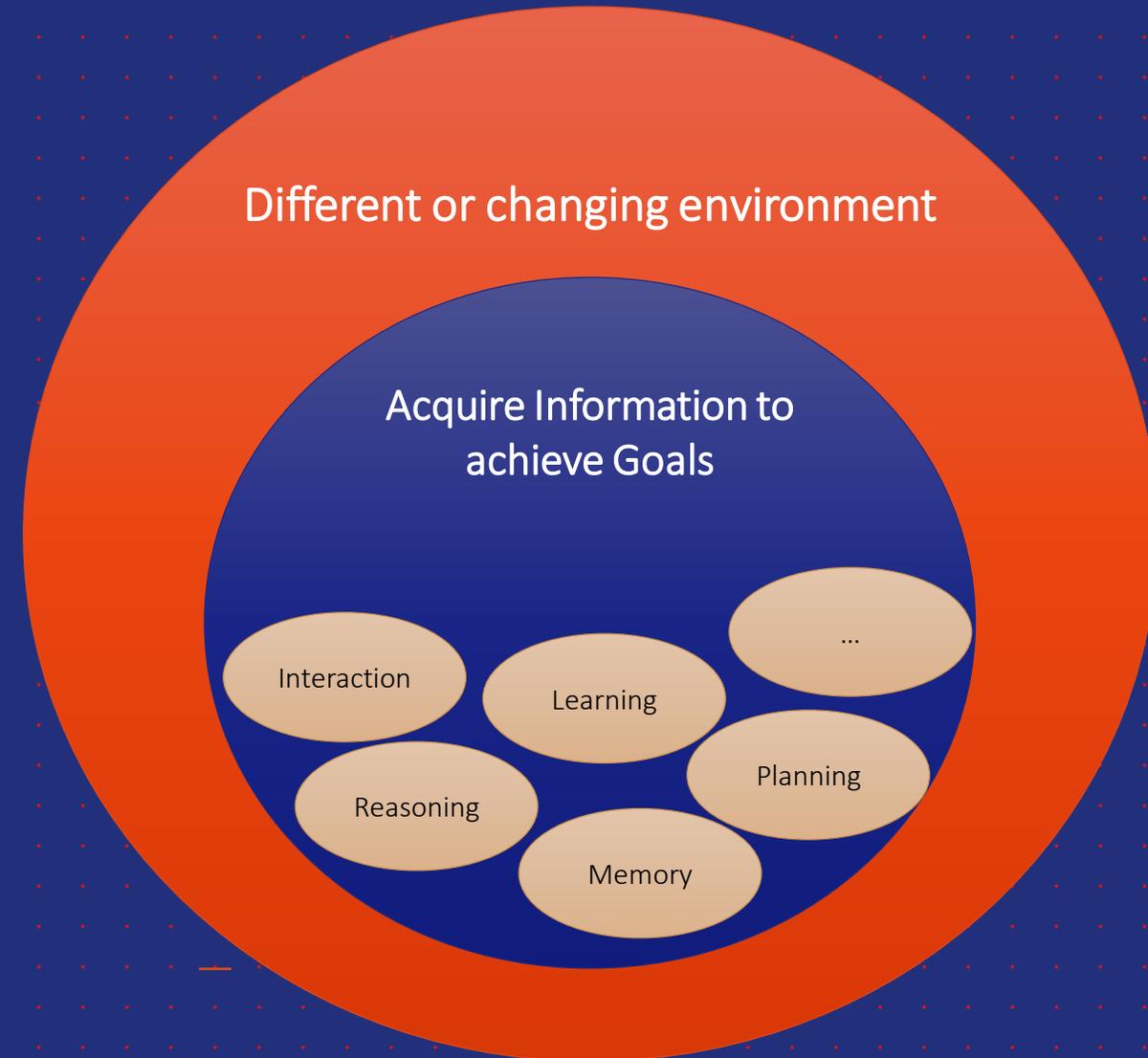
Artificial Intelligence

Definition:

“Intelligence demonstrated by machines and software”

Problems

- Hard to define intelligence, due to the is no common agreed definition
- Hard to measure intelligence, often people use different types. E.g. logical, spacial, etc.

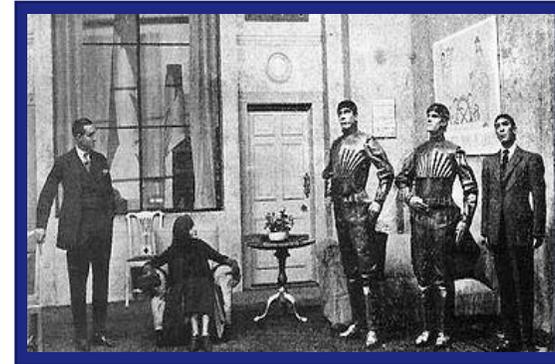


Talos protecting Crete



Pierre Jaquet Droz's "writer"

Rossumovi Univerzální Roboti

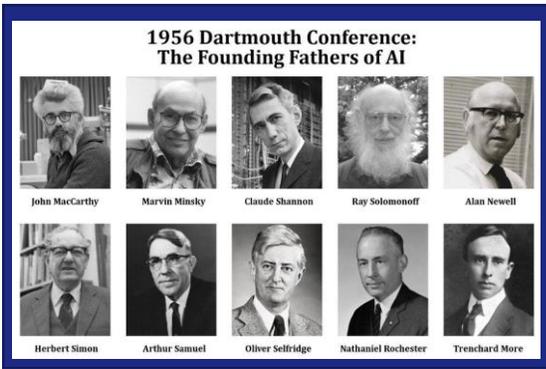


Greek Mythology

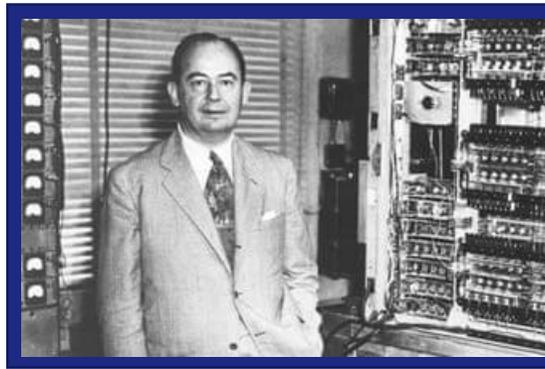
1774

1921

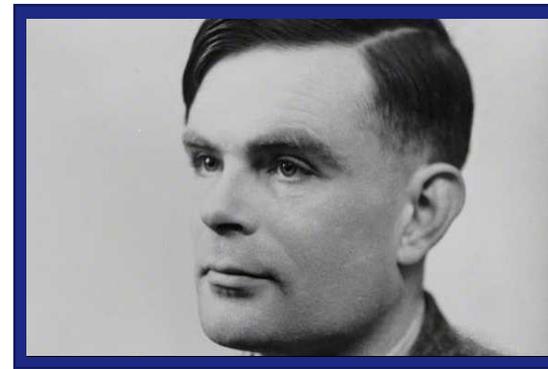
Dartmouth Conference



John von Neumann



Alan Turing



1956

1948

1903-1957

1912-1954



Two main AI categorise:

Current AI

Weak Artificial Intelligence

States that some type of "thinking" features can be added to computers to make them more useful for humans. **A machine with the ability to apply intelligence one specific problem or class of problems**

Artificial Narrow Intelligence

Ordinary Artificial Intelligence

Narrow Artificial Intelligence

...

Future AI

Strong Artificial Intelligence

makes the bold claim that computers can be made to mimic the cognitive processes of humans. Involves goal setting and reflection he process of making and acting on decisions. **A machine with the ability to apply intelligence to any problem**

Artificial General Intelligence

Full Artificial Intelligence

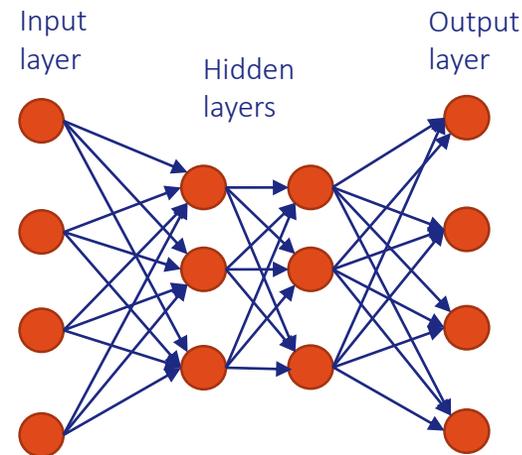
Broad Artificial Intelligence

...

Symbolic vs. Subsymbolic AI

- Symbolic AI: Models make sense to humans
 - White box (e.g. expert system)
- Subsymbolic AI: modelling the problem is inspired by the neuron. Let knowledge and planning emerge.
 - Black box (Neural Network)

(apple(isa fruit)
(shape round)
(colour green)



AI: climate change

DARPA funds
AI progress and too large
claims



1956

The Lighthill report
Scale combinatorial
problem.



1973-1980

DARPA funds
Expert System
Japan 5th generation



1980



Hardware Changes
Expert System
Over promise



1987-1995



DARPA funds
...



1995 - today

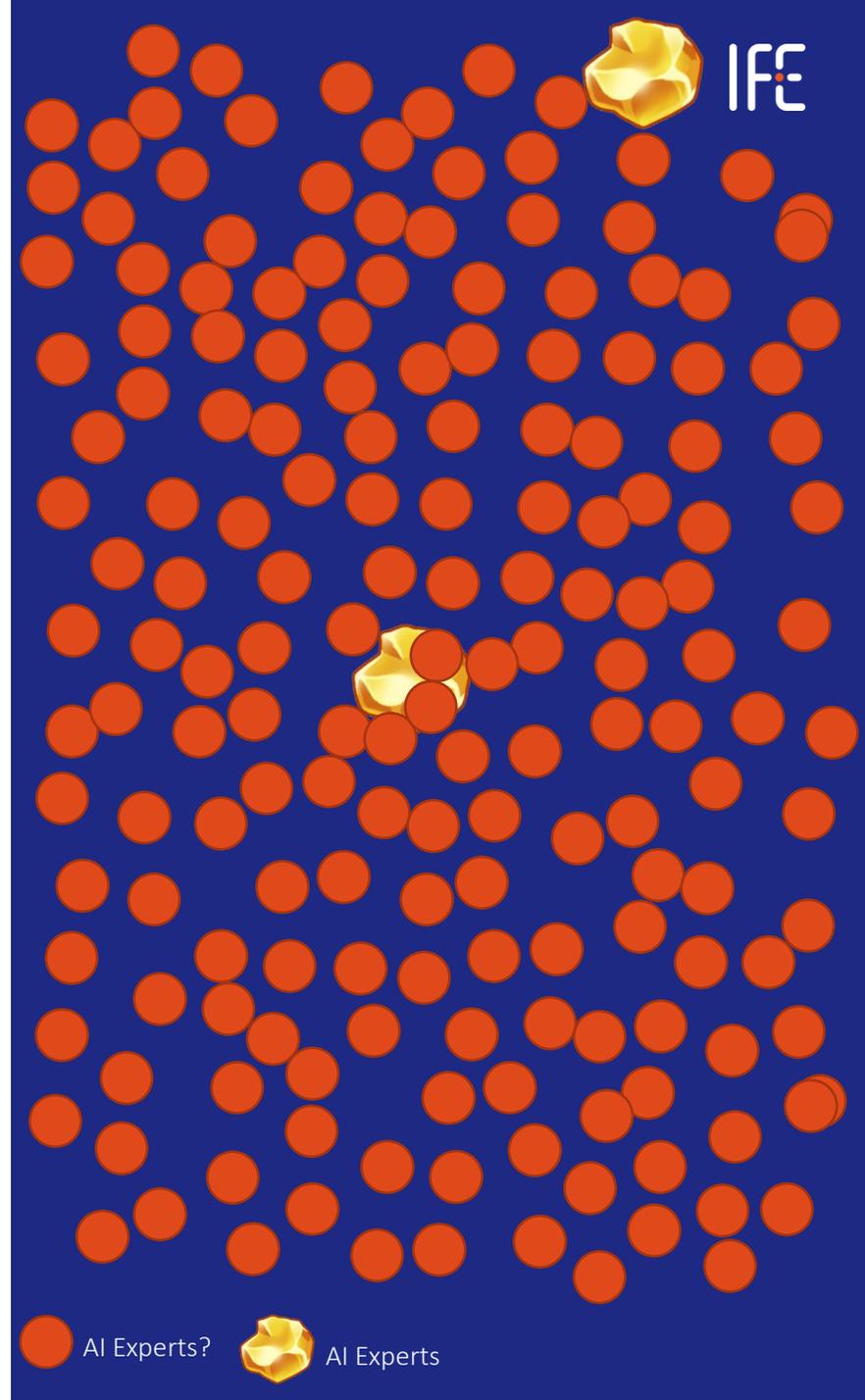
Today it is warm

- Large Promises
- Increase AI funds
 - Ad AI to your startup name to attract funds
 - Opportunistic name changes (e.g. statistics becomes AI)
- AI Experts appears everywhere without academic or AI track record.
- Is it getting colder???



The Hype, be sceptic

- AI company
 - Does it have customer for what its providing?
 - Does it has a finished product?
 - Does the product actually apply AI?
- Research Institute/University
 - How many AI researcher are there?
 - How long have you worked with AI?
 - Can they show some applied AI?



AI it is here to stay

Yes its hyped but AI has gone mainstream!

- new algorithms
- available training data
- dedicated hardware
- cloud AI services
- great investment
- ...



TRUST & Ethics

- Black box & Bias
- EU
 - Develop AI to respect human
 - Autonomy,
 - Prevention of harm,
 - Fairness,
 - And explicability
- Pay attention to vulnerable groups and their risks of exclusion
- Acknowledge the risks with AI and the potential negative impact
 - Winner takes all



European Commission > Futurium



Ethics Guidelines for Trustworthy AI

Join AI Ethics Guidelines

[Home](#) [Guidelines](#) [Register for the piloting](#) [Consultation on draft Guidelines](#) [Best practices](#)

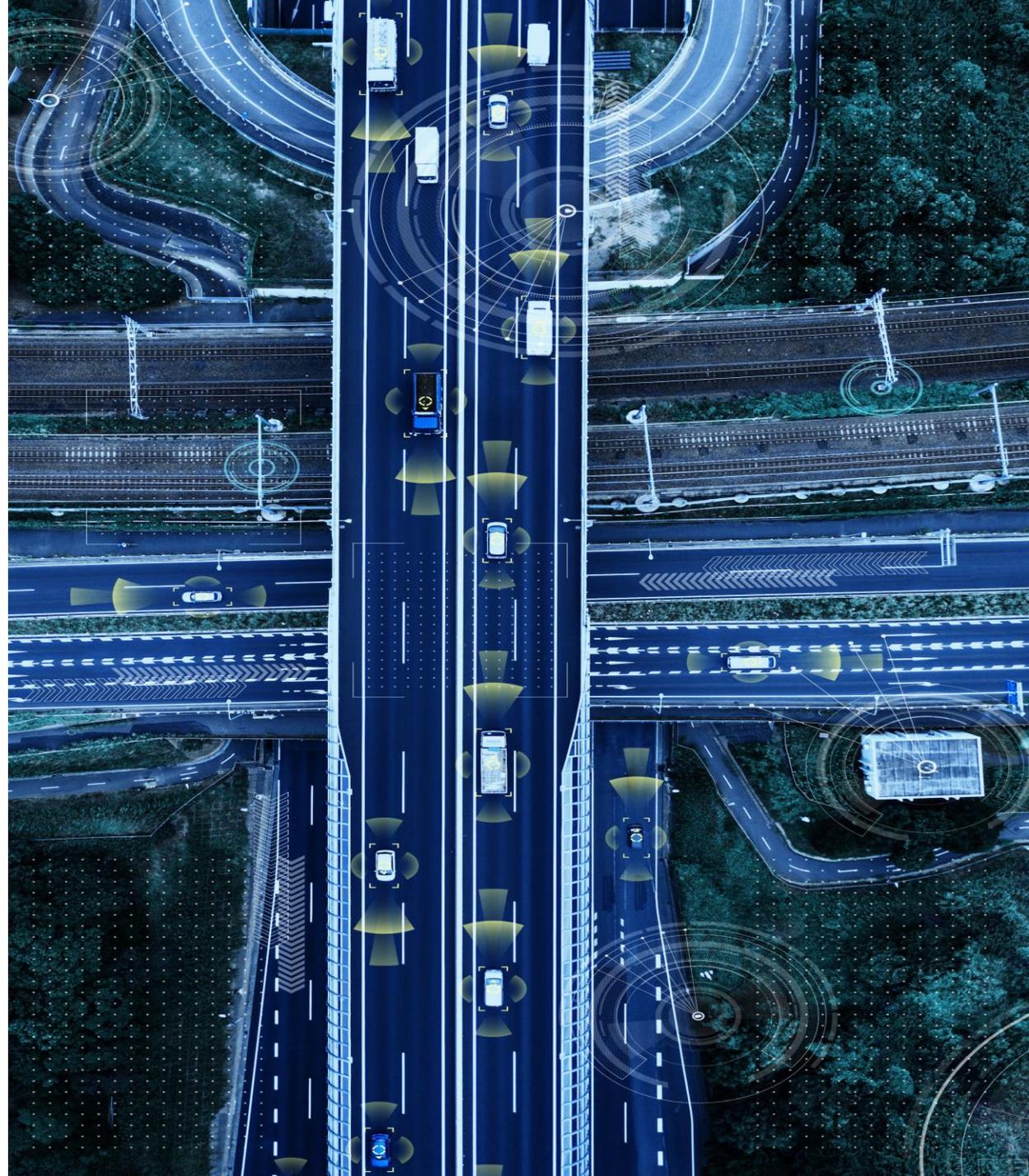
Building trust in human-centric AI

The Ethics Guidelines for Trustworthy Artificial Intelligence (AI) is a document prepared by the [High-Level Expert Group on Artificial Intelligence \(AI HLEG\)](#). This independent expert group was set up by the European Commission in June 2018, as part of the [AI strategy](#) announced earlier that year.

Download the Guidelines

AI potential, in transport

- Autonomous vehicles (cars, drones, ships, etc.)
 - User Monitoring
- Maintenance planning
 - Infrastructure and vehicles
- Infrastructure & system optimisation
 - Minimize Traffic flow, congestion, etc.
 - Prediction and detection of traffic accidents
- Fleet management
 - Optimise route planning pick-ups while consider a range of criteria (financial, environment, etc.)
- Control application
 - Intelligent traffic signalling



DARPA Grand Challenge

2004



On a 240 km desert route

15 teams participated

Results

- 2 withdrawn before the race
- None finished
- Best managed 11,9 km out of 240 km

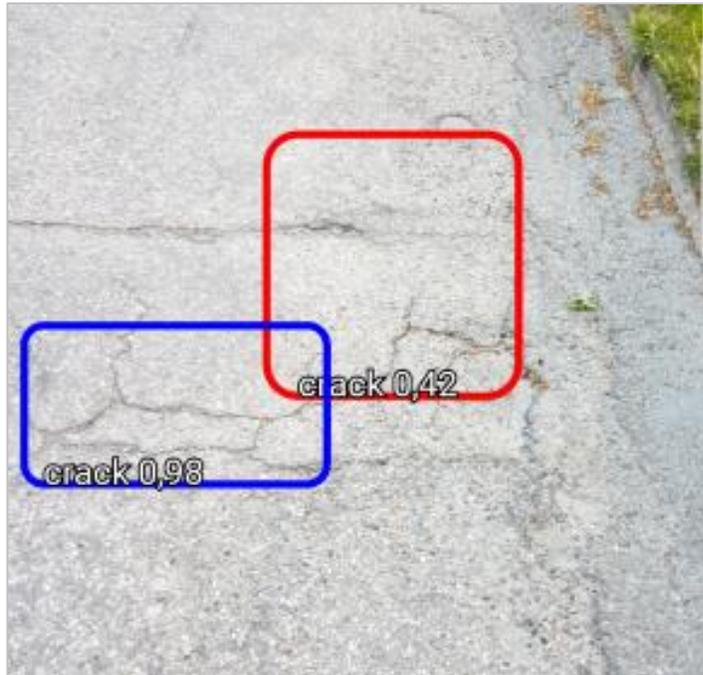
12 year later, still many things to solve

- Snow & bad weather
- Variation of pavement lines and curbs
- Dealing with human drivers and Pedestrian
- Legal Responsibility
- Lack of trust

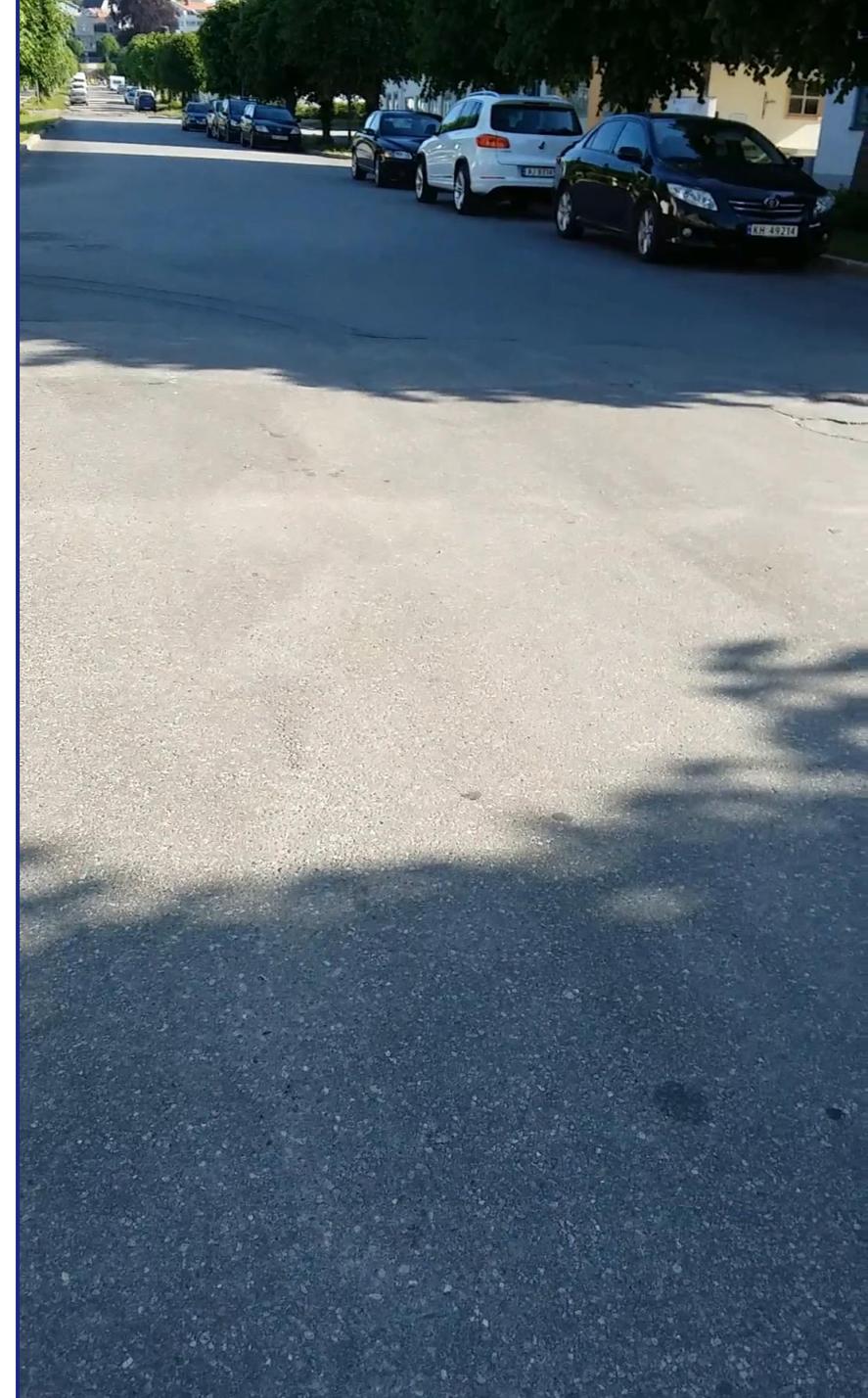
For on-road vehicles

		 Human driver	 Automated system		
		Steering and acceleration/ deceleration	Monitoring of driving environment	Fallback when automation fails	Automated system is in control
Human driver monitors the road	0 NO AUTOMATION				N/A
	1 DRIVER ASSISTANCE				SOME DRIVING MODES
	2 PARTIAL AUTOMATION				SOME DRIVING MODES
Automated driving system monitors the road	3 CONDITIONAL AUTOMATION				SOME DRIVING MODES
	4 HIGH AUTOMATION				SOME DRIVING MODES
	5 FULL AUTOMATION				

Comp. vision for road maintenance



Two young researchers at IFE: Hoa Thi Nguyen and; Jens-Patrick Langstrand got some internal funds to test their idea of computer vision to analyse road quality.



Condition-Based Maintenance

Prognostics modelling

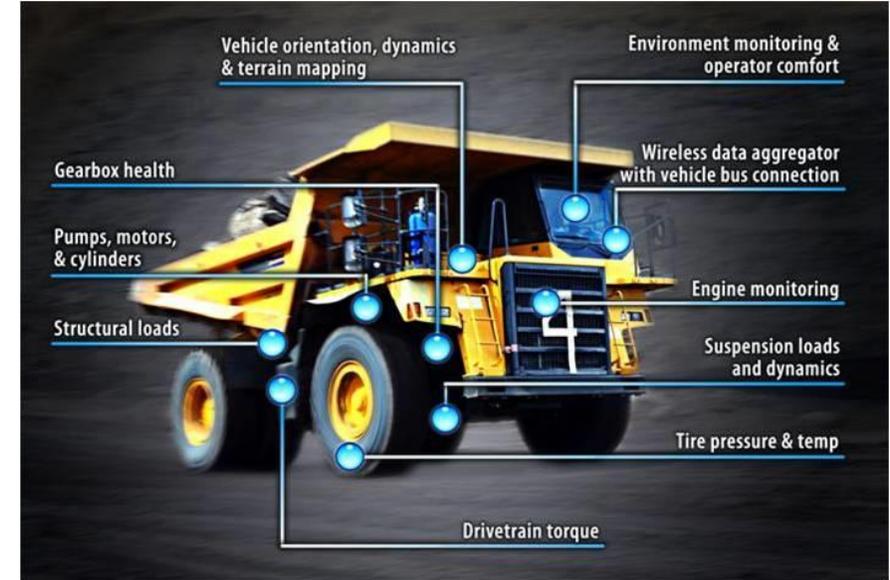
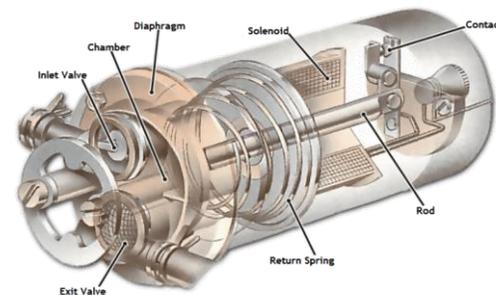
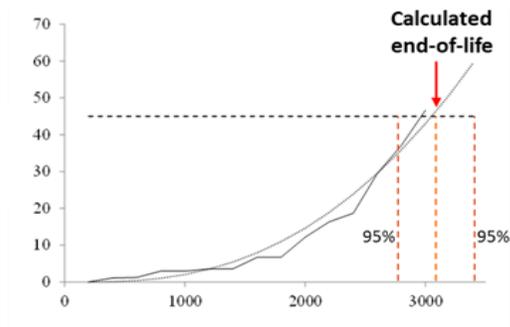
- Remaining Useful Life (RUL)
- Health index
 - Machine Learning & Physical Modelling

Target maintenance efforts

- At the right time
- On the right equipment

Predictive Maintenance uses condition-based indicators and alerts to surface maintenance needs only when your trucks are at risk of breaking down

- E.g. fuel pump of the car





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References

- Chance Calum, Surviving AI
- Nordlander Tomas Eric, AI Surveying: Artificial Intelligence in Business
- MMC Ventures, The State of AI:2019 divergence <https://www.stateofai2019.com/>
- Lighthill report <https://www.youtube.com/watch?v=03p2CADwGF8> &
- https://en.wikipedia.org/wiki/Lighthill_report
- Jerre Jaquet-Droz the writer, Available from <http://www.jaquet-droz.tv/video/9308963/the-writer-by-pierre-jaquet-droz>
- Rossumovi Univerzální Roboti <https://en.wikipedia.org/wiki/R.U.R.>
- Alan Turing <https://www.bl.uk/people/alan-turing>
- John von Neuman <https://www.ias.edu/von-neumann>

Fig 75. With twice as many AI startups as any other country, the UK is the powerhouse of European AI entrepreneurship

