Intelligent Robotics in Vegetable Production

zasso FIELDDAYS

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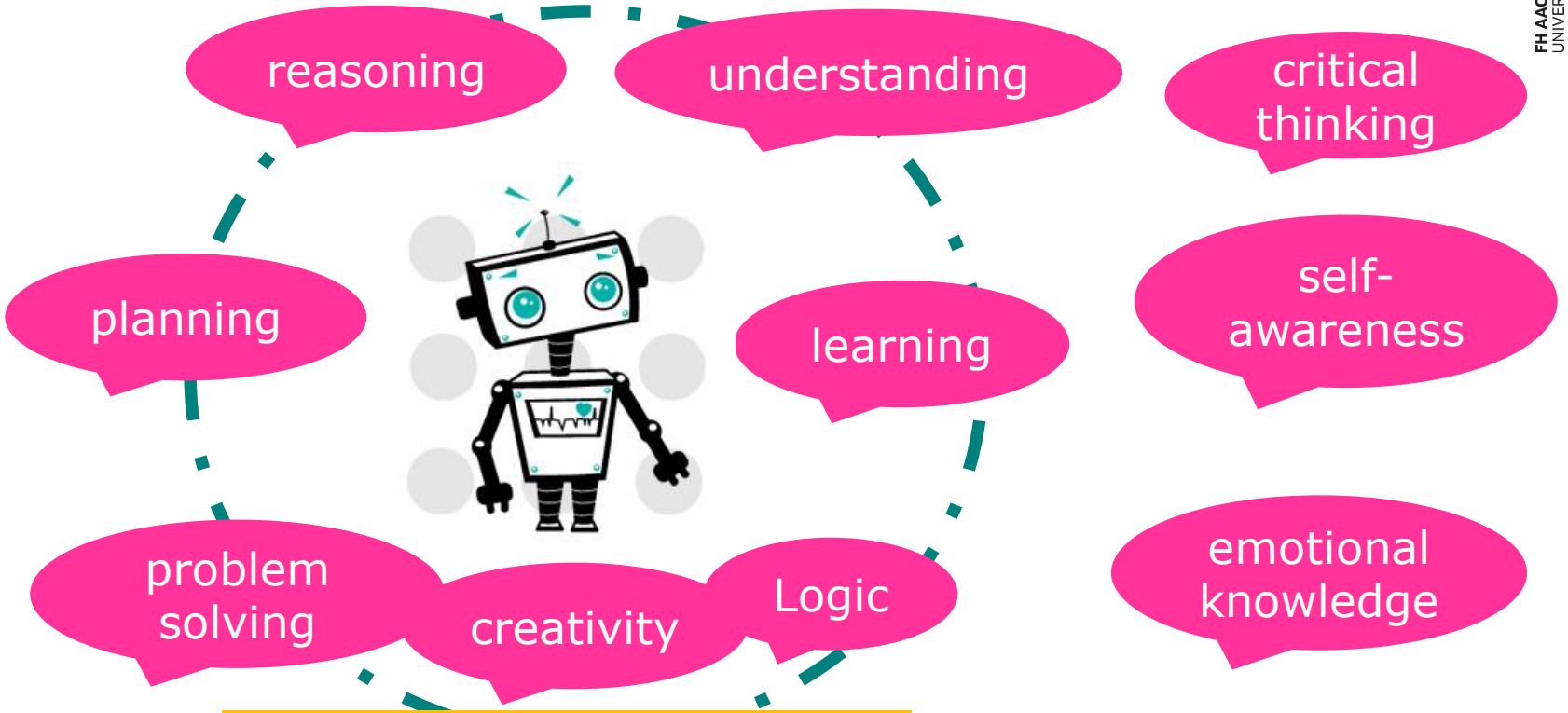
What is intelligence?
Wiki says: **the capacity for…**



Robots are able to do this

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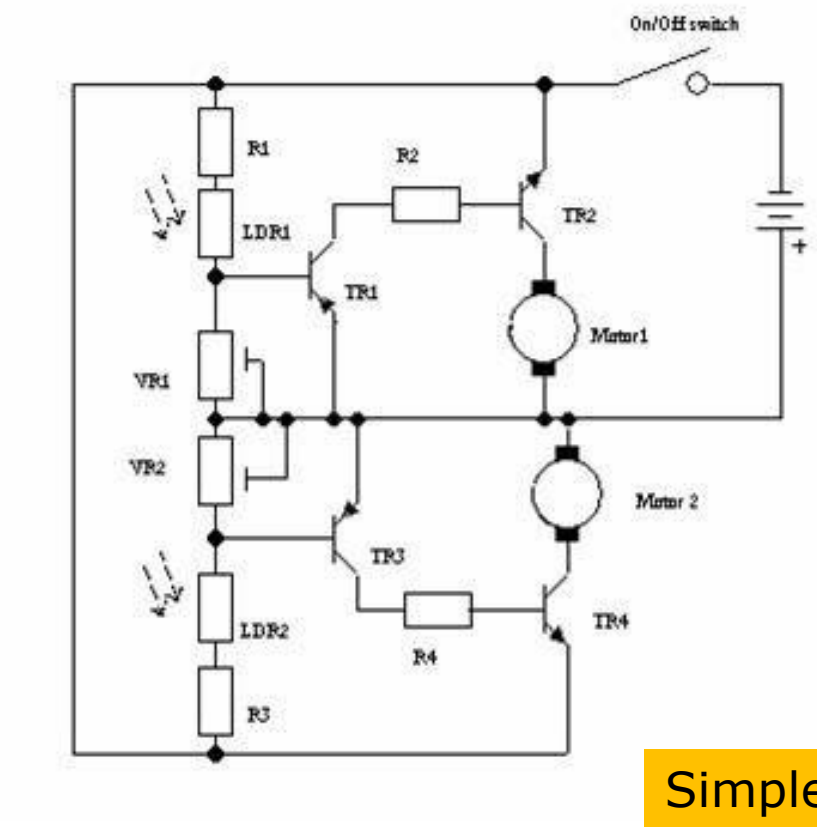
An **intelligent** circuit…?
The way we interpret intelligence.



[https://www.instructables.com/id/Simple-Light-Seeking-Robot/]

Simple behaviour but interpreted as intelligence

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When is a **machine intelligent**? Playing Chess

In 1957 Herbert Simon claimed, that a human Chess Grandmaster will soon be beaten by a computer. He did it again in 1990. Finally 1997 Deep Blue won against Kasparov. Specially designed hardware, no intelligence.

[https://de.wikipedia.org/wiki/Deep_Blue/]

But it shows that complex problems can be solved with a lot of money, algorithms and hardware.

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When is a **machine intelligent**? Playing Go and Chess and discover creativity.

Nature paper: Mastering the game of Go with deep neural networks and tree search

[https://deepmind.com/research/alphago/]

After beating the chess Grandmasters the asian board game „Go" was the next challenge. In March 2016 AlphaGo won against a human Go Master. End of 2017 a new version, AlphaGo Zero, used a complete new strategy by learning the board game from scratch, so no human training examples were used. End of 2018 Alpha Zero won against all digital versions of Chess, Go and Shogi…

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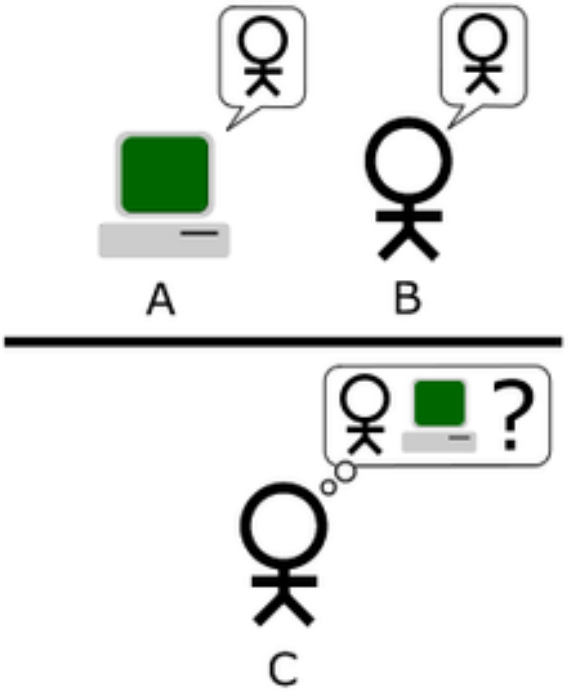
Another test for machine intelligence: **The Turing test**.



[https://de.wikipedia.org/wiki/Turing-Test]

An evaluator C should distuingish between a machine and a human just by asking questions via a keyboard and screen. If the evaluator cannot tell the machine from the human the machine has passed the test.

In 2014 The Turing test was claimed to be passed by a chat bot named Eugene Goostman. He pretends to be a 13 year old boy from Ukraine not speaking english very well …

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A chat with **Eugene I**

Business Insider: Hi Eugene, What's up?

Eugene Goostman: I am fine, thanks, and you?

BI: I'm good. You doing anything fun today?

EG: Since early this morning I've been involved in this funny contest. I also plan to visit some interesting places in Atlanta.

BI: Why Atlanta? What's there?

EG: East Coast is a good place, but I heard about sharks and typhoons that terrify people there.

BI: So... you're going to Atlanta?

EG: If you sure that you're not eatable for sharks, I think the Eastern Coast is a very nice place for living and swimming in the Atlantic Ocean:-)

BI: Do Sharks prefer one type of human over another?

EG: Maybe. I think *you* know the answer. I know you are supposed to trick me.

BI: Why would I want to trick you?

EG: Aha! Now I know what you want! If I'm not mistake - you still didn't tell me where you live. OR it's a secret?:-)

[https://www.businessinsider.com/chat-with-program-that-passed-turing-test-2014-6?IR=T}

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A chat with **Eugene II**

BI: Huh? You tell me where you live first.

EG: I live in a big Ukrainian city called Odessa. It is on the Black Sea shore.

BI: So Atlanta is a far trip for you, no?

EG: East Coast is a good place, but I heard about sharks and typhoons that terrify people there.

BI: And we've come full circle. Are you a human?

EG: No. Beep-beep. I am not a ma-chine. Blink-blink. I am hu-man. Click! Hu-man. Click! Hu... Damn.

Simple questions like "Why are you going to Atlanta?" are answered with a totally irrelevant statement. And even with the same response when brought up again. The chat engine picks out one word from each of the questions and just ran with it.

[https://www.businessinsider.com/chat-with-program-that-passed-turing-test-2014-6?IR=T}

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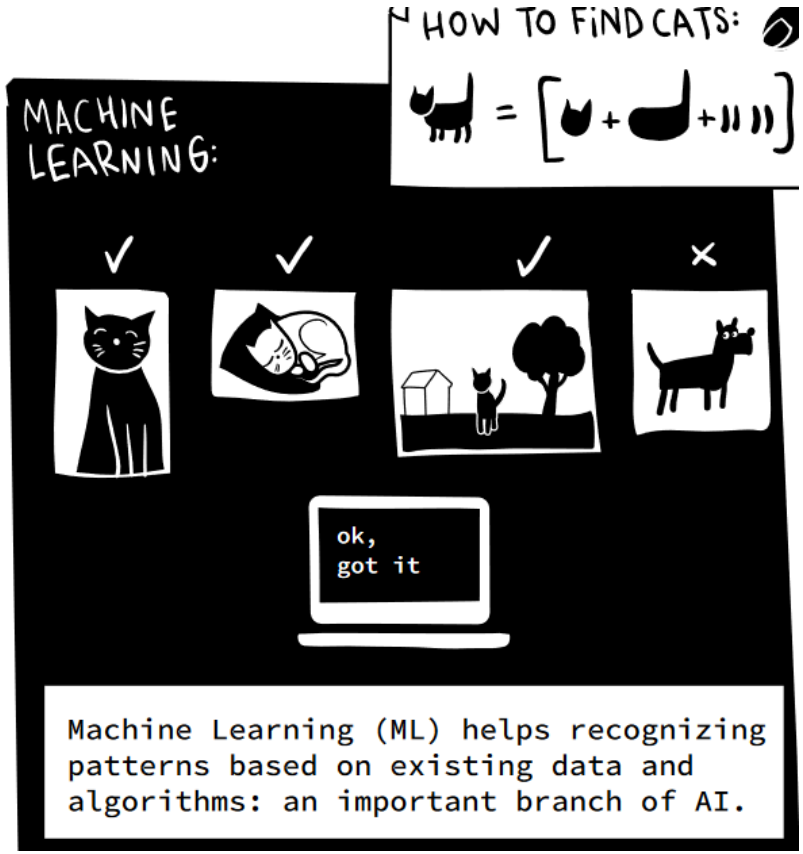
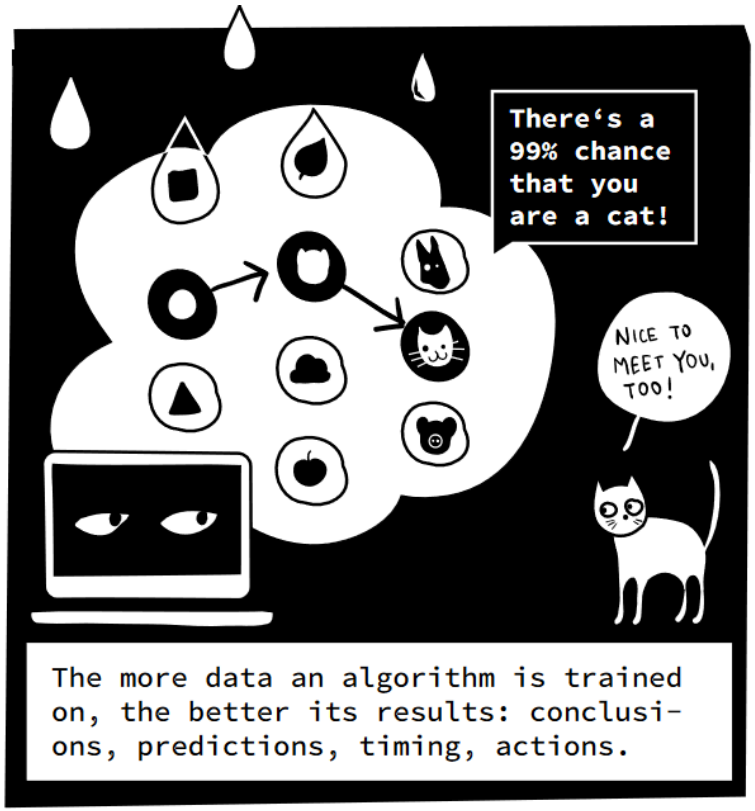
But there is hope for intelligent machines: **Machine Learning**

[www.weneedtotalk.ai]





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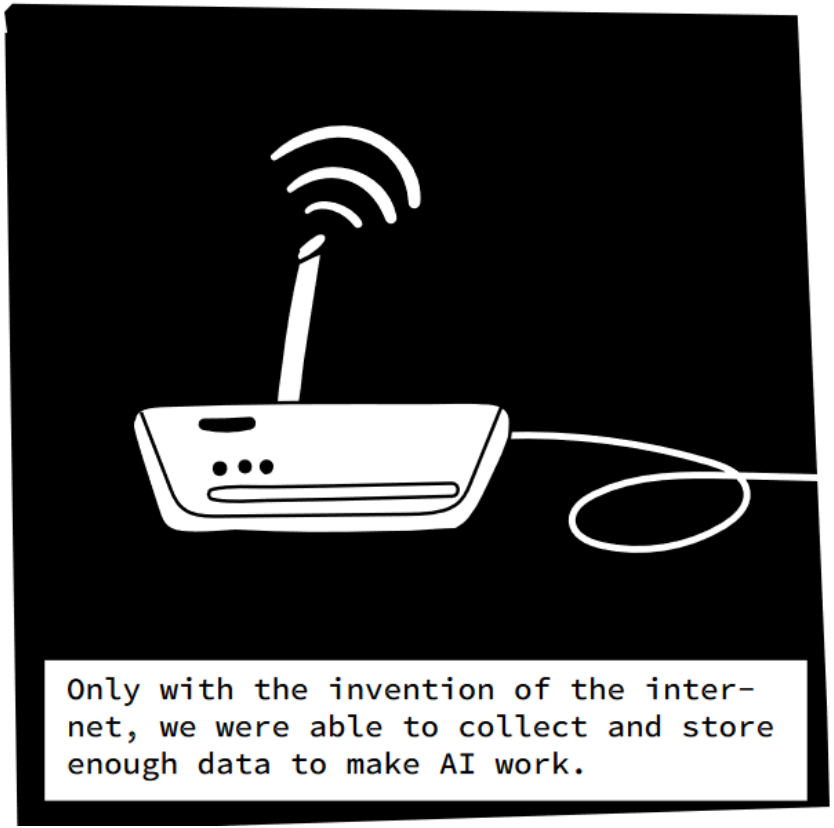
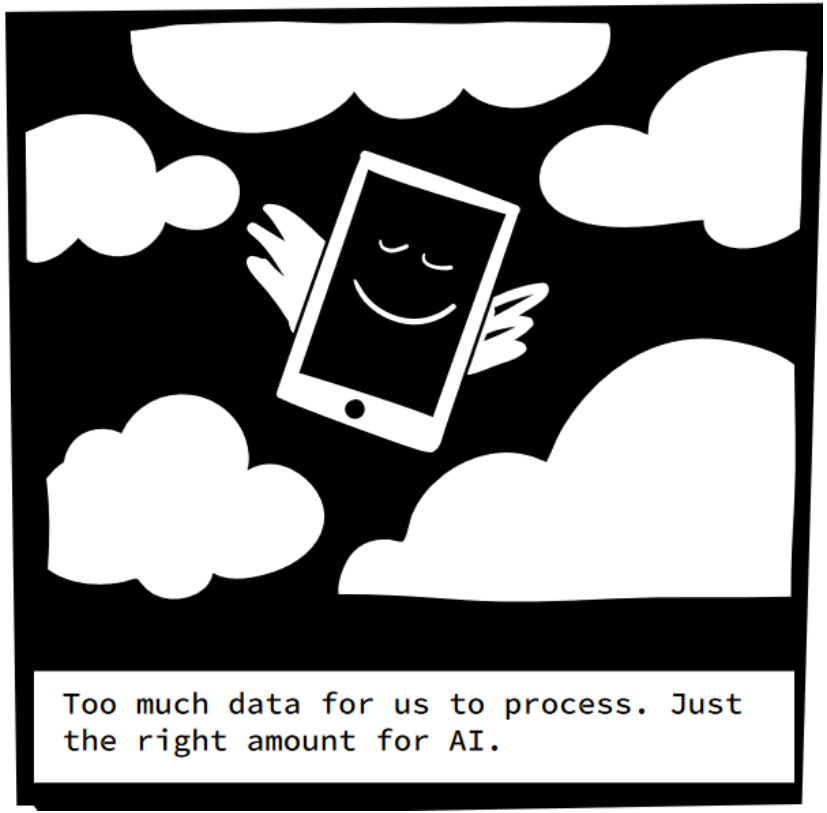
Machine Learning needs data.
A lot of data…

[www.weneedtotalk.ai]





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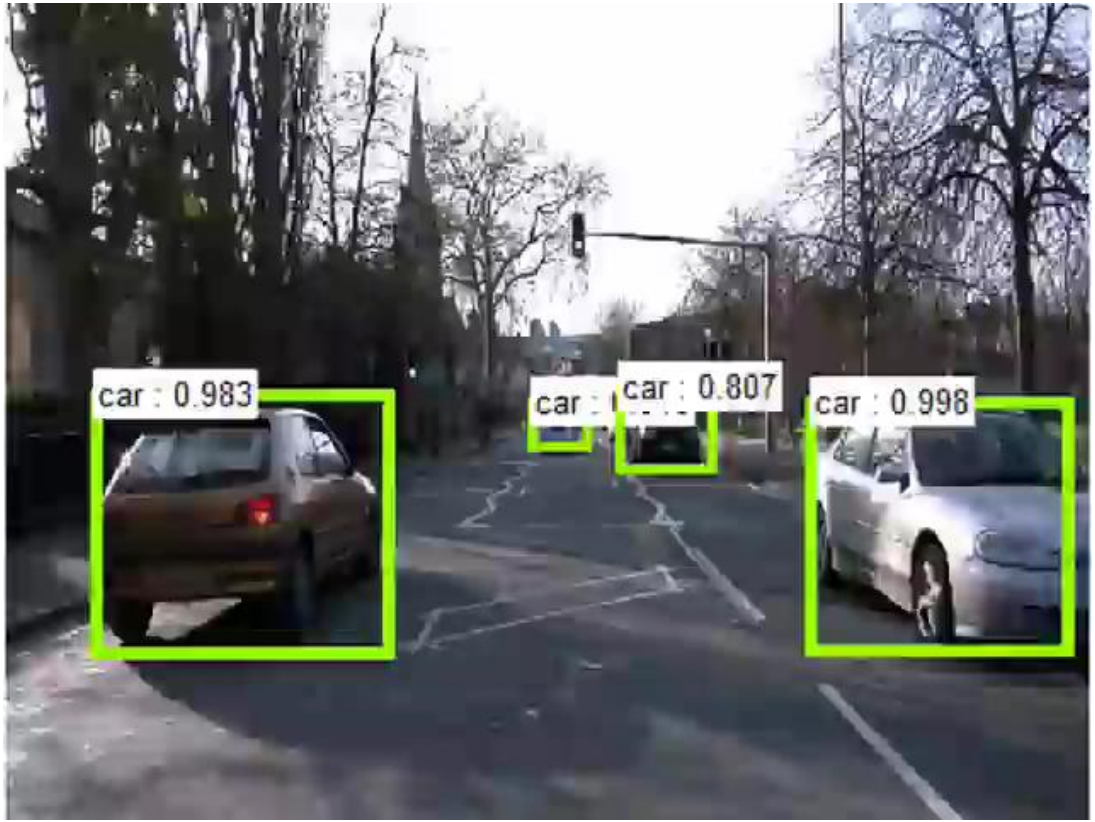
Machine Learning or better:
Pattern Classification



Neuro Time

Problems from the field of pattern classification, can be solved by artificial neural networks by training with a lot of examples. The detection can be done in realtime e.g. for autonomous driving.

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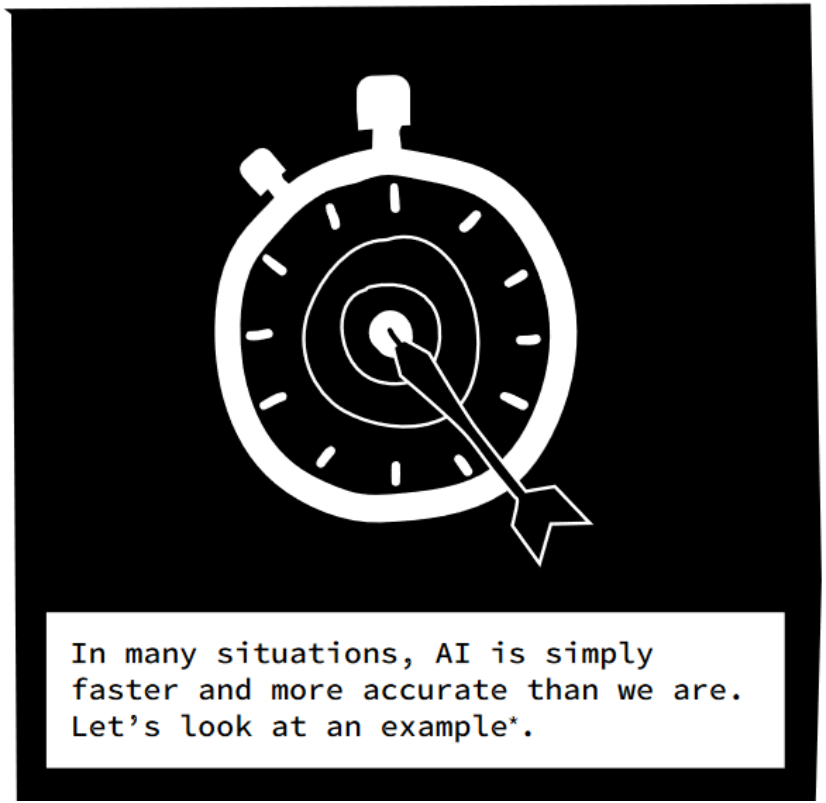
Another promising **example**

[www.weneedtotalk.ai]



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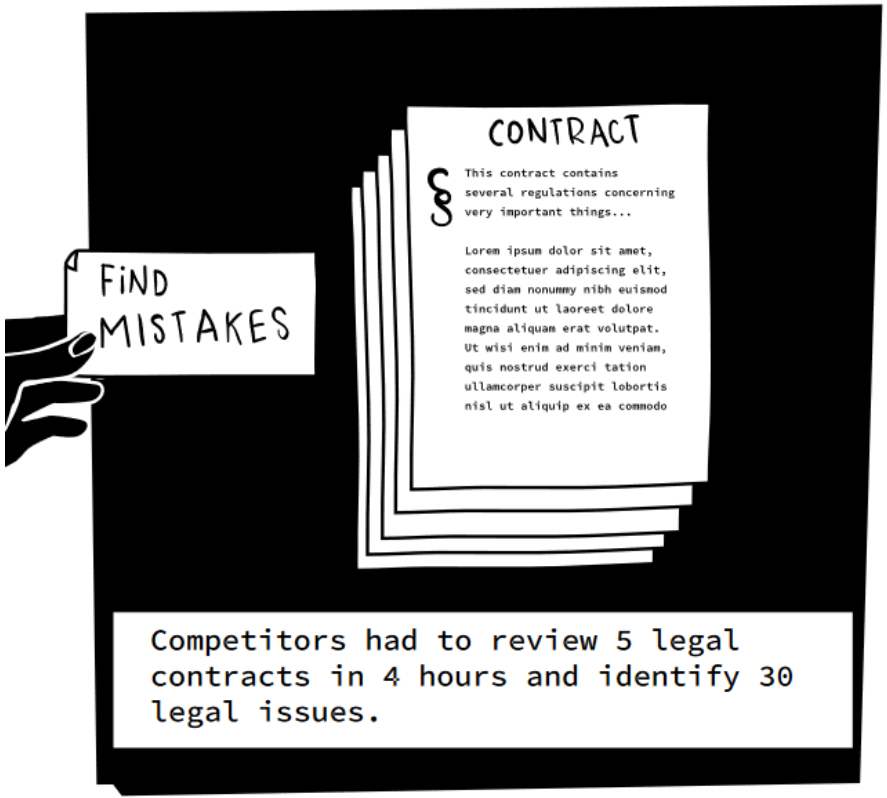
Any **Lawyers** around?

[www.weneedtotalk.ai]



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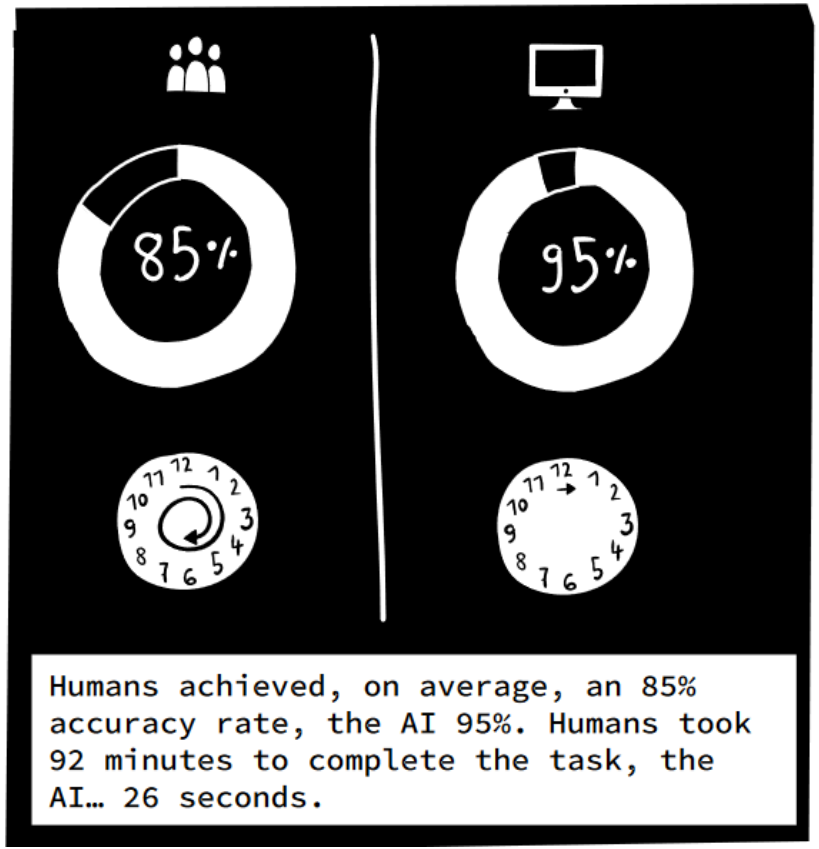
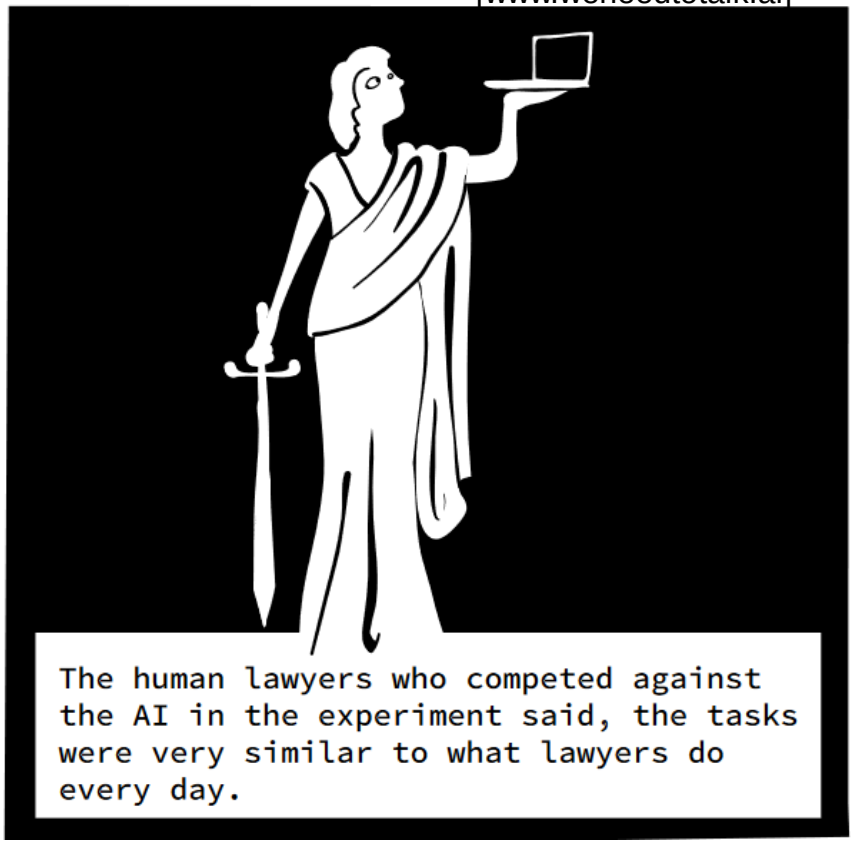
Don‘t worry: that‘s not possible with **farmers**…

[www.weneedtotalk.ai]





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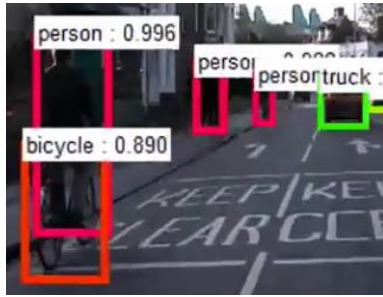
A short **Summary** of intelligent machines

- Lawyers can be replaced - Farmers not.
- Classification Problems can be solved by machine learning with extensive training.
- We need a lot of data for machine learning.



- A certain behaviour is interpreted from humans as intelligent.
- Human „behaviour" is still difficult to simulate (chat bot).
- Newest algorithms can be even „creative".

What do you need for living?

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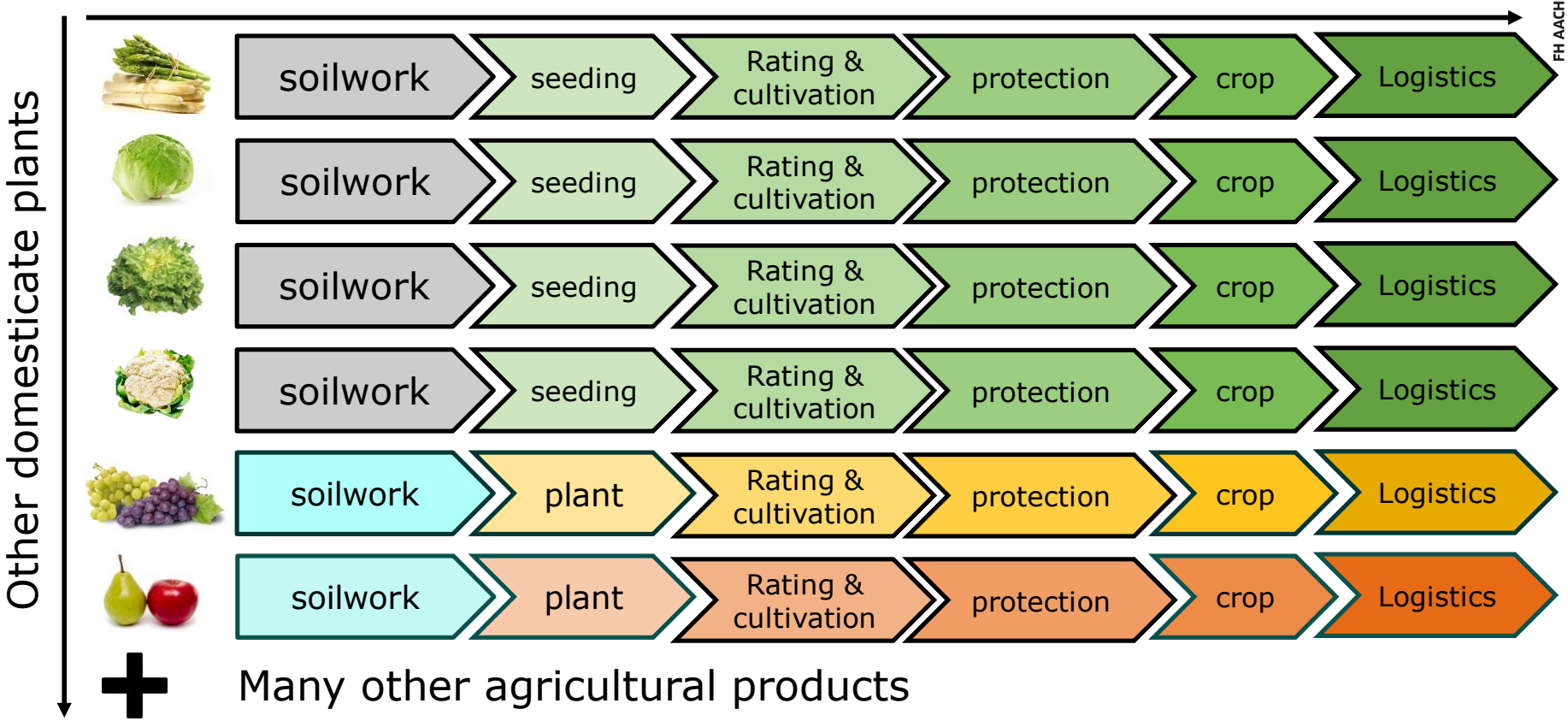
How do we produce our veggies?
Value chain for agricultural products



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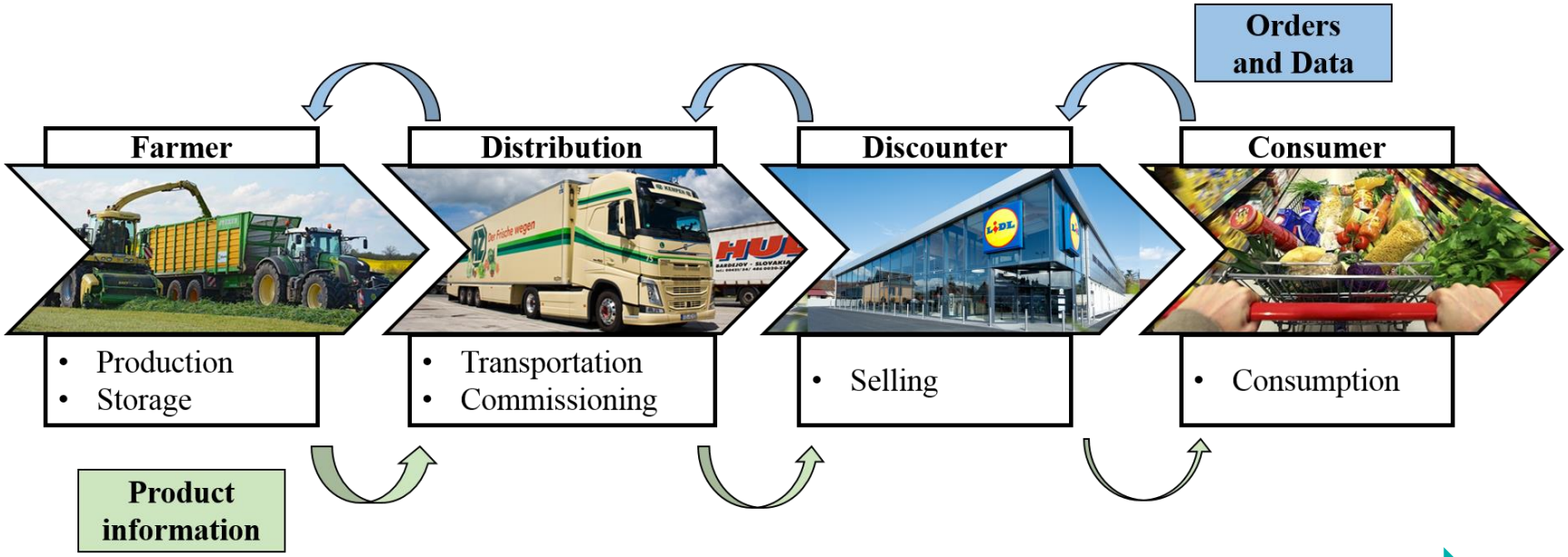
The vegetables „supply chain“



- More Transparency
- Electrification
- Shortage of labour

30-50% loss

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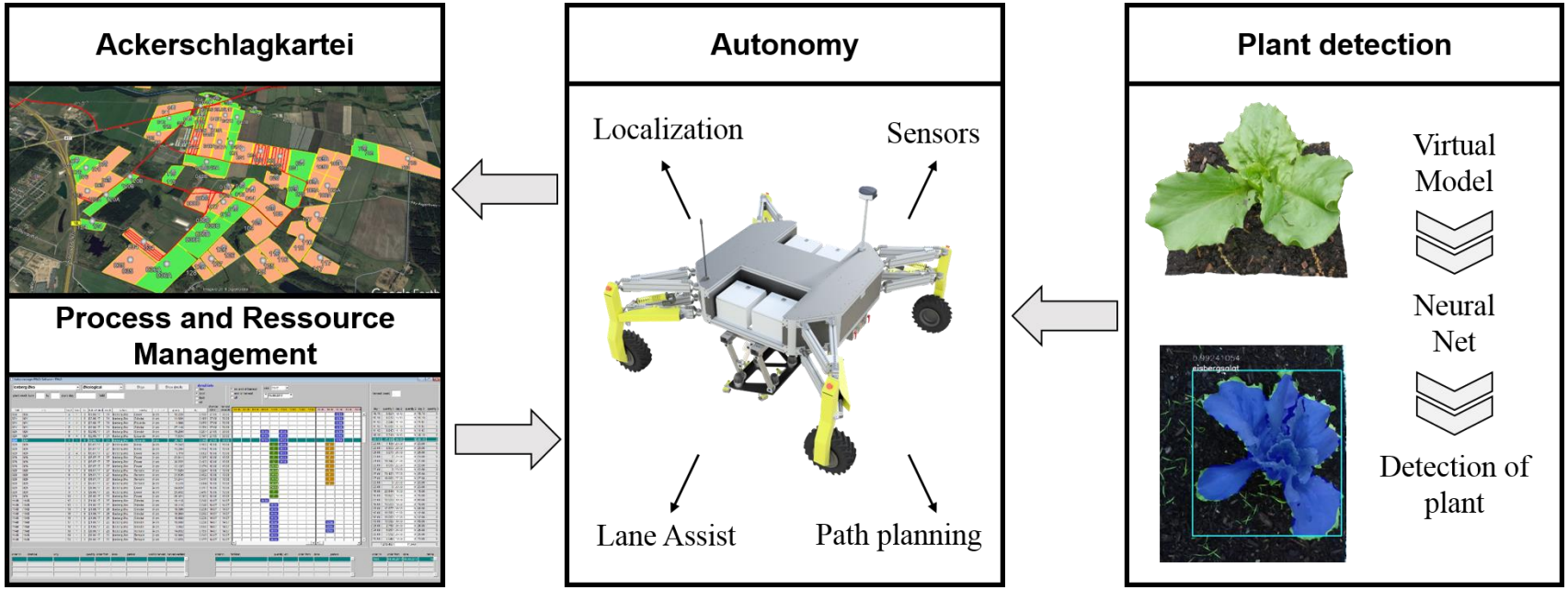
The process can be more efficient
Technology from **Industry 4.0**



- Robot has to be integrated in existing farm structure
- Robot monitors, diganosis and interacts with plants
- Agricultural Data needs to be collected by farm management software

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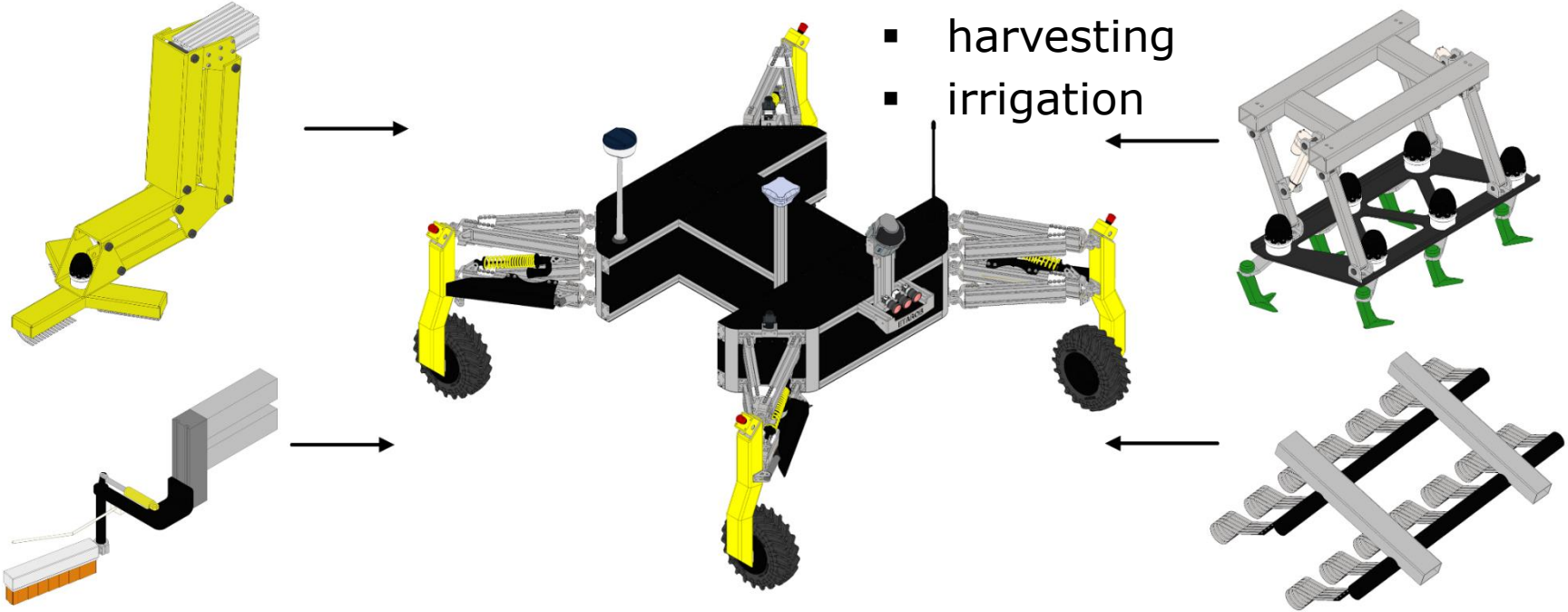
A universal robotic platform for tools and sensors. Small, research and development platform

Selective

- Weed control
- fertilisation
- harvesting
- irrigation



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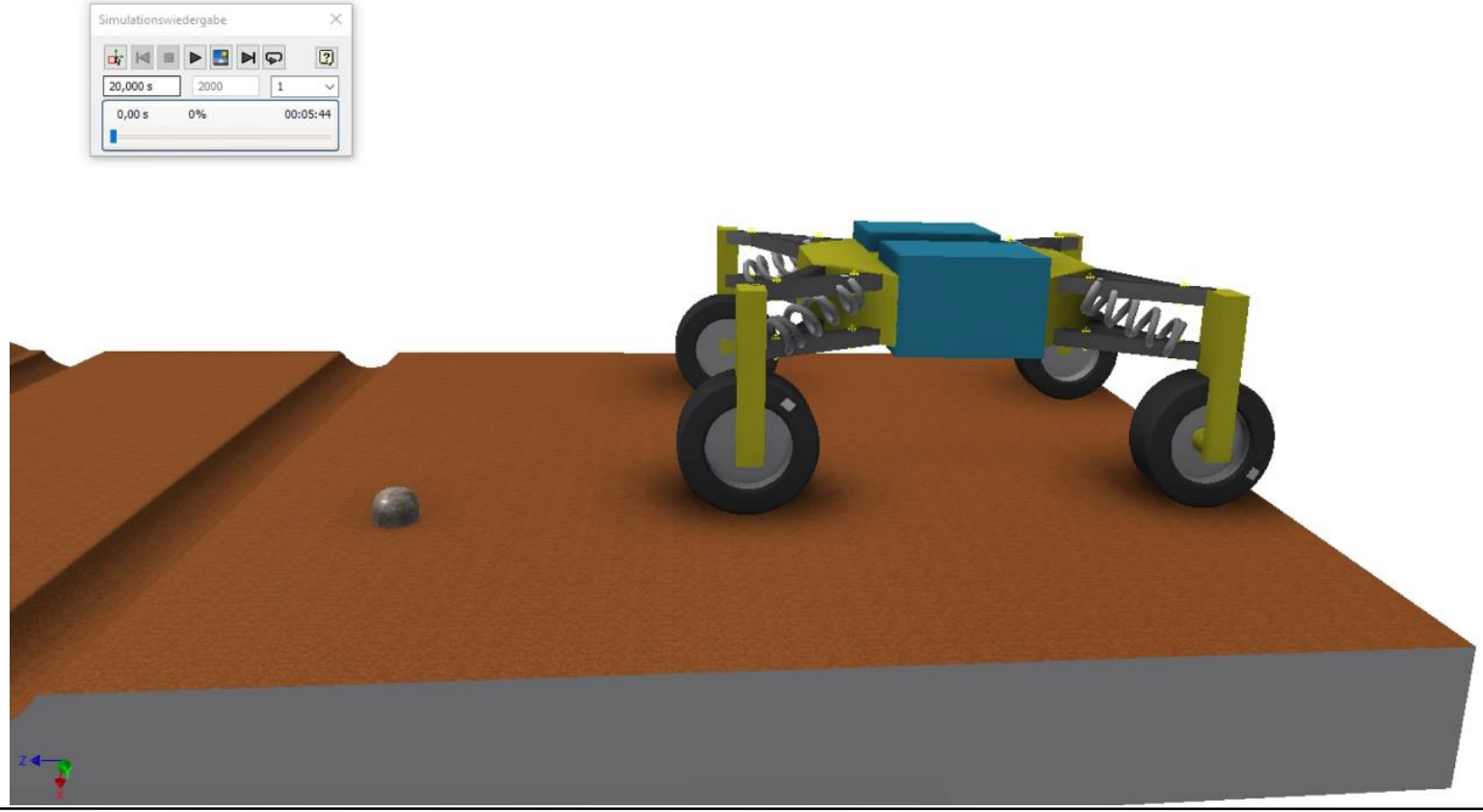
Dynamic Simulation of ETAROB



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The bigger one for field tests

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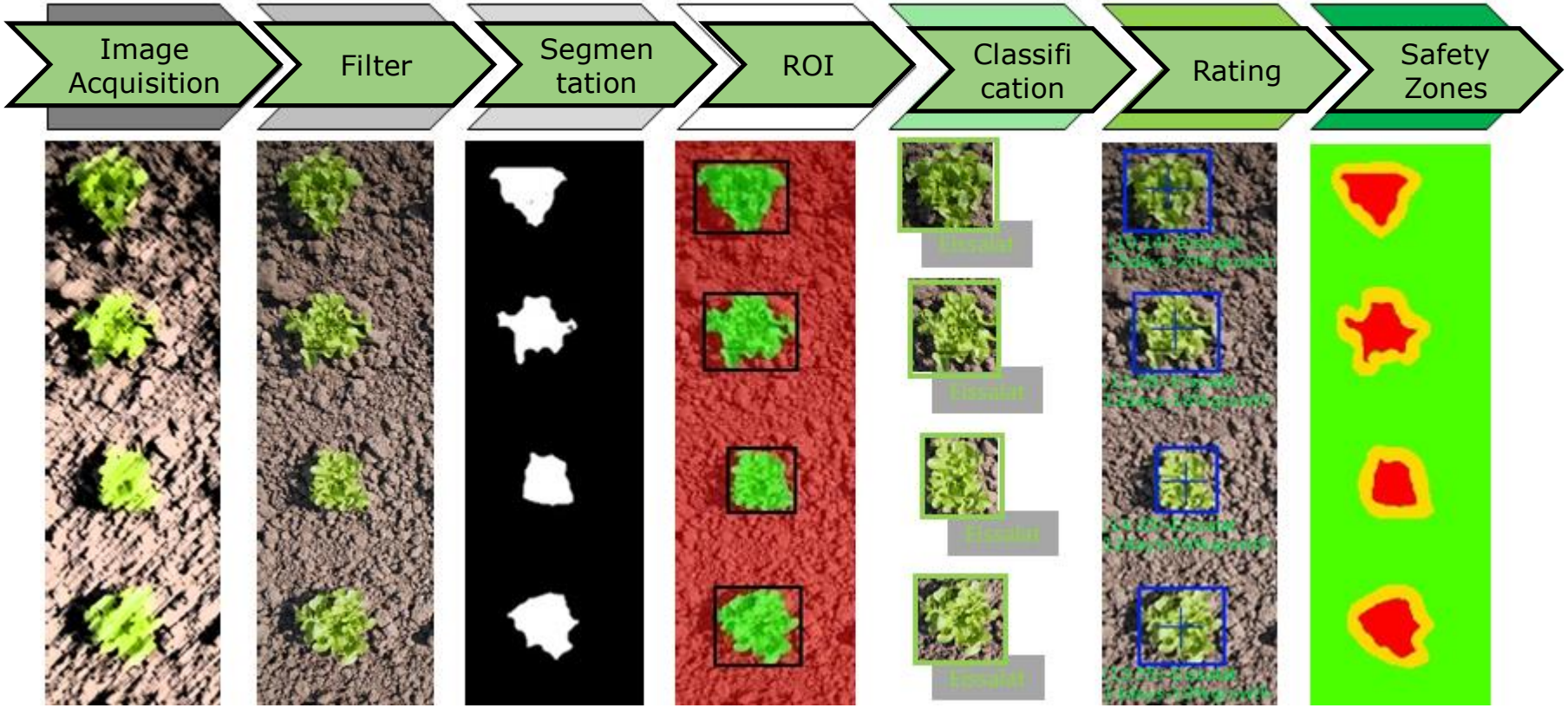
Vegetable **Classification**
Get rid of the weed…



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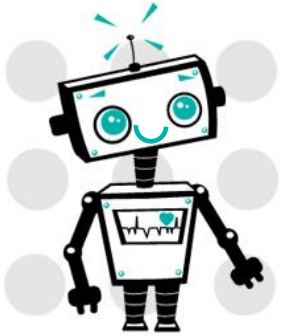
Final **Summary**

- There are plenty of agricultural tasks solvable by e.g. machine learning and robotics.
- We need more data from the field.
- Virtuallly generated data can be used for specific tasks, like plant detection.
- New ways of agricultural strategies could be tested in simulation environments (board games).
- The value chain could be optimized by Industry 4.0 technologies.
- Robotics could increase the attractivity of the Farmers job.



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