

## Künstliche Intelligenz KI – Revolution in der Landwirtschaft?

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20.031

**Jahrestagung der Chartagegemeinschaft Digitalisierung**

Online Angebot via zoom

22. Oktober 2020



**agridea**

ENTWICKLUNG DER LANDWIRTSCHAFT UND DES LÄNDLICHEN RAUMS  
DÉVELOPPEMENT DE L'AGRICULTURE ET DE L'ESPACE RURAL  
SVILUPPO DELL'AGRICOLTURA E DELLE AREE RURALI  
DEVELOPING AGRICULTURE AND RURAL AREAS







Story inspired by David Fankhauser, Syntech GmbH

## Big Players in AI

facebook®

 Microsoft

amazon

Google

Baidu 百度

IBM

 NVIDIA®



KÜNSTLICHE INTELLIGENZ

## Wie Googles Mutterkonzern Alphabet mit Robotern die Landwirtschaft verändern will



Die Prototypen sollen bei ihren Streifzügen durch die Felder Daten von jeder Pflanze sammeln.  
© Mineral / Hersteller

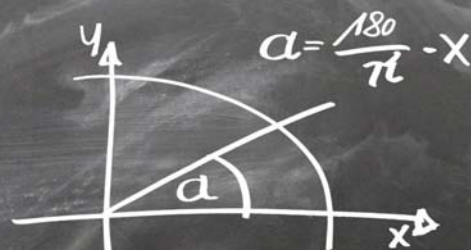
15.10.2020, 18:17 Uhr

Google hat Roboter  
verändern könnte



## Heute – Smarte Computer?

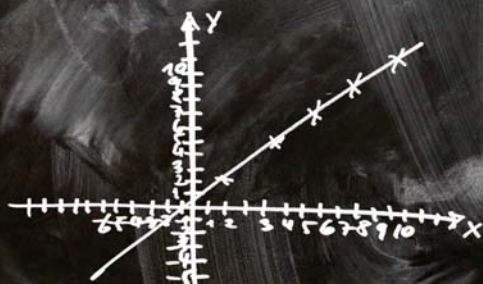
$$X_{1/2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



$$x^2 + px + q = 0$$

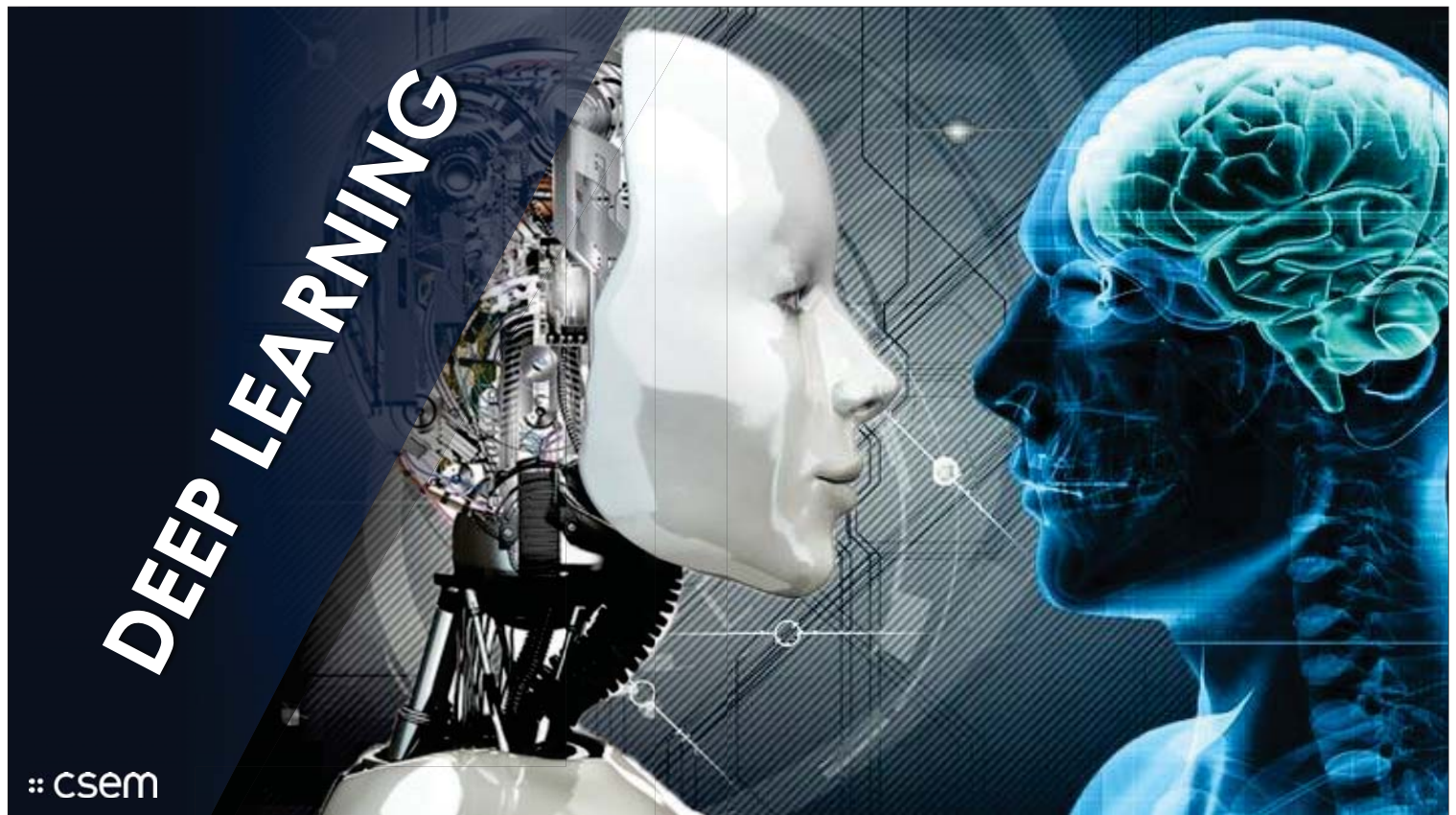


$$X_{1/2} = -\frac{p}{2} \pm \sqrt{\left(\frac{p}{2}\right)^2 - q}$$



$$f(x) = \tan x$$

$$f(x) = \sin x$$



Deep what...?

## ARTIFICIAL INTELLIGENCE

Any technique which enables computers to mimic human behavior



## MACHINE LEARNING

AI techniques that give computers the ability to learn without being explicitly programmed to do so



## DEEP LEARNING

A subset of ML which make the computation of multi-layer neural networks feasible



1950's    1960's    1970's    1980's    1990's    2000's    2010's

Moore's law



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**How Long Until Computers Have the Same  
Power As the Human Brain?**

**1940**

**1**

calc/second

Mother Jones

# How Long Until Computers Have the Same Power As the Human Brain?

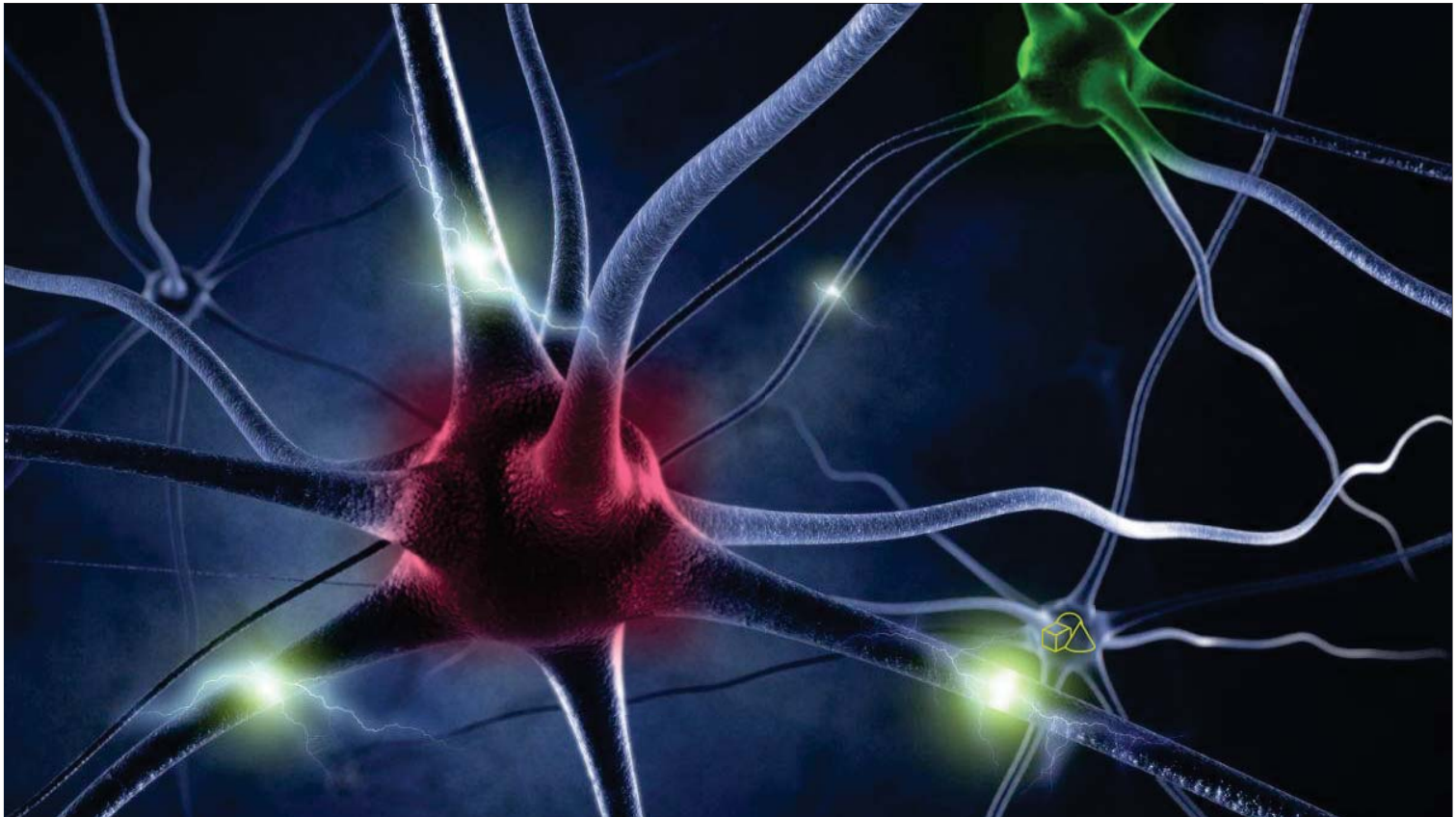
**2024**

$1.44 \times 10^{17}$   
calcs/second

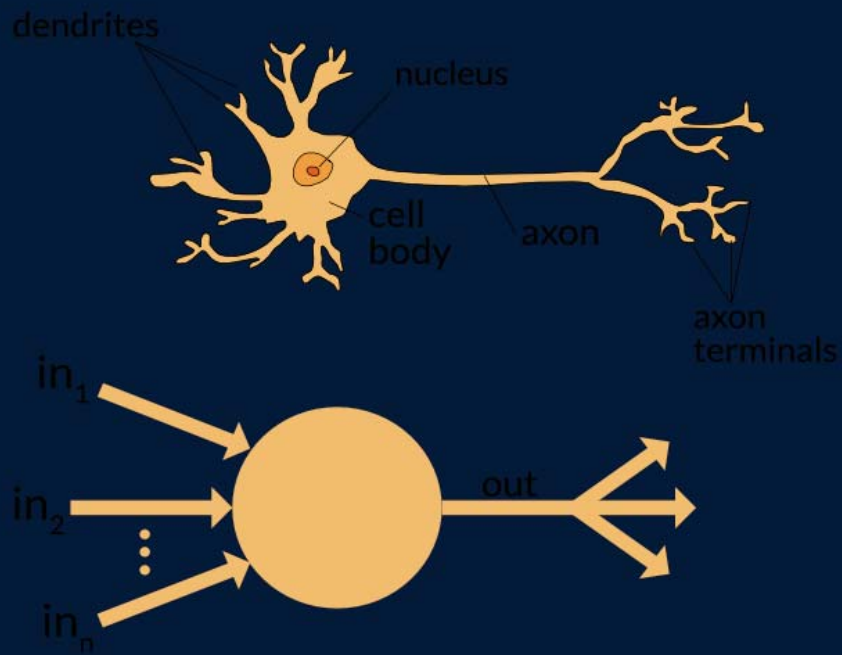
Mother Jones







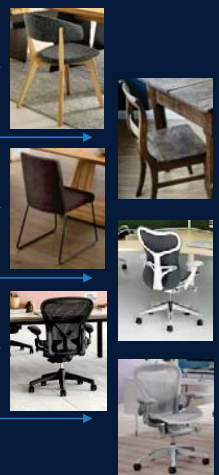
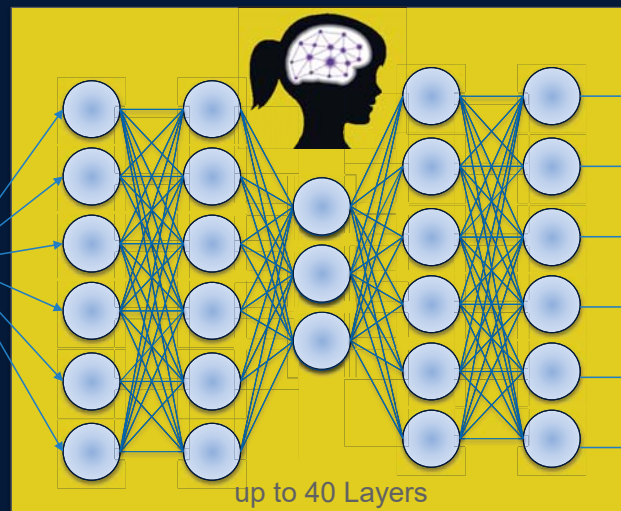
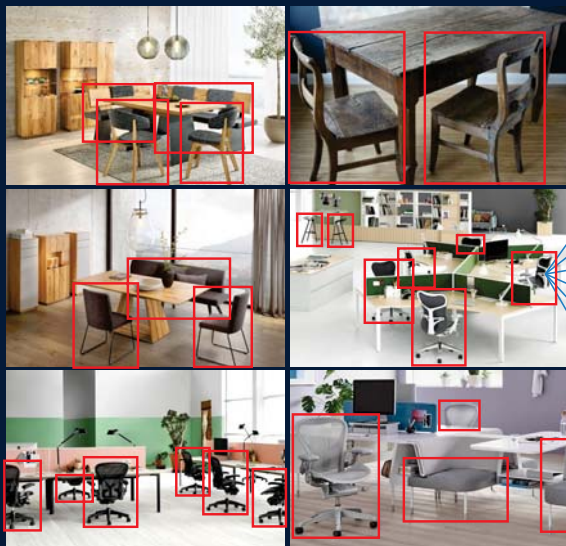
## Von der Natur inspiriert



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## Künstliches Hirn



# Deep Learning

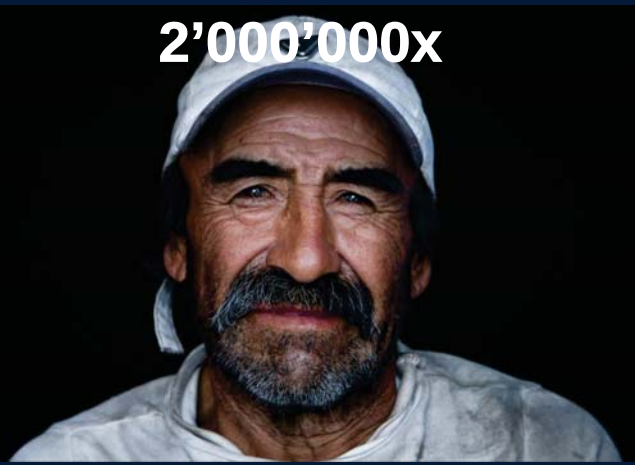
:: csem



Natur



20x



2'000'000x

Embedded AI computer



✓ Nvidia AGX Xavier

✓ 32 TFLOPs ( $10^{12}$ )

✓ 10W



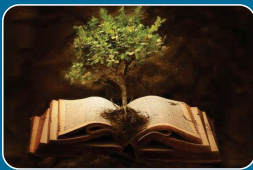
Wie lernt ein Mensch?



## Supervised Learning



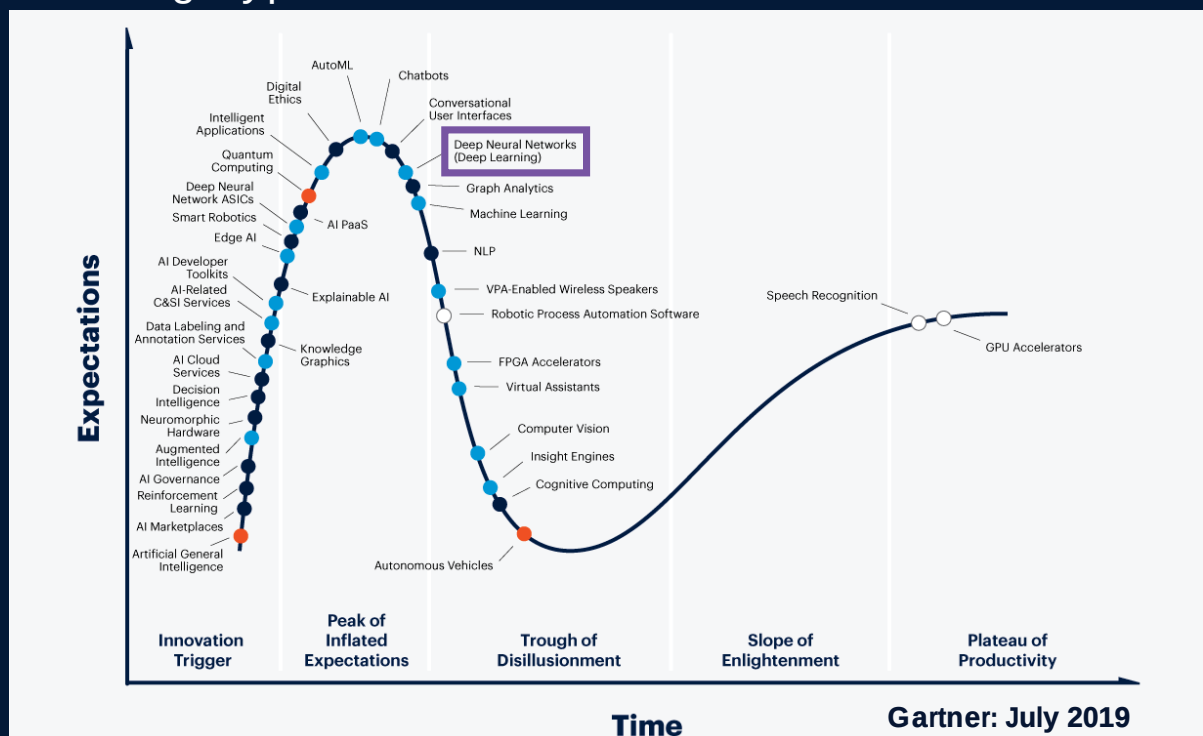
## Reinforcement Learning



## Unsupervised Learning

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Deep Learning Hype – schon vorbei...



:: csem



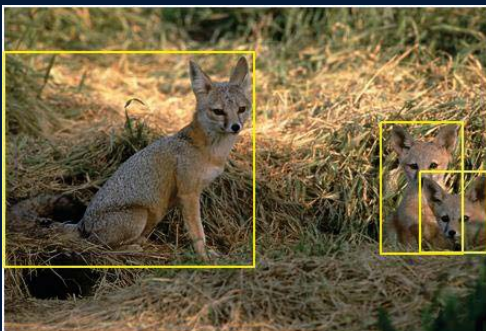
Human-Parity

**2018** – Text Verständnis

**SQuAD2.0**  
The Stanford Question Answering Dataset

**2017** – Sprache Erkennung

**2016** – Bilder Erkennung



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## Snapchat – Geschlecht wechseln



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## Visuelle Vorstellungskraft – Elefant



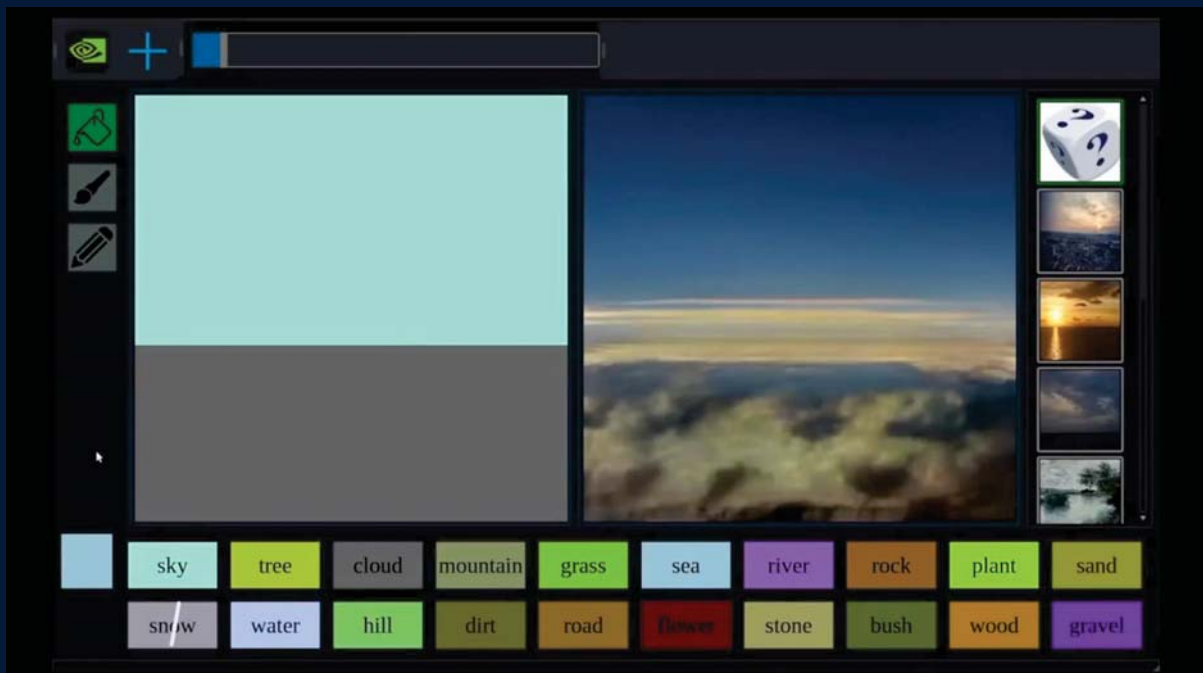
:: csem

## Vincent van Gogh?



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## Angewandtes Träumen



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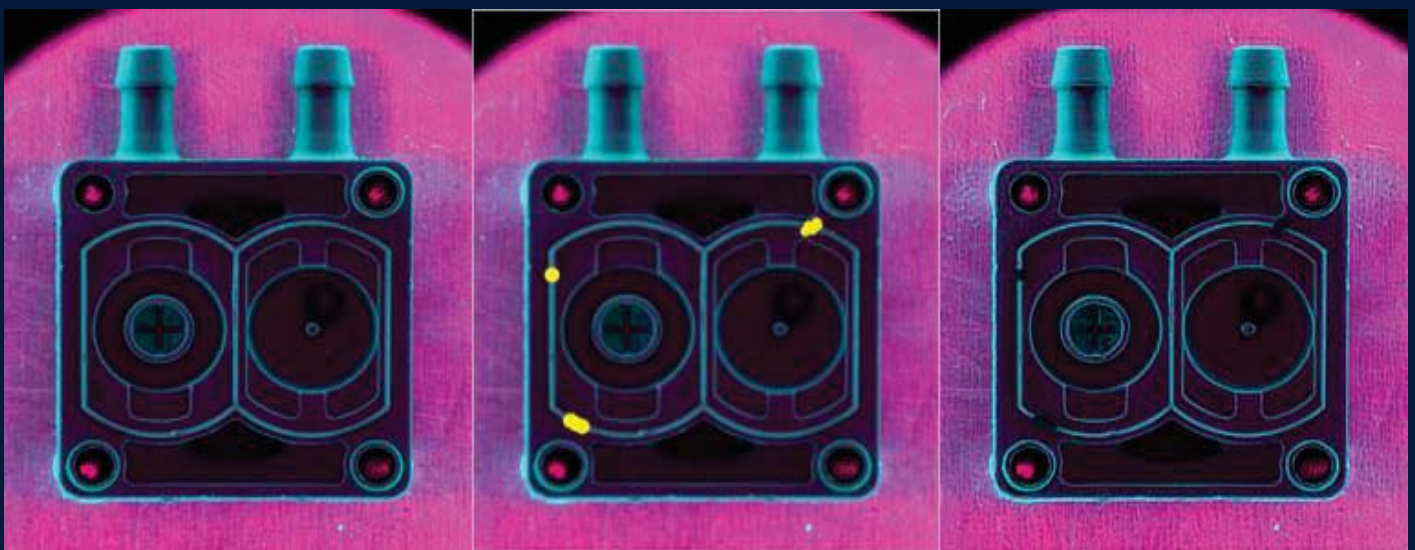
<https://youtu.be/p5U4NgVGAwg>

CSEM - TECHNOLOGY  
ORGANIZATION IN  
SWITZERLAND

# Technology Transfer to Industry

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## Angewandtes Träumen (GAN)



Original Image

Desired Defect Locations

Generated Images with defects

## Industry 4.0 & Machine Learning

### Quality and Process Control



### Predictive Maintenance



### Digital Manufacturing



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## DEEP LEARNING FOR INDUSTRY

- :: CSEM 2008
- :: ViDi 2012
- :: Cognex 2017

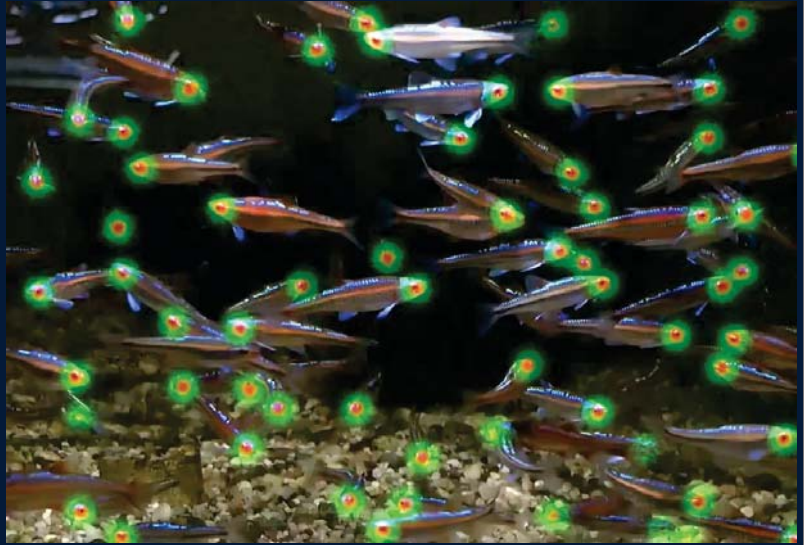
:: csem

ViDi

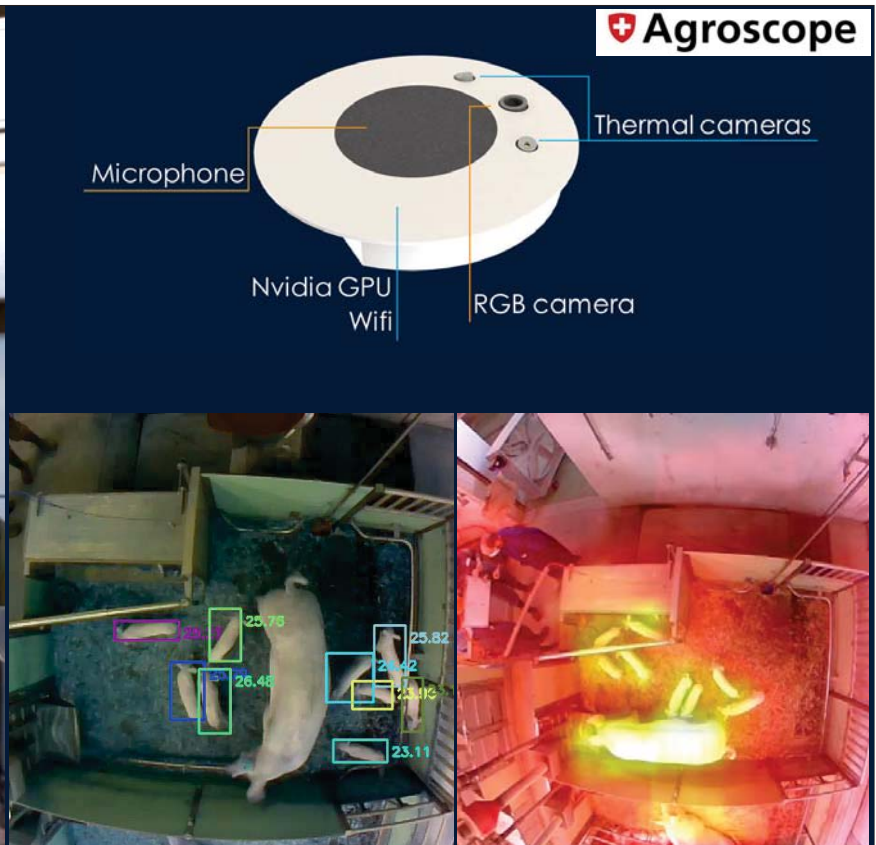
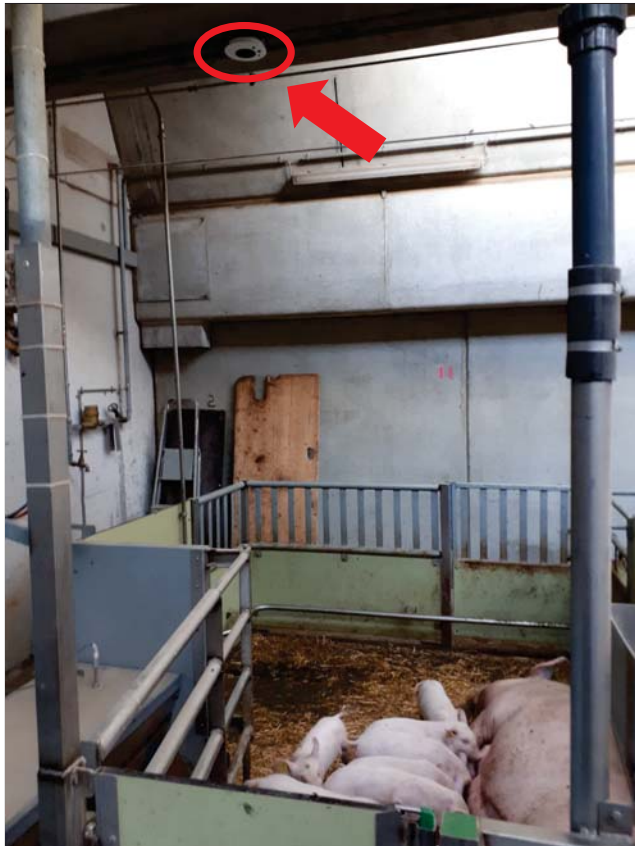
COGNEX



## Anwendungen in der Natur



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## Sortiermaschine



:: csem

## Tomaten



:: csem

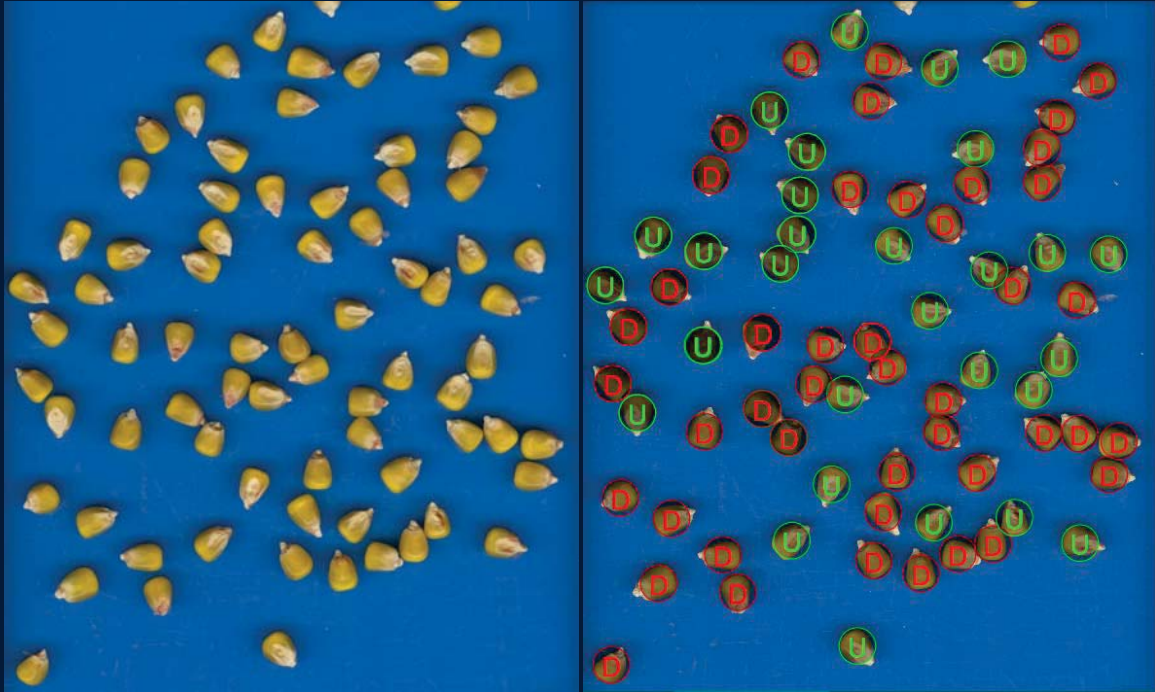
## Dock, Ampfer, Blacke – (lat. Rumex)



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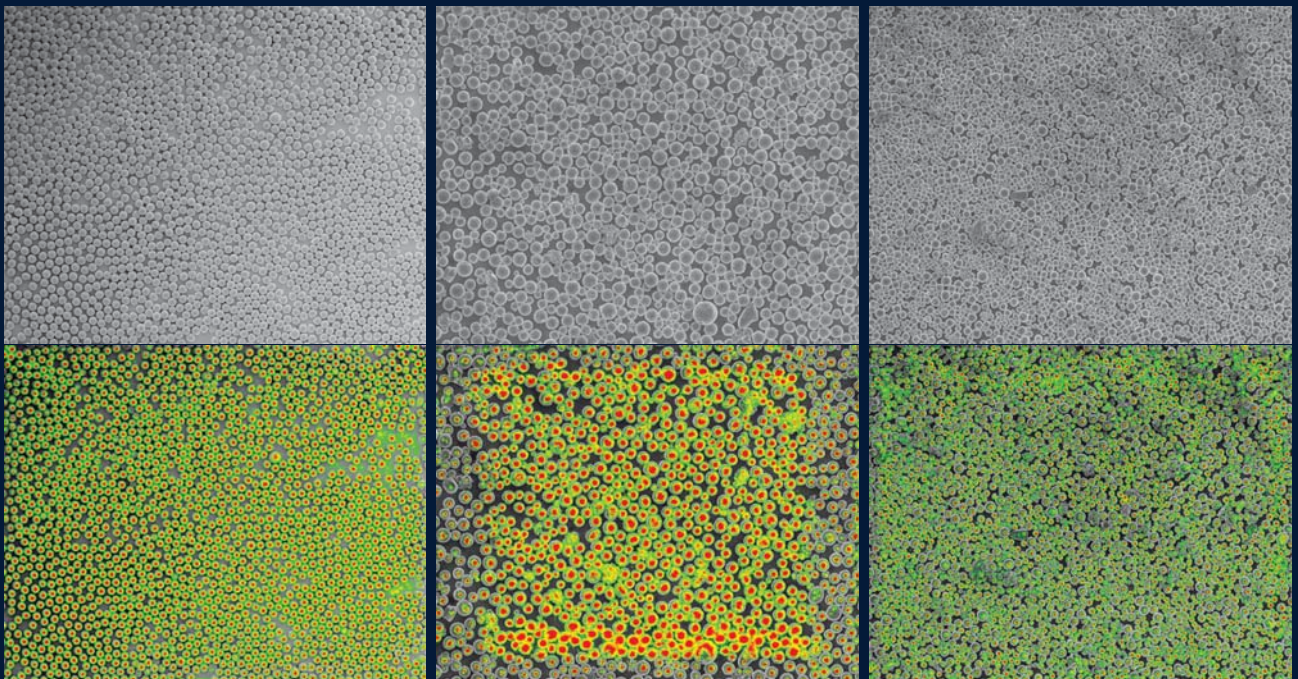


## Corn Embryo



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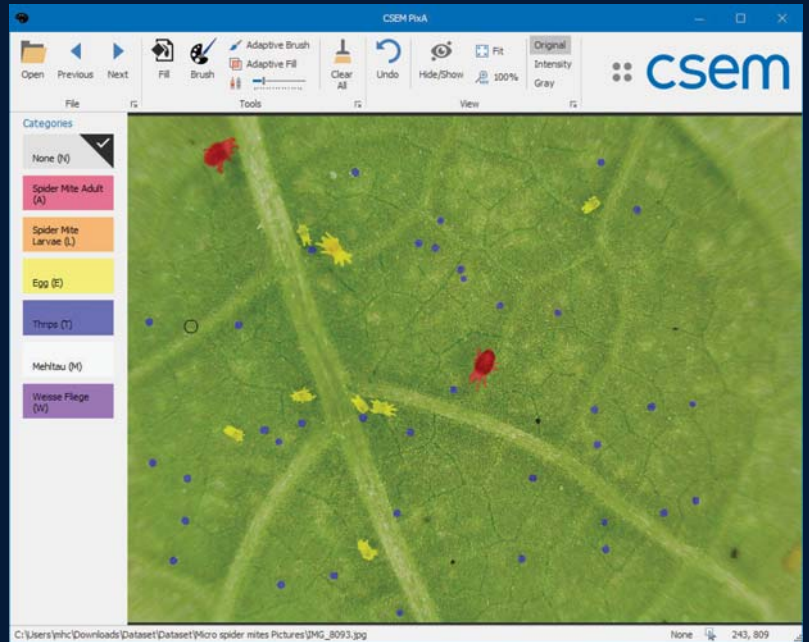
## Zellen / Körner / Futter



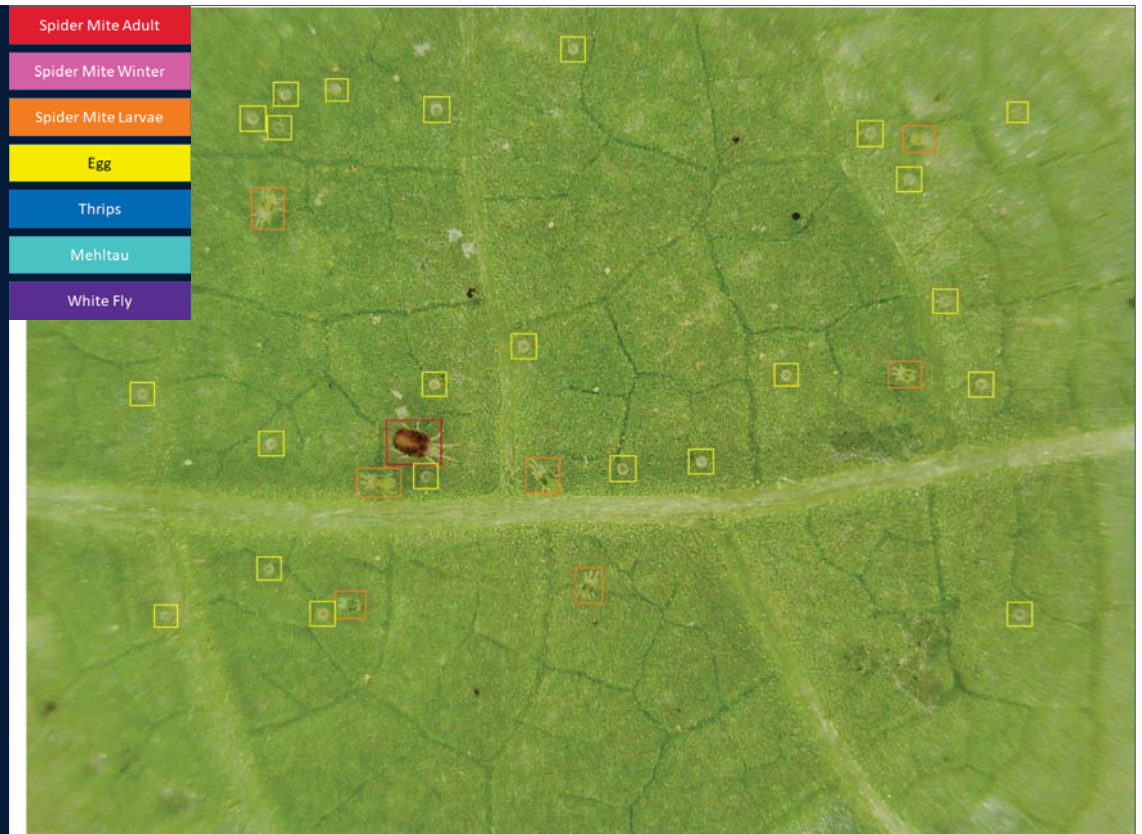
:: csem



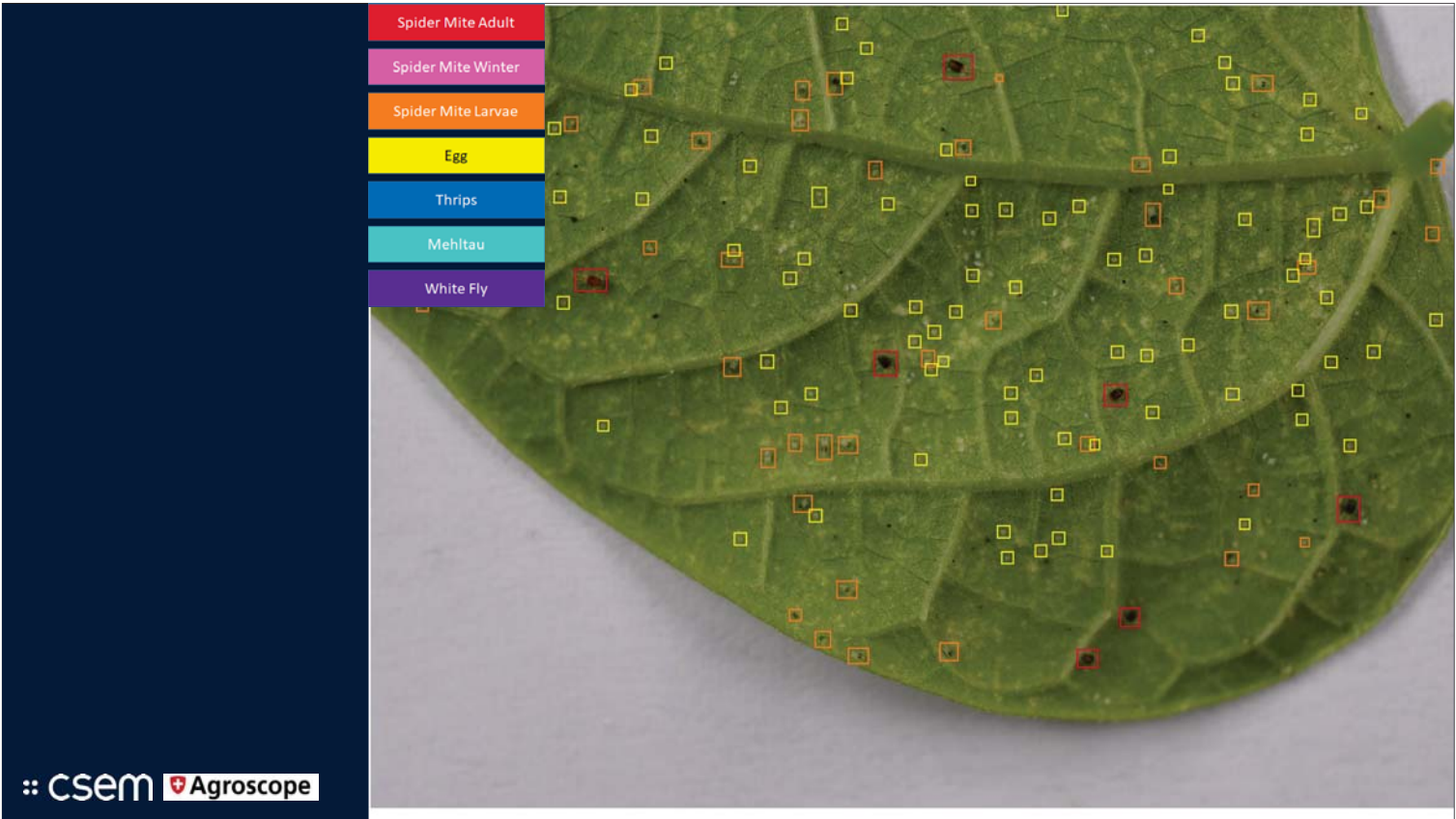
# Greenhouse



:: csem



:: csem 



## Crop classification



### Deep Learning for Agriculture and Forestry

- Hyperspectral images from Sentinel satellites
- Remote sensing
- Continuous monitoring of health status

:: csem

Received funding from European Union's Horizon 2020 research and innovation programme grant agreement No 732064



## The 10k pixel issue



:: csem

## Big data

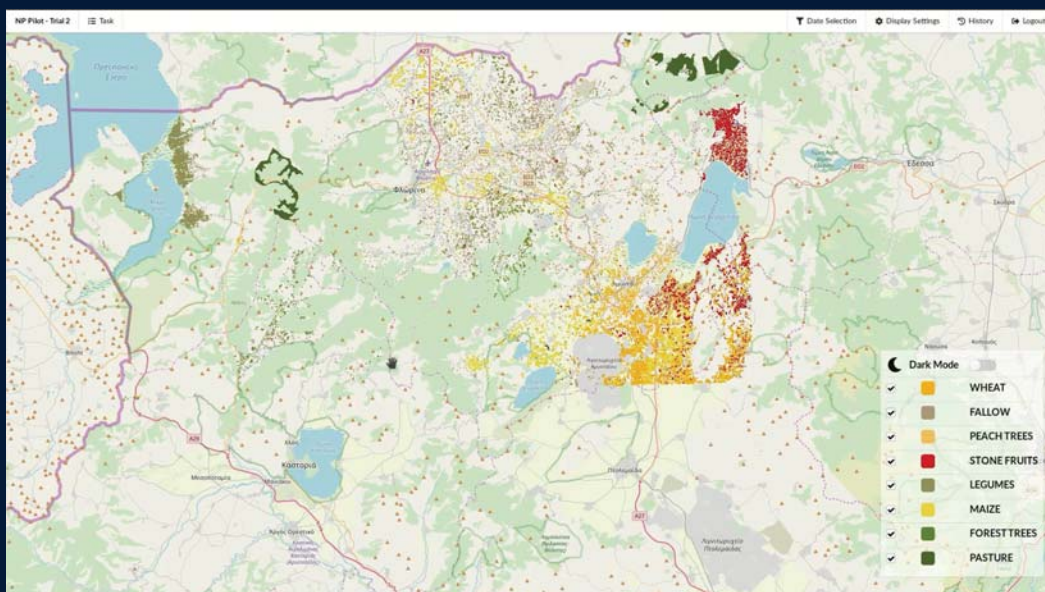


- Multi-Spectral data
- Labelled at parcel level
- 27k parcels for 1 tile

- Wheat
- Maize
- Legumes
- Fruits

:: csem

## Scenario 2: In-Depth Parcel Assessment



:: csem

## Time Series Data



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## Prognose Handelsumsätze

- Vorhersage komplexer Zeitreihen über Transaktionen im Tierhandel
- Neuronale Netzwerke lernen Merkmale einzelner Produkte und Handelspartner in den Daten
- Automatische Prognose mit mehreren spezifischen Modellen



Mehrdimensionale Zeitreihen



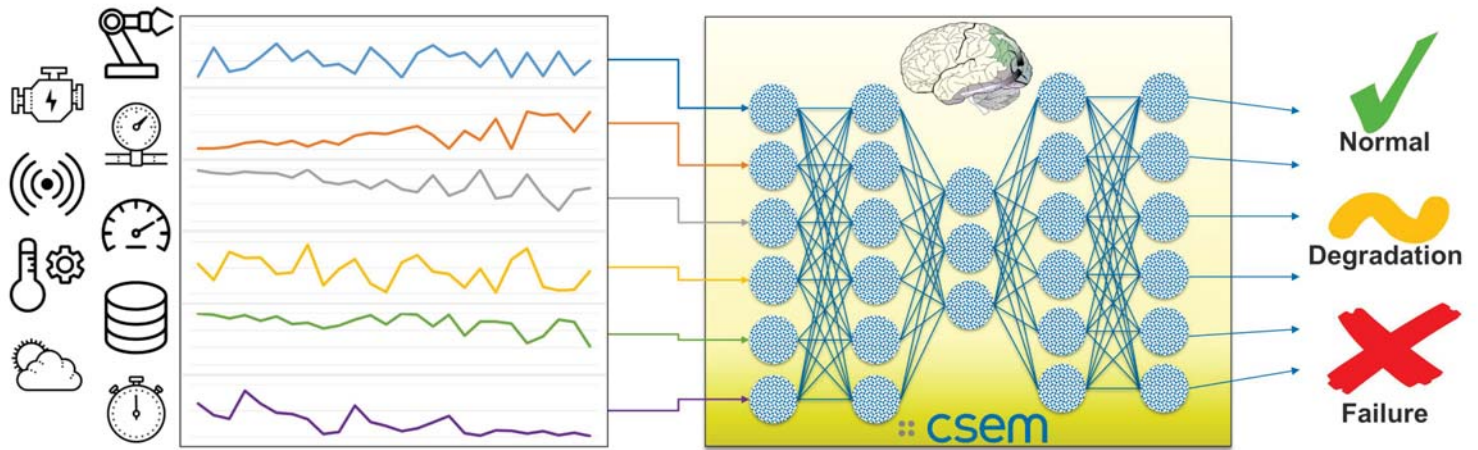
Deep Learning



Prognose

:: csem

# Maintenance with Deep Learning



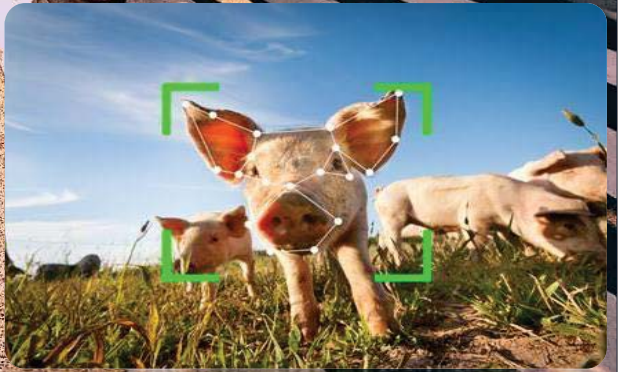
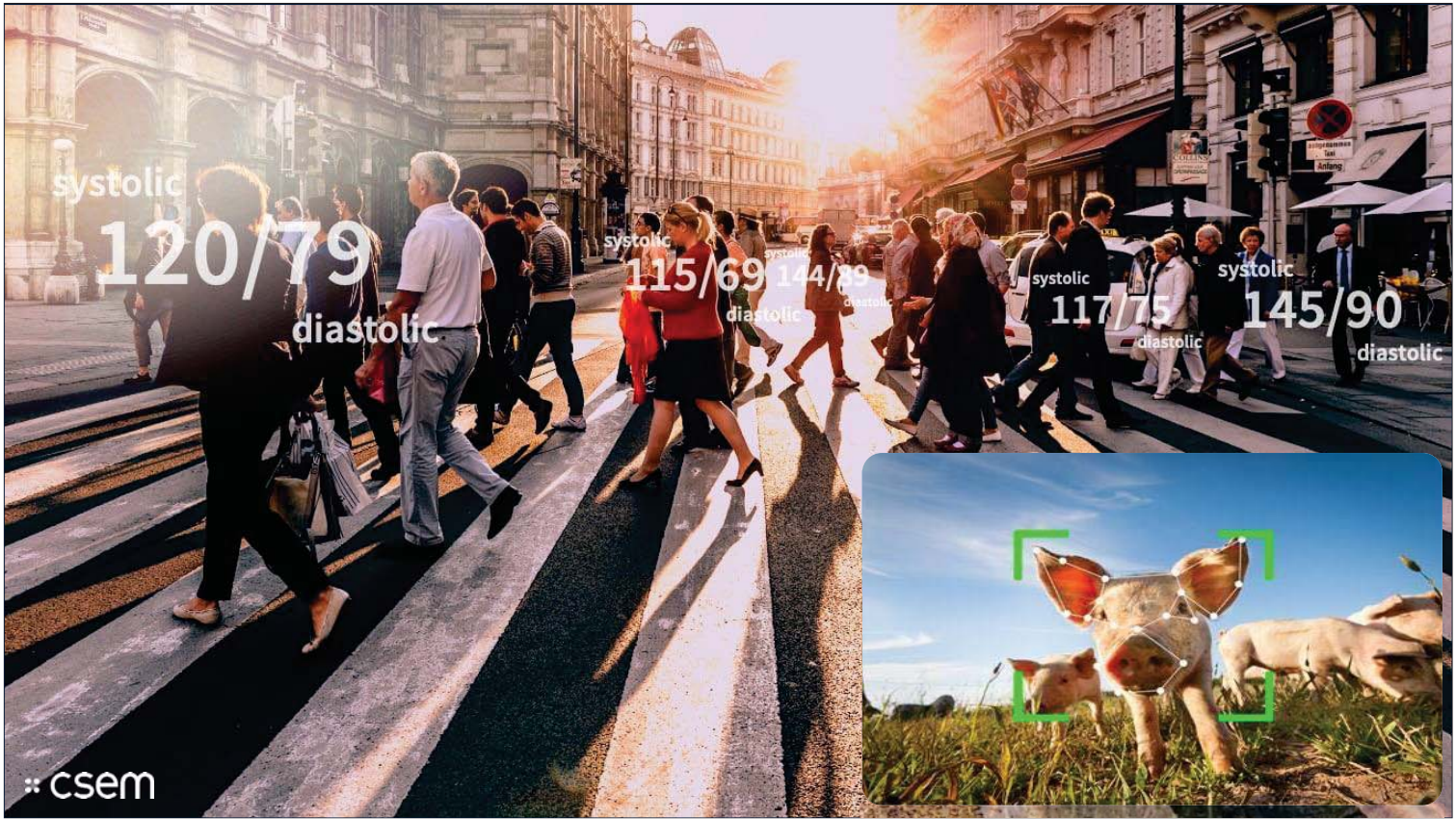
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## Condition Based Monitoring for Trains



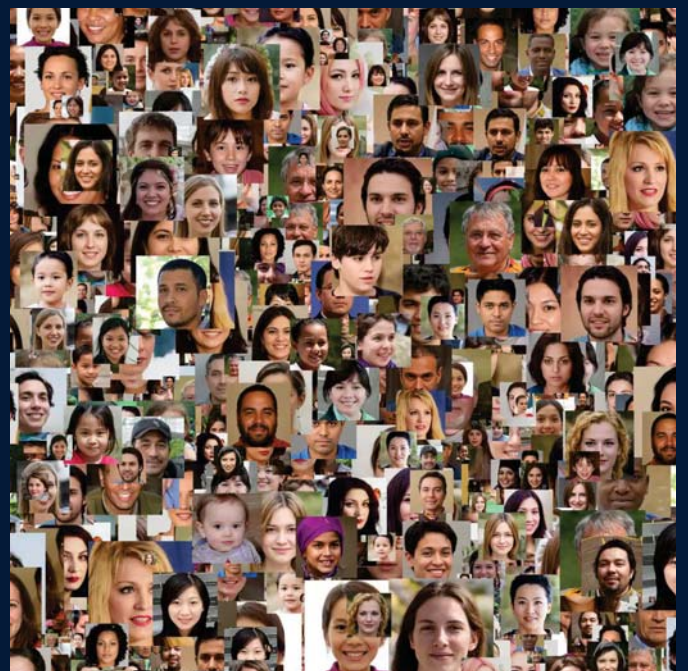
:: csem STADLER







### 3 Milliarden Gesichter (Clearview AI)



# WER DARF DEINE PERSÖNLICHEN DATEN SAMMELN?

|                   |   |
|-------------------|---|
| Facebook          | ✓ |
| Google            | ✓ |
| Twitter           | ✓ |
| Instagram         | ✓ |
| Microsoft         | ✓ |
| Apple             | ✓ |
| Der Staat         | ✓ |
| Dein Netzanbieter | ✓ |
| Die Chinesen      | ✗ |

## Die Zukunft?



Auch die KI ist nicht perfekt...



Ara 97.3%

+



x0.01

Noise

=



Bücherregal 99.1%

:: csem

Auch die KI ist nicht perfekt...



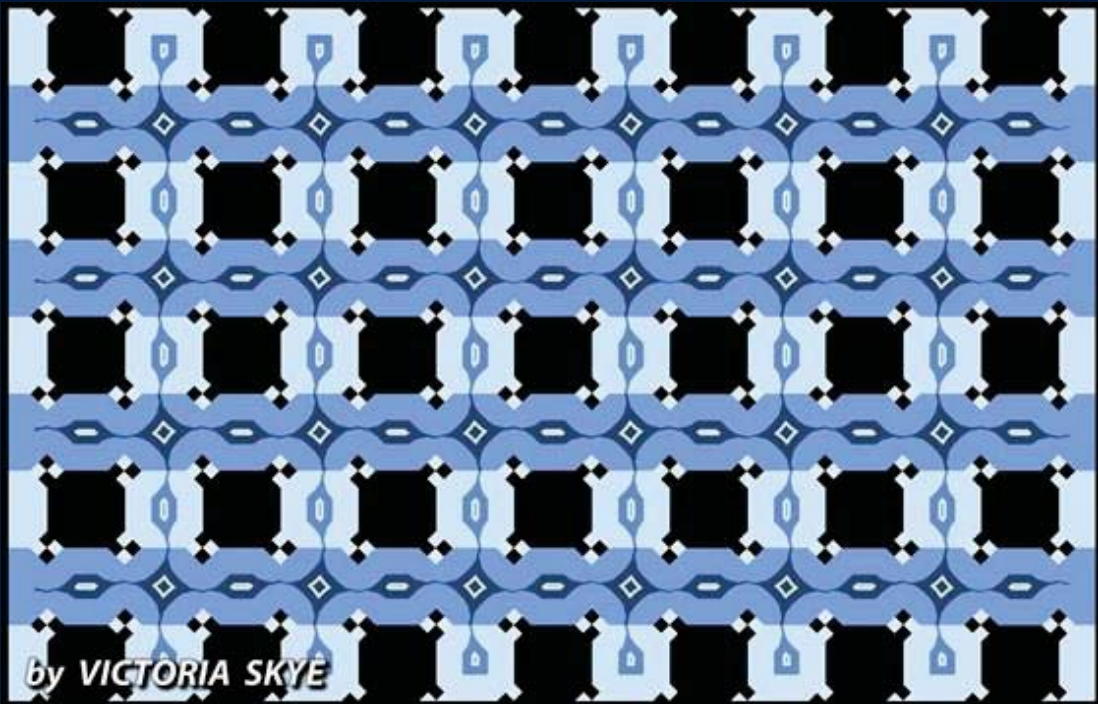
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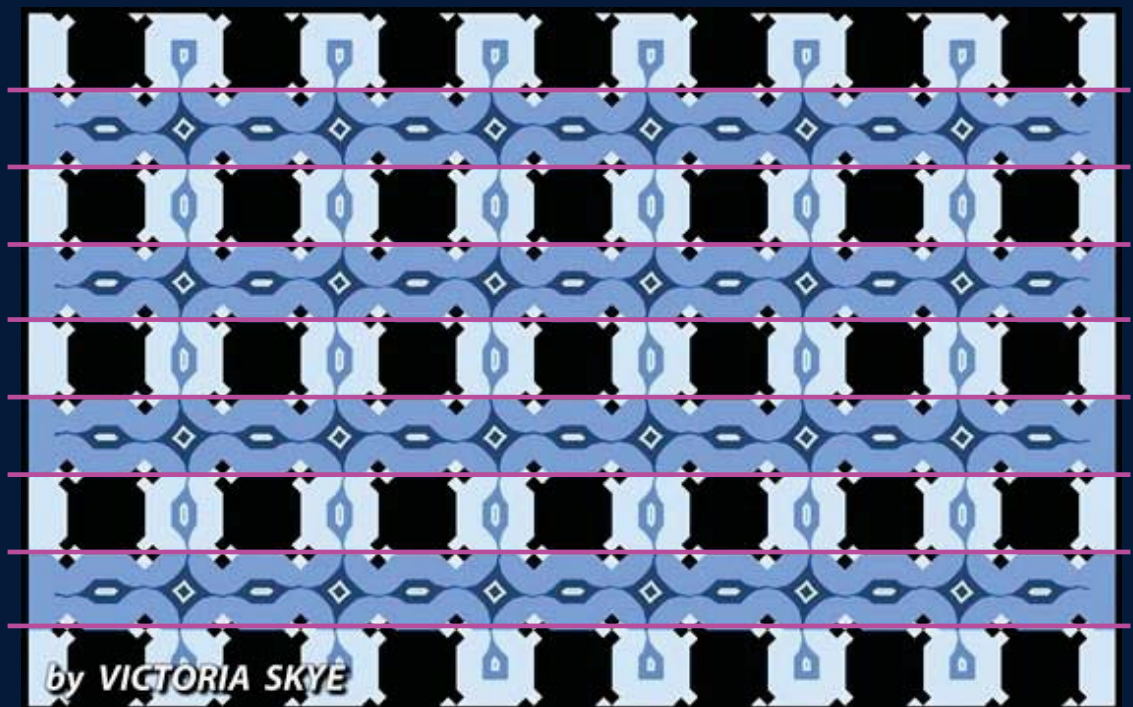
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Mensch?



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Mensch?



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## Contact

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