Fachvortrag Gewerbe@OST am 20. Februar 2024

17.00 Uhr **Begrüssung**
Gian Bazzi
Präsident Gewerbe Stadt St.Gallen

17.05 Uhr **Fachvortrag «Künstliche Intelligenz und die Chancen für die Wirtschaft»**
Prof. Dr. Guido M. Schuster
Leiter ICAI - Interdisciplinary Center for Artificial Intelligence

18.20 Uhr **Schlusswort**
Prof. Dr. Pascale Baer-Baldauf
Leiterin Institut für Informations- und Prozessmanagement,
Professorin für Wirtschaftsinformatik

18.30 Uhr **Apéro**
in der Aula im EG

gewerbe stadt st.gallen

OST

OST
Ostschweizer Fachhochschule

Künstliche Intelligenz und die Chancen für die Wirtschaft

Prof. Dr. Guido M. Schuster
Director ICAI - Interdisciplinary Center for Artificial Intelligence

20. Februar 2024

ICAI

Kompetenzzentrum Wissenstransfer & Innovation (WTT)
ISM Institut für Strategie und Marketing

ICAI Team

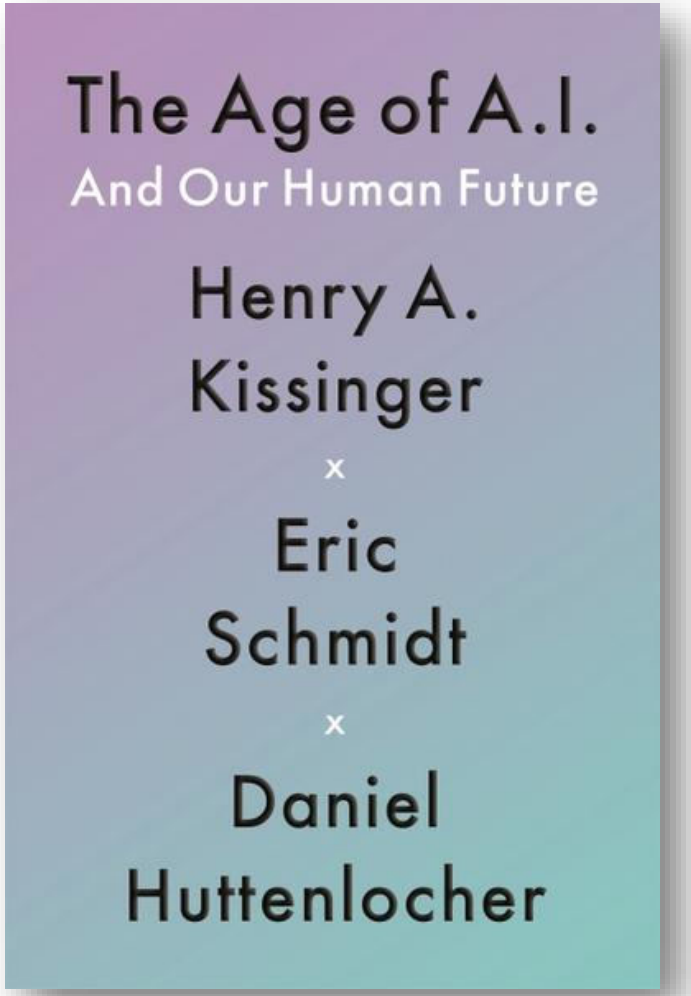
OST - Eastern Switzerland University of Applied Sciences

- **Campus Rapperswil, SG, Switzerland**

OST

Age of AI

- **We are entering the Age of AI**
  - Comparable in its effects only to the introduction of
    - Fire
    - Agriculture
    - **Electricity**
- **Decisions, Decisions, Decisions …**
  - In the age of AI, computers make decisions for and about us every day
    - Work: HR Analytics
    - Love: Tinder
    - Entertainment: YouTube Video
    - Finances: Credit Card Approval
    - And many more …



OST

Data

- **Data** is fundamental to AI, but what kind of data is there and where does it come from?

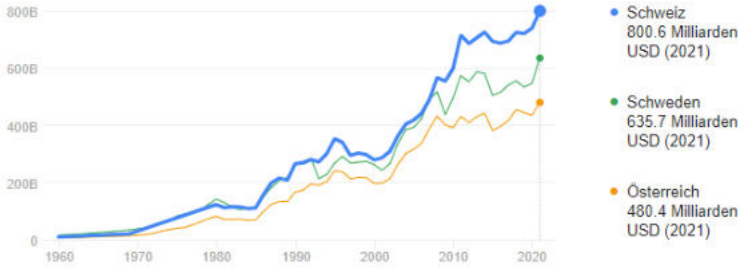
- IT systems
  - Official documents
  - Books
  - Personnel files
  - Medical records
  - Credit cards
  - Access cards
  - Cell phone positions
  - Browser history …

- Dedicated sensors
  - Cameras
  - Microphones
  - Pressure sensors
  - IMU
  - LIDAR
  - RADAR
  - And many more …

Data & Computing

Schweiz / Bruttoinlandsprodukt

800.6 Milliarden USD (2021)



Mehr entdecken →

Schweiz

Land in Europa

Die Schweiz ist ein gebirgiges Land in Zentraleuropa mit zahlreichen Seen, Dörfern und hohen Alpengipfeln. In ihren Städten findet man mittelalterliche Viertel mit Wahrzeichen wie dem Uhrturm Zytglogge in der Hauptstadt Bern und der Kapellbrücke von Luzern. Die Schweiz ist auch bekannt für ihre Skigebiete und Wanderwege. Das Bank- und das Finanzwesen sind wichtige Branchen, Schweizer Uhren und Schokolade sind weltbekannt. — Google

NVIDIA

Marktbericht > Nvidia

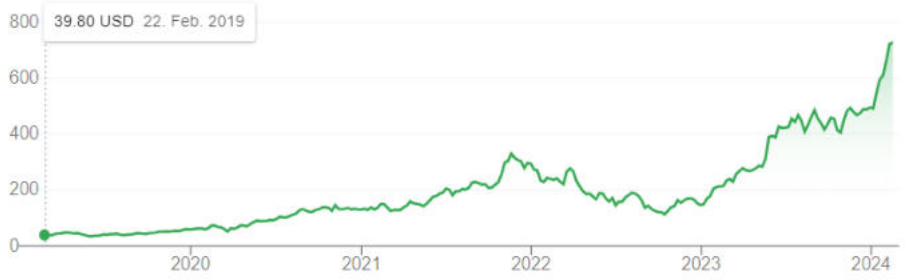
726.58 USD

+686.78 (1'725.58%) ↑ in den letzten 5 Jahren

Geschlossen: 15. Feb., 19:59 GMT-5 • Haftungsausschluss

Nachbörse 732.27 +5.69 (0.78%)

1 T. | 5 T. | 1 M. | 6 M. | YTD | 1 J. | 5 J. | Max.

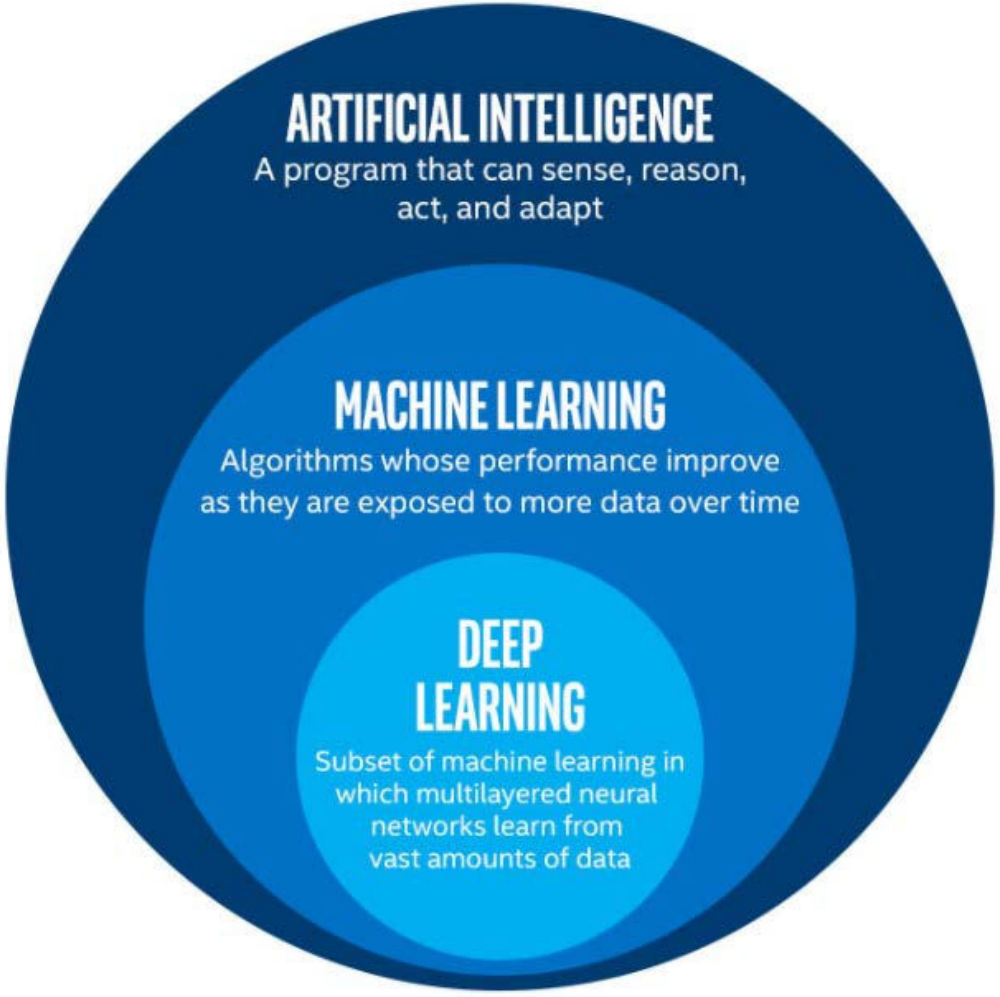


Eröffnung	738.69	Marktkap.	1.79 Bio.	52-Wo-Hoch	746.11
Hoch	739.75	KGV	95.94	52-Wo-Tief	204.21
Tief	724.00	Rendite	0.022%		

- DGX-2 Deep Learning Supercomputer
  - 2 Petaflops (2e15) per second
  - Earth: 8e9 people
    - 2e15/8e9=1/4e6=250’000 flops/person per second

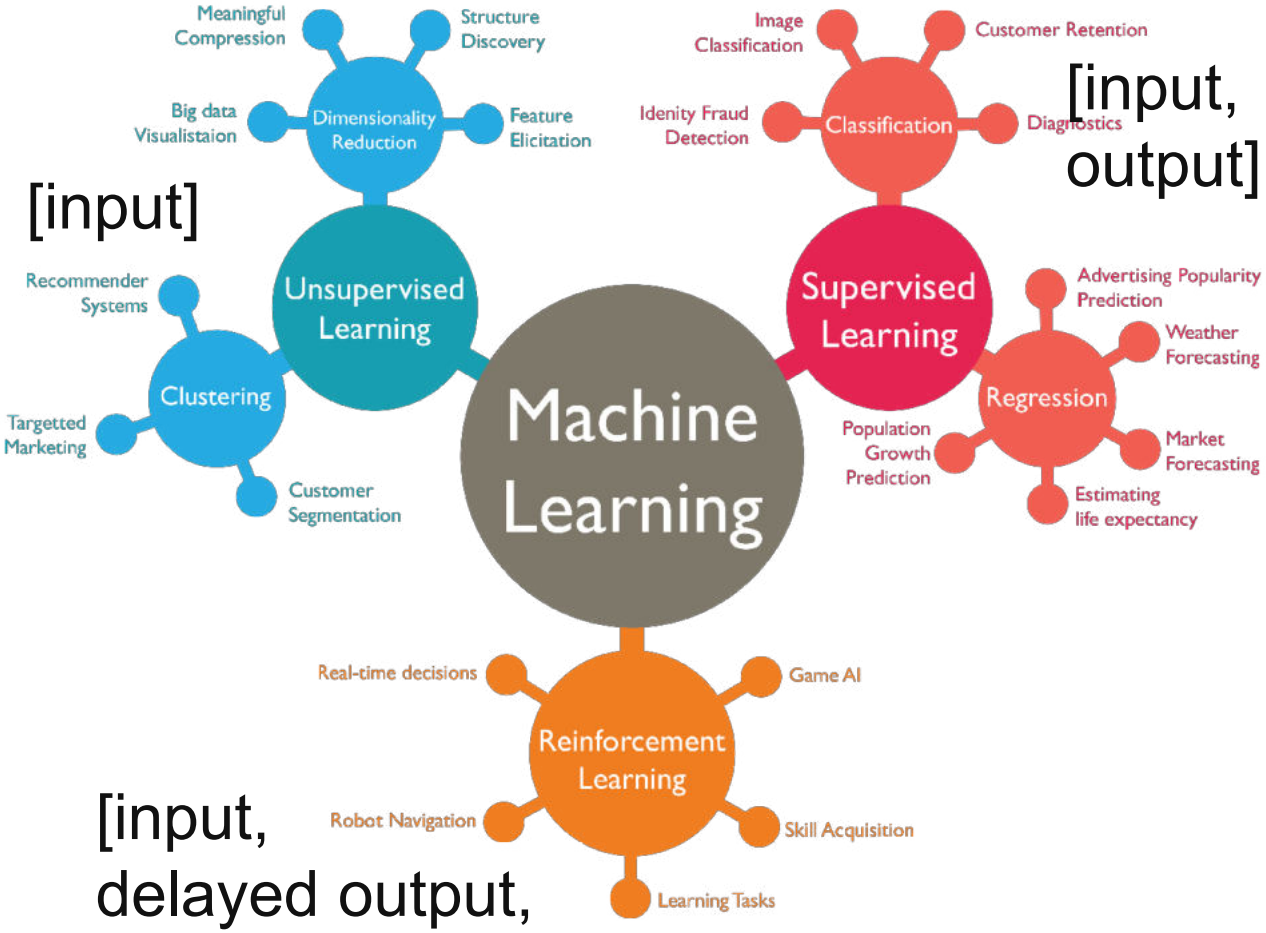
Data & Computing & Algorithms

[What kind of data?]



[input]

[input, output]



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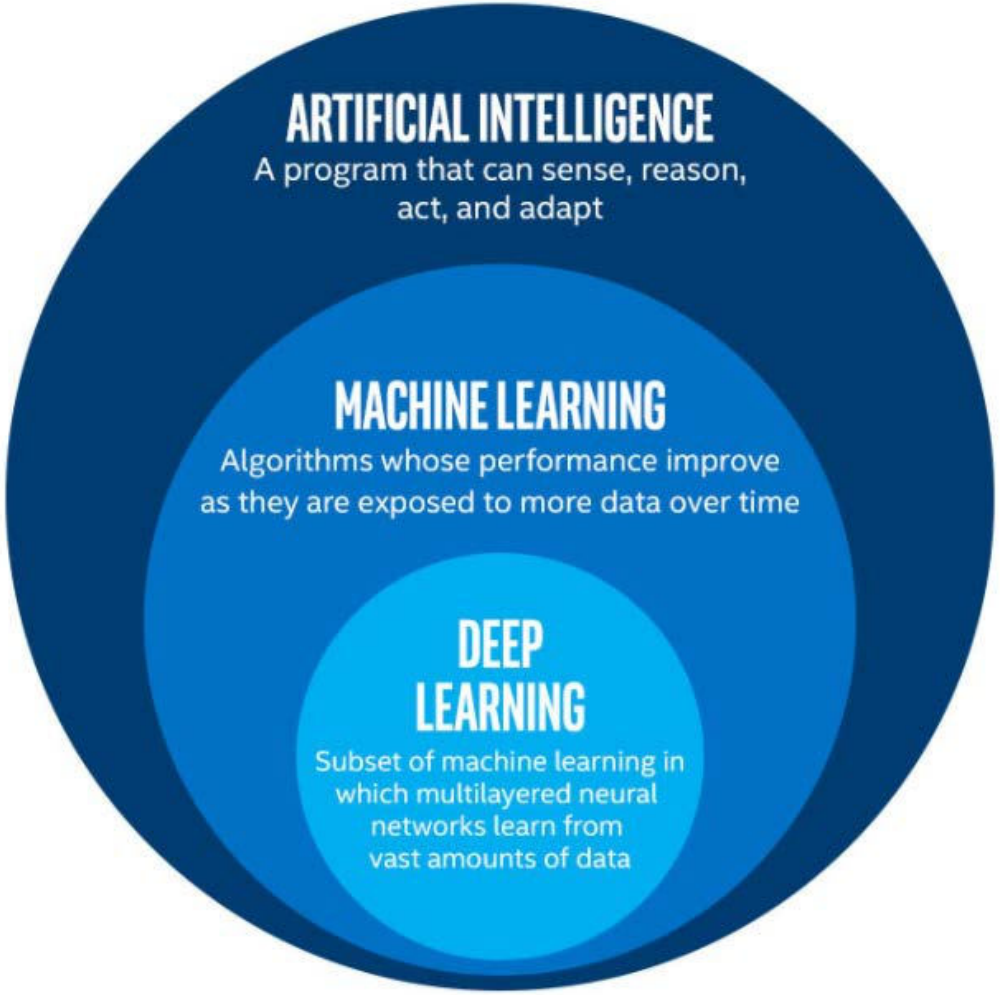
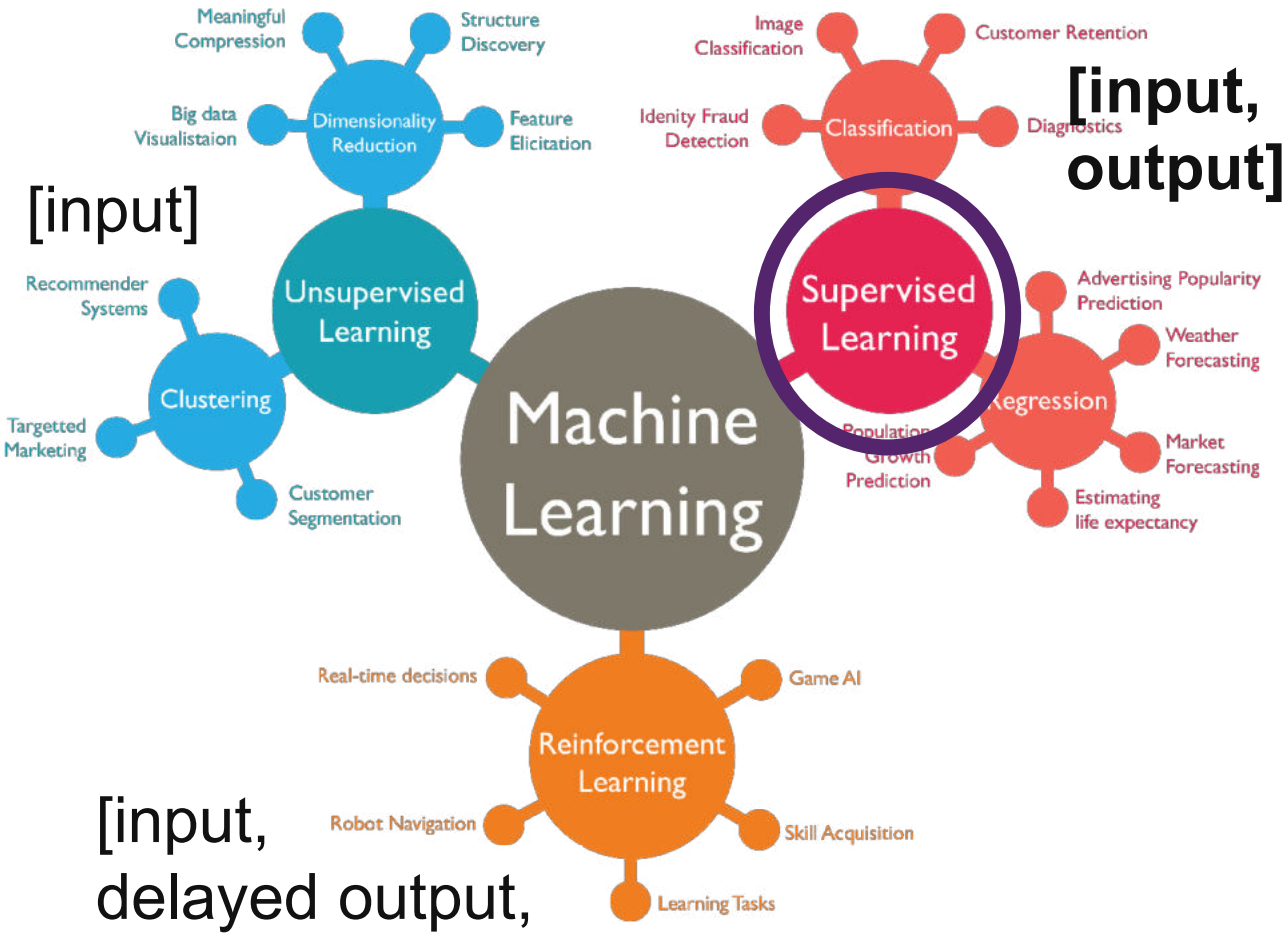
Focus: Supervised Learning

[What kind of data?]





[input]

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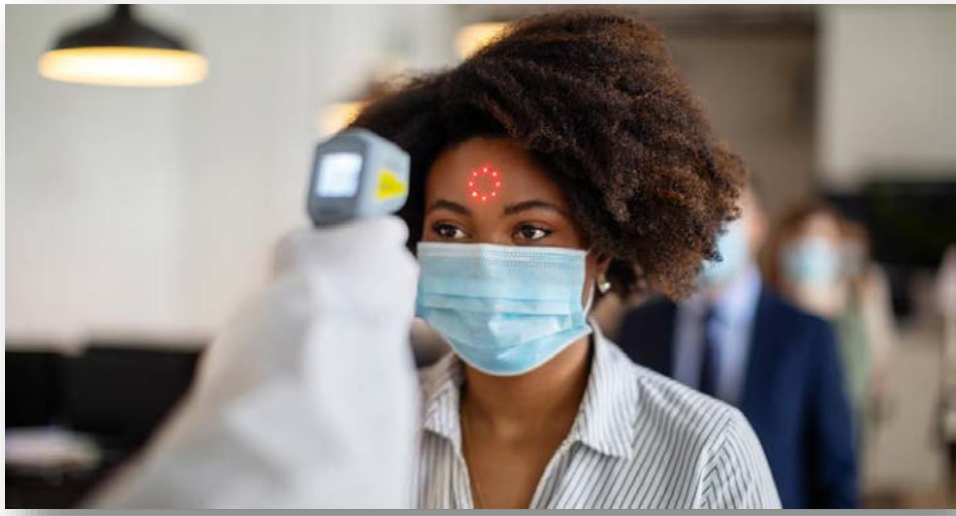
Supervised Machine Learning

- **An example**
  - Based on the temperature, the AI estimates the probability whether a person is **healthy**

    P(**healthy**|temperature)

  - For this crucial estimation, data from the past (examples, also called training data) are used, where doctors have made this decision



Training data

Person #	Temperature [C]	Doctor decision [healthy] [sick]
1	37.00	healthy
2	36.75	healthy
3	39.50	sick
4	40.25	sick
5	38.25	healthy
6	36.75	healthy
…	…	…
100'000	41.25	sick

Supervised Machine Learning

Labels!

The steps of Supervised Machine Learning:

Person #	Temperature [C]	Doctor decision [healthy] [sick]
1	37.00	healthy
2	36.75	healthy
3	39.50	sick
4	40.25	sick
5	38.25	healthy
6	36.75	healthy
…	…	…
100'000	41.25	sick

1. **Training data**: Labeled data in a table
2. **Test data**: Temperature in Celsius → but no doctor's opinion
3. **AI-Decision**: **healthy**? or **sick**?

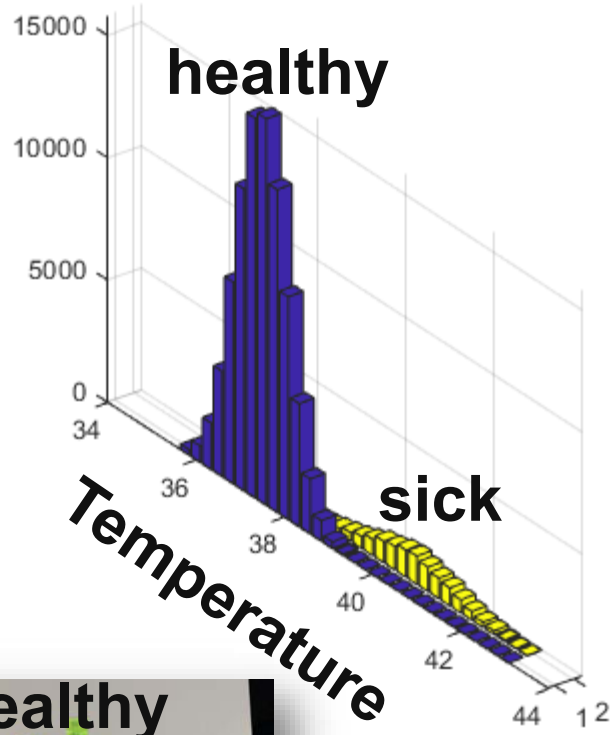
Supervised Machine Learning

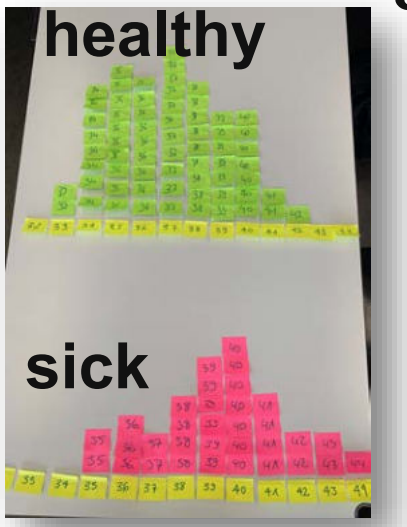
- **Training data (examples):**

Person #	Temperature [C]	Decision [healthy] [sick]
1	37.00	healthy
2	36.75	healthy
3	39.50	sick
4	40.25	sick
5	38.25	healthy
6	36.75	healthy
…	…	…
100'000	41.25	sick

Create a 2D Histogramm

Temperature	#healthy	#sick
35.75	229	0
36.00	676	0
36.25	1910	0
36.50	4314	1
36.75	8253	1
37.00	12356	3
37.25	15542	2
37.50	15812	4
37.75	13209	13
38.00	9119	32
38.25	5044	76
38.50	2261	120
38.75	850	232
39.00	271	352
39.25	65	485
39.50	9	664
39.75	1	882
40.00	0	964
40.25	0	1111
40.50	0	1154
40.75	0	1004
41.00	0	845
41.25	0	733
41.50	0	544
41.75	0	360
42.00	0	211
42.25	0	153
42.50	0	82
42.75	0	28
43.00	0	23





Temperature

- Labeled training data (examples), here, doctors made the decisions (**healthy** or **sick**)

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Supervised Machine Learning

- **Minimum error decisions making**
  - A reasonable goal is to make as few mistakes as possible
  - **Bayes' theorem**
    - For a measured temperature, estimate (based on the training data) the probabilities that the person is **healthy**

      P(**healthy**|temperature)

Decide **healthy**, if P(**healthy**|temperature) > P(**sick**|temperature)

On average, by taking the most likely option, the fewest mistakes are made → optimal decision making

The Reverend
Thomas Bayes

Portrait purportedly of Bayes used in a 1936 book,[1] but it is doubtful whether the portrait is actually of him.[2] No earlier portrait or claimed portrait survives.

Born	c. 1701 London, England
Died	7 April 1761 (aged 59) Tunbridge Wells, Kent, Great Britain
Alma mater	University of Edinburgh
Known for	Bayes' theorem
	Scientific career
Fields	Probability

Signature

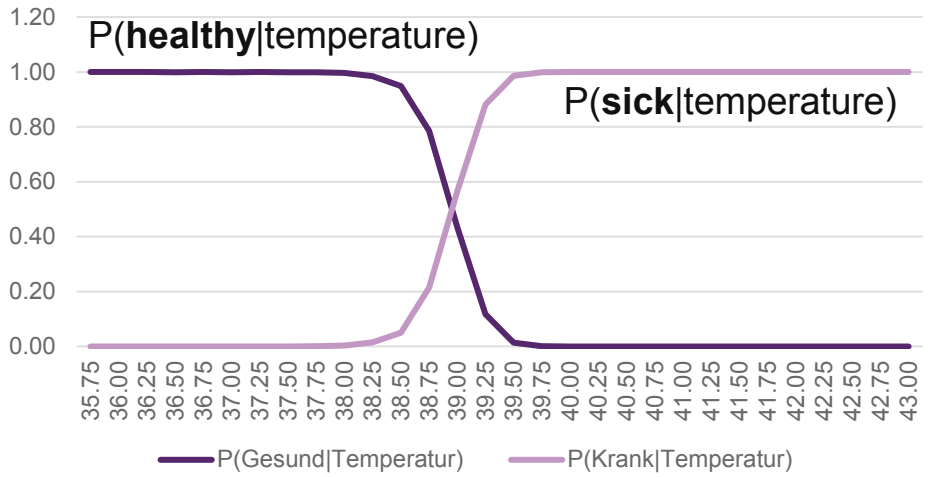
Supervised Machine Learning

Key question:

How is P(**healthy**|temperature) estimated from the **training data**?

$$P(\textbf{healthy}|\text{temperature}) = \frac{(\textbf{\#healthy}|\text{temperature})}{(\textbf{\#healthy}|\text{temperature}) + (\textbf{\#sick}|\text{temperature})}$$

- Where each row in the histogram table corresponds to a given temperature → P(**healthy**|temperature) can be calculated per temperature (line)
- Now for every measured temperature, pick the more likely option (**healthy** or **sick**)



Training data

Temperature	#healthy	#sick	P(**healthy**|temperature)= #healthy/(#healthy+#sick)
35.75	229	0	1.00
36.00	676	0	1.00
36.25	1910	0	1.00
36.50	4314	1	1.00
36.75	8253	1	1.00
37.00	12356	3	1.00
37.25	15542	2	1.00
37.50	15812	4	1.00
37.75	13209	13	1.00
38.00	9119	32	1.00
38.25	5044	76	0.99
38.50	2261	120	0.95
38.75	**850**	**232**	**850/(850+232)=0.79**
39.00	271	352	0.43
39.25	65	485	0.12
39.50	9	664	0.01
39.75	1	882	0.00
40.00	0	964	0.00
40.25	0	1111	0.00
40.50	0	1154	0.00
40.75	0	1004	0.00
41.00	0	845	0.00
41.25	0	733	0.00
41.50	0	544	0.00
41.75	0	360	0.00
42.00	0	211	0.00
42.25	0	153	0.00
42.50	0	82	0.00
42.75	0	28	0.00
43.00	0	23	0.00

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Supervised Machine Learning

- **Minimum risk decisions making**
  - A reasonable goal is to take as small a risk as possible
    - Risk is defined as the product between a probability of a particular event and its associated cost **R=P·C**
  - Hence, we need to define costs, since we have learned how AI can estimate probabilities
    - Costs are associated with errors:
      - In this examples, the cost for the AI to classify somebody a healthy, even though the person is sick, is 10 times higher, then when the AI classifies a healthy person as sick.

		Truth!	
		healthy!	**sick!**
AI?	**healthy?**	C_HH=0	**C_HS=10**
	sick?	**C_SH=1**	C_SS=0

Supervised Machine Learning

Key question:

How is Risk(**healthy?**|temperature) estimated from the **estimated probabilities** and **the cost**?

Risk(**healthy**?|temperature) = C_HH*P(**healthy**!|temperature)+**C_HS***P(**sick**!|temperature) =

= 0*P(**healthy**!|temperature)+ **10***P(**sick**!|temperature) =

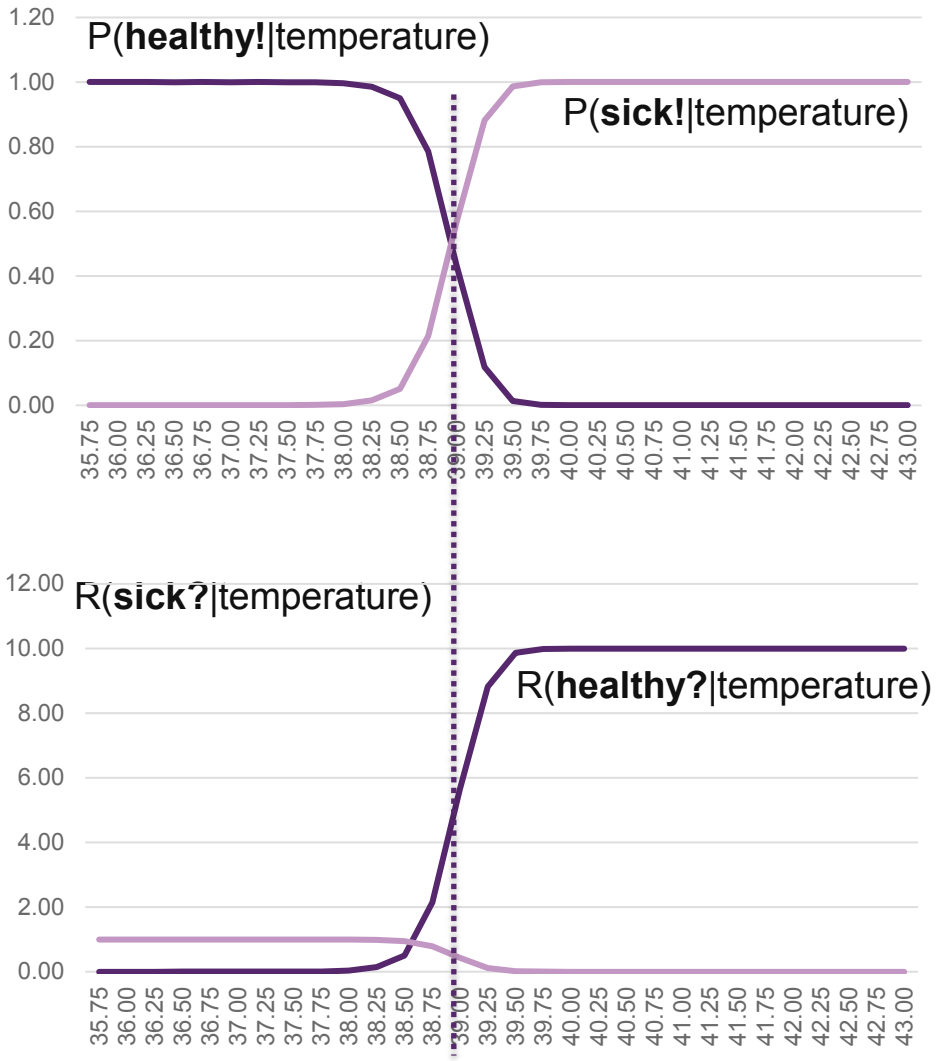
= **10***P(**sick**!|temperature)

		Truth!	
		healthy!	**sick!**
AI?	**healthy?**	C_HH=0	**C_HS=10**
	sick?	**C_SH=1**	C_SS=0

OST

Supervised Machine Learning

		Truth!	
		healthy!	**sick!**
AI?	**healthy?**	C_HH=0	**C_HS=10**
	sick?	**C_SH=1**	C_SS=0



Risk(**healthy**?|temperature)=

C_HH*P(**healthy**!|temperature)+**C_HS***P(**sick**!|temperature) =

= 10*P(**sick**!|temperature)

Risk(**sick**?|temperature) =

C_SH*P(**healthy**!|temperature)+C_SS*P(**sick**!|temperature) =

= 1*P(**healthy**!|temperature)

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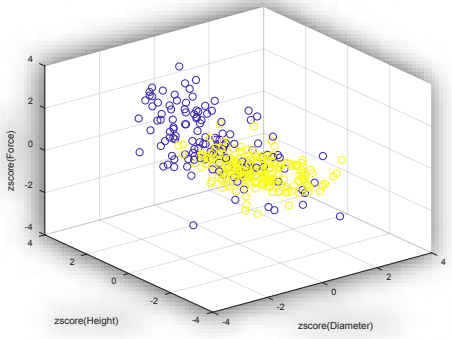
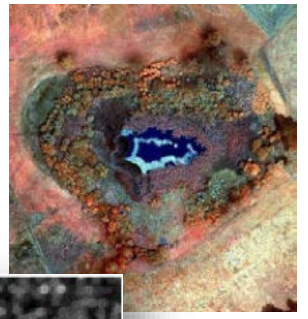
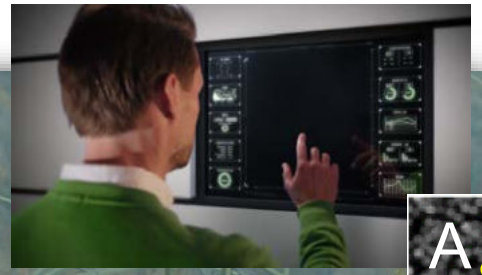
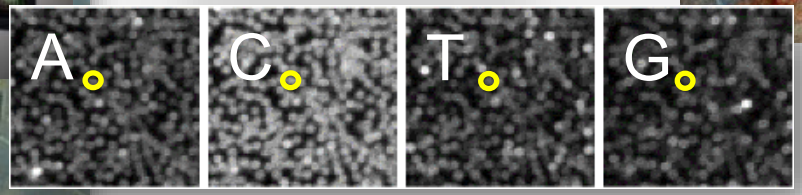
Industrial Applications of Artificial Intelligence

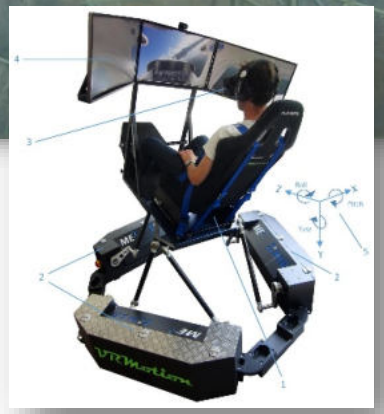
- **Research & Development**
  - ~1500kCH/Year external R&D

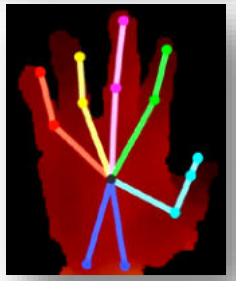












ICAI

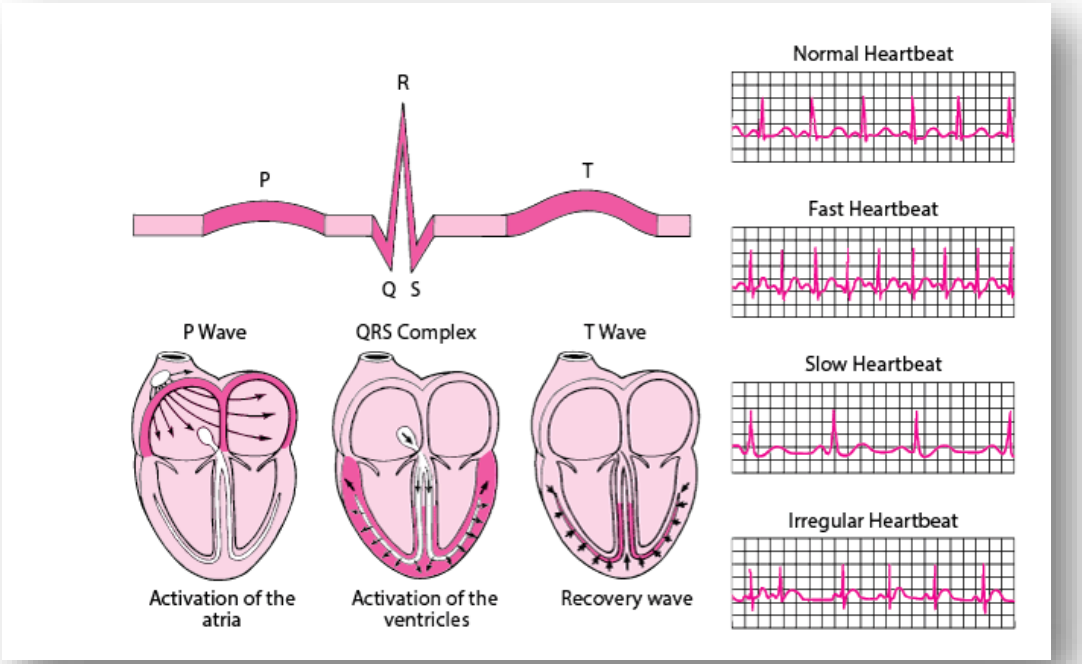
Deep Learning for ECG Analysis

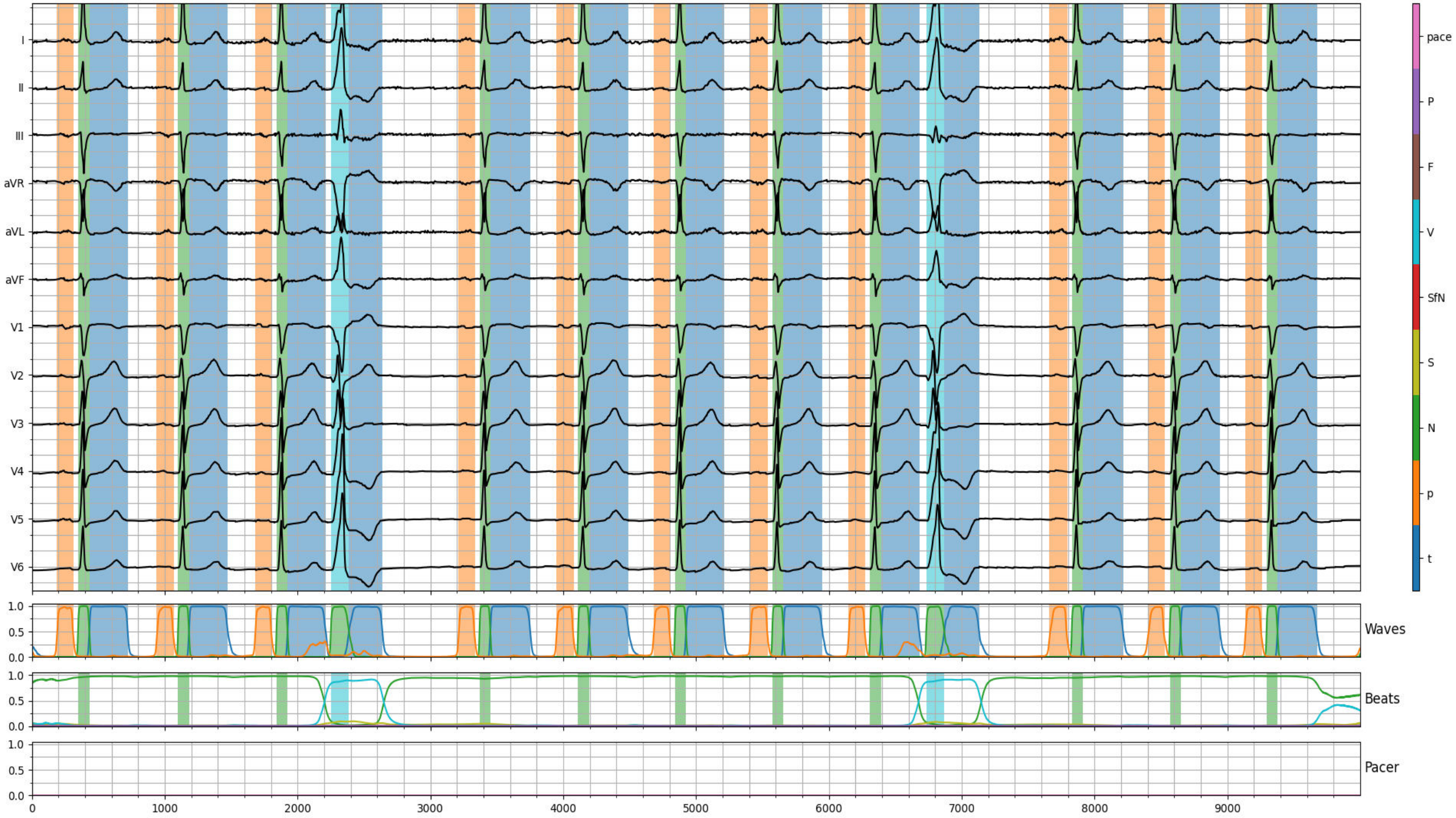
Application Number: 36433.1 IP-LS

Application Title: Data-driven Electrocardiogram Interpretation

Main partners and project manager

Project manager	Ramun Schmid SCHILLER AG
Main research partner	Professor Dr Guido Schuster HSR Hochschule Rapperswil
Research partner	Professor Dr Christian Mueller Universitätsspital Basel
Main implementation partner	Ramun Schmid SCHILLER AG

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4000
5000
6000
7000
8000
9000

ML for Injection Moulding Control

iwk
INSTITUT FÜR
WERKSTOFFTECHNIK UND
KUNSTSTOFFVERARBEITUNG

SUBVENTIONSVERTRAG

Innovationsprojekt 29621.1 IP-ENG

Zwischen der **Innosuisse – Schweizerische Agentur für Innovationsförderung** (nachstehend **Beitragsgeberin** genannt)

und den folgenden Projektpartnern:

Forschungspartner:

HSR Hochschule für Technik Rapperswil (nachstehend **Empfänger**)

Umsetzungspartner:

Kistler Instrumente AG

Netstal-Maschinen AG

Geberit International AG

Weidmann Medical Technology AG

Krauss Maffei Schweiz AG

betreffend

Machine Learning basiertes Prozessmanagementsystem zur Optimierung des Spritzgiessprozesses

Data Driven Injection Moulding

Curdin Wick(✉), Frank Ehrig, and Guido Schuster

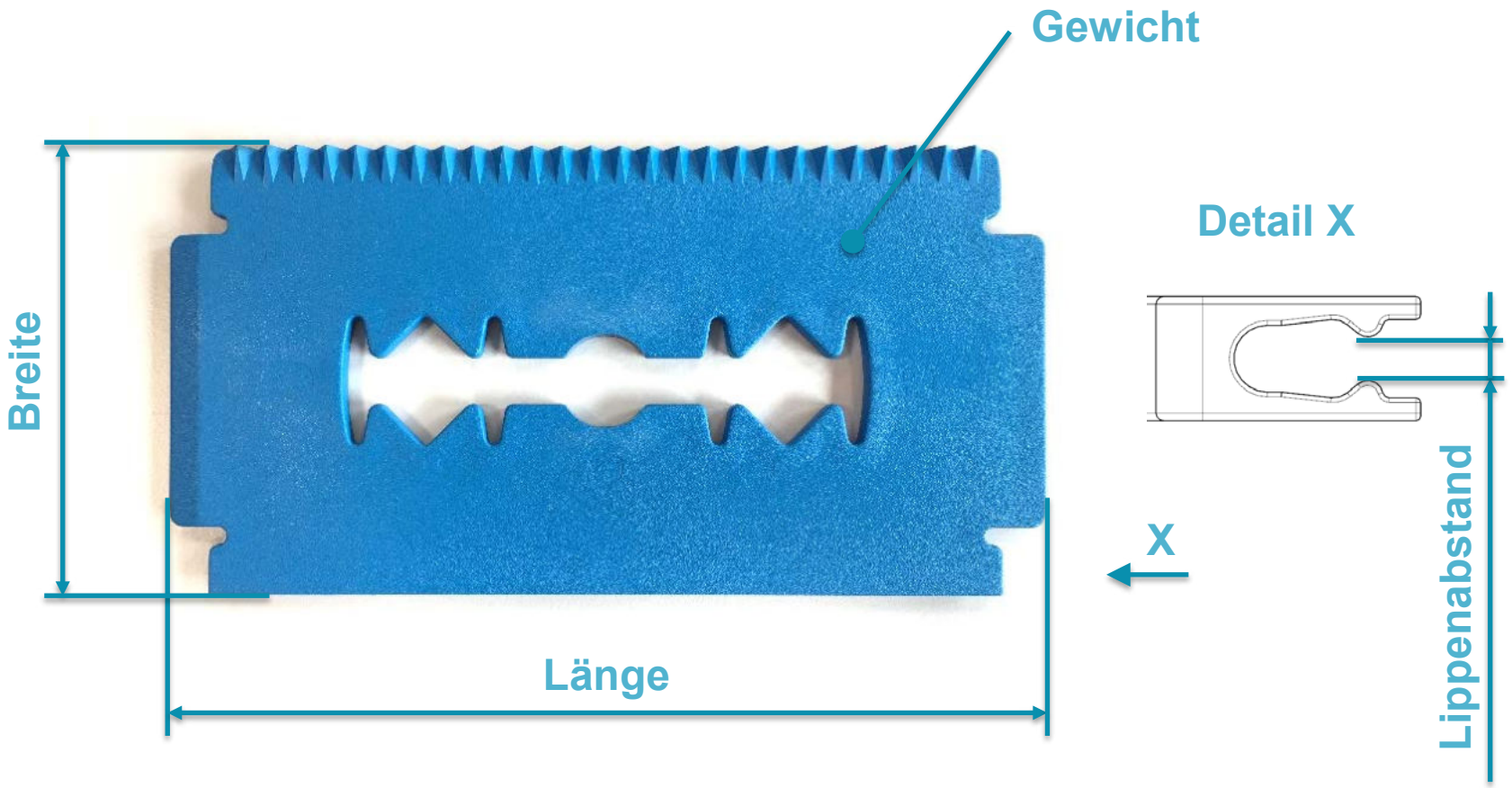
University of applied science Rapperswil, Rapperswil SG, Switzerland
{curdin.wick,frank.ehrig,guido.schuster}@hsr.ch

Abstract. The injection moulding process for the production of plastic parts is a very complex process. Therefore, a lot of experience and expert knowledge is necessary to produce parts with high quality. Changes in granule-batches, environmental influences and wear of the machine and the mould can strongly affect the quality of the produced parts. For this reason an injection moulding machine needs an experienced operator, who reacts properly to changing input variables and sets appropriate countermeasures. Modern injection moulding machines are able to record all countermeasures and have access to a wealth of internal machine data. Consequently, an adequate machine learning (ML) method should be able to observe, to learn the proper countermeasures and to evaluate their effectiveness. With deep learning (DL), a state of the art technology in ML, it will be possible to predictively detect process anomalies for the first time, based only on the knowledge about the internal machine data. If an operator changes the setting parameters of the injection moulding machine, the correlation between the adjustment and the anomaly is being learnt. The aim is to get process adjustment recommendations from the machine learning system.

This is a fundamentally new approach for process management in injection moulding, as the machine learning system detects problems long before they can be seen by an operator. Furthermore, the system provides process adjustment recommendations, based on the supervised and automatically generalized actions from different operators using different injection moulding machines, moulds and materials.

Keywords: Injection moulding · Machine learning · Process anomalies

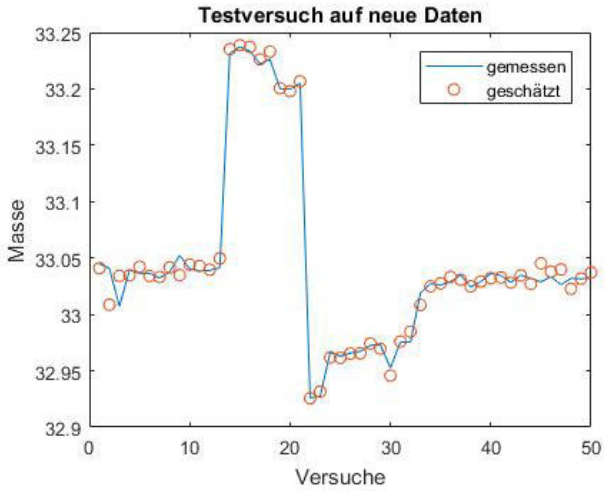
ML for Injection Moulding Control

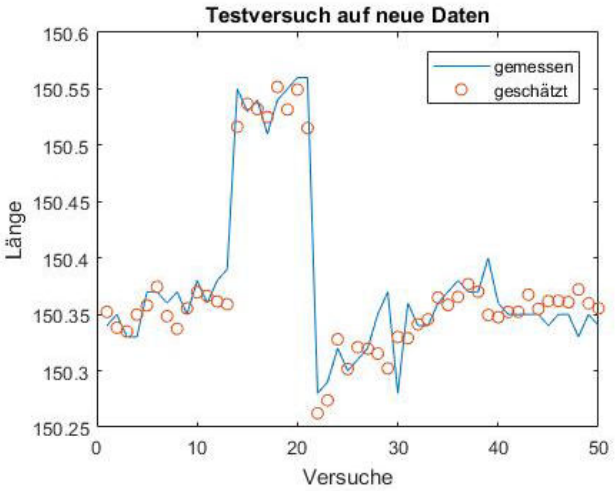


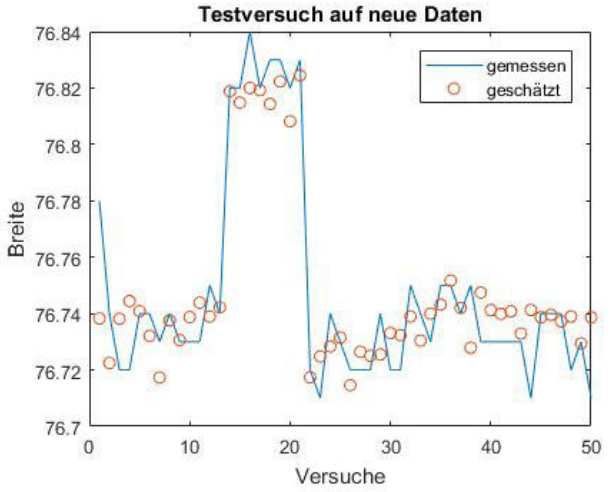
ML for Injection Moulding Control

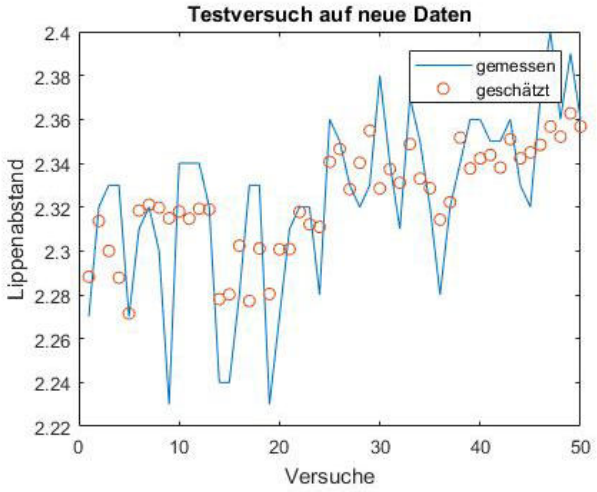
- Internal signals were used to train ML model to predict quality data
- Trained model was able to predict the mass, the length and the width with surprising precision

	STD-Error σ	$CV = \frac{\sigma}{\mu}$ in %
Masse	0.009 g	0.03%
Länge	0.017 mm	0.02%
Breite	0.014 mm	0.02%
Lippen-abstand	0.032 mm	1.38%









VR Helicopter Simulator

- **Loft Dynamics**
  - More than 2/3 of the engineering team was educated at the ICAI
  - CTO former ICAI engineer

Loft Dynamics

Erster Virtual-Reality-Simulator EASA-qualifiziert

Das aus dem Labor des Interdiciplinary Center for Artificial Intelligence (ICAI) hervorgegangene Unternehmen VRM Switzerland hat den ersten Helikopter-Flugsimulator entwickelt, der vollständig auf Virtual Reality (VR) basiert und von der Europäischen Agentur für Flugsicherheit (EASA) anerkannt ist.

Application Number: 38437.1 IP-ICT

Application Title: VR motion helicopter hoist operation simulator

Main partners and project manager

Project manager	Fabian Riesen VRMotion AG
Main research partner	Professor Dr Guido Schuster HSR Hochschule Rapperswil
Main implementation partner	Fabian Riesen VRMotion AG

AI based Condition Monitoring using Drones

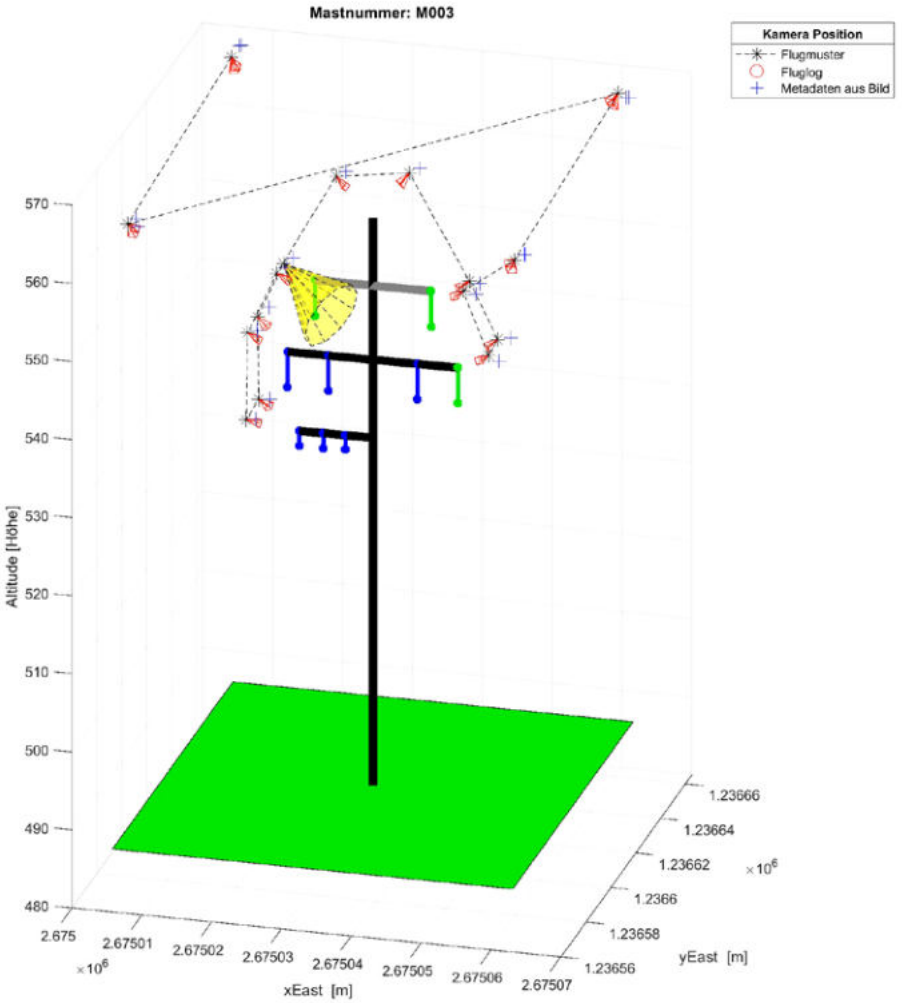
Application Number: 52765.1 IP-EE

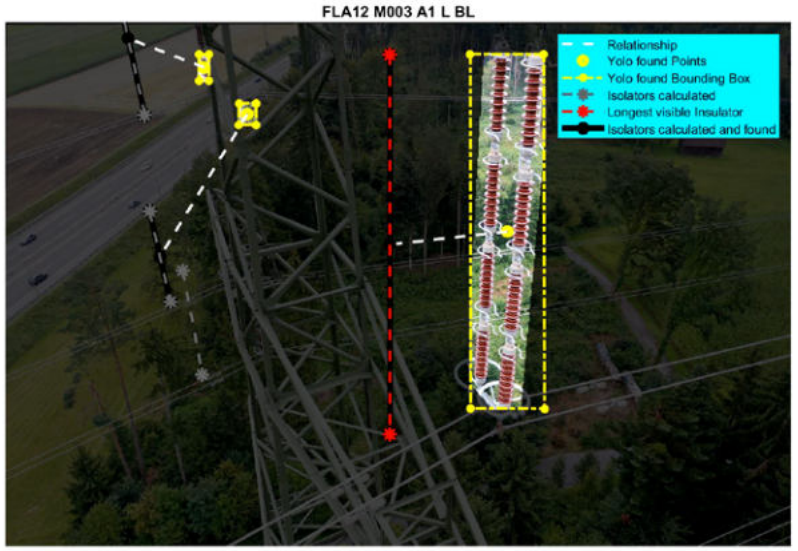
Application Title: CURO: Automatische Zustandsüberwachung und vorausschauende Wartung für Hochspannungsleitungen mittels automatisierten Drohnen und künstlicher Intelligenz

Main partners and project manager

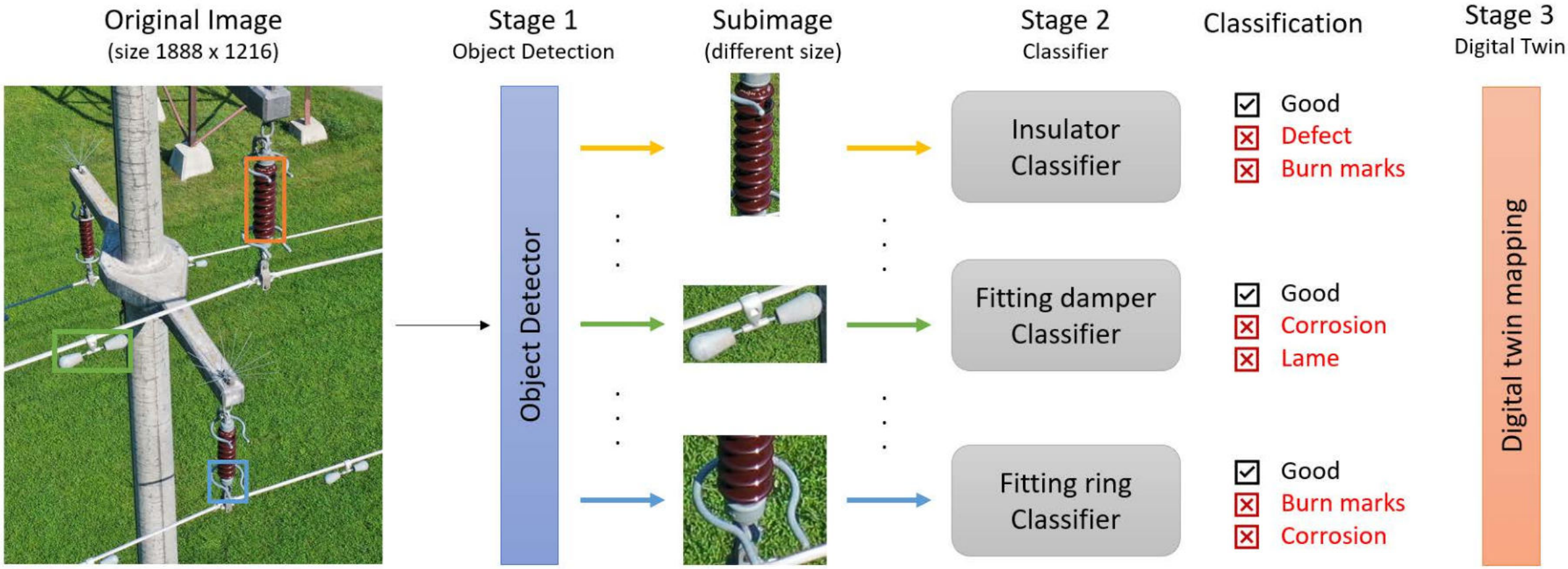
Project manager	Lorenzo Arizzoli-Bulato
	LINIA GmbH
Main research partner	Professor Dr Guido Schuster
	OST - Ostschweizer Fachhochschule
Main implementation partner	Lorenzo Arizzoli-Bulato
	LINIA GmbH

AI based Condition Monitoring using Drones



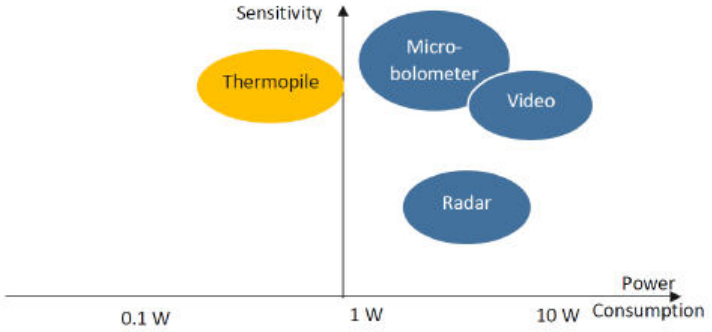


AI based Condition Monitoring using Drones



Solar powered pedestrian/bicycle detection/counting system based on low-power and low-cost thermopile arrays AI & CV

- **ADEC**



FUNDING AGREEMENT

Innovation project 102.568 IP-ENG

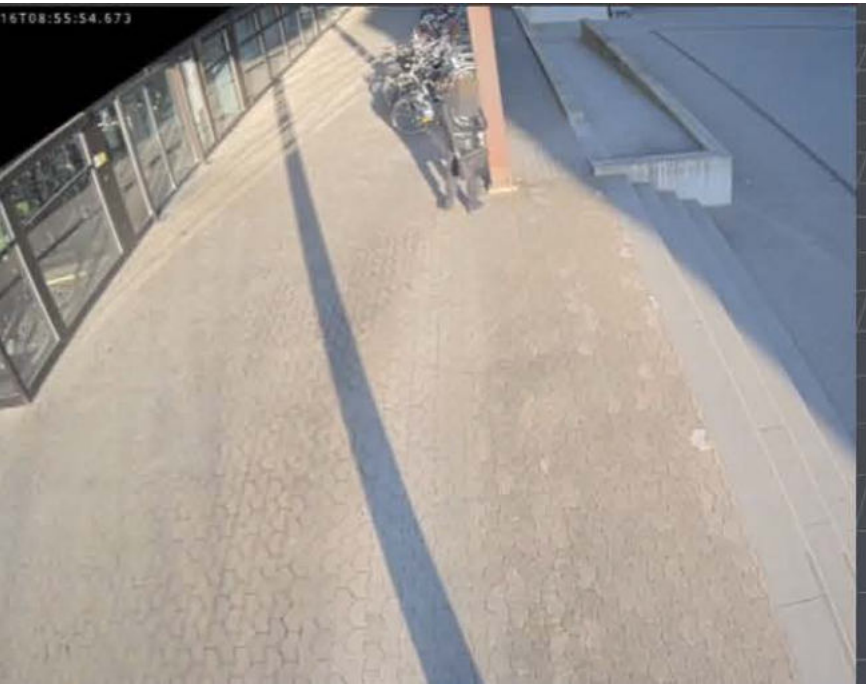
between Innosuisse – Swiss Innovation Agency
(hereinafter referred to as Contributor)

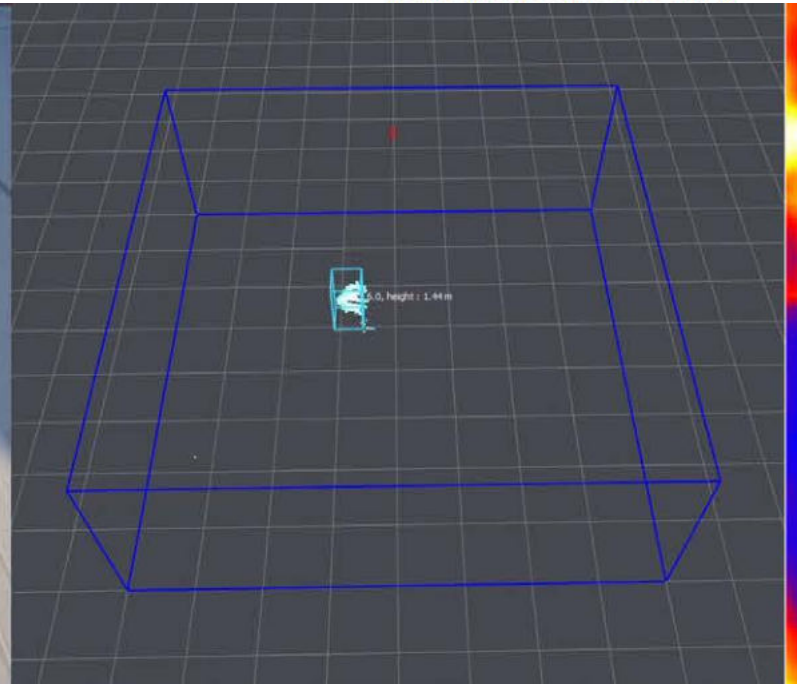
and the following
project partners:

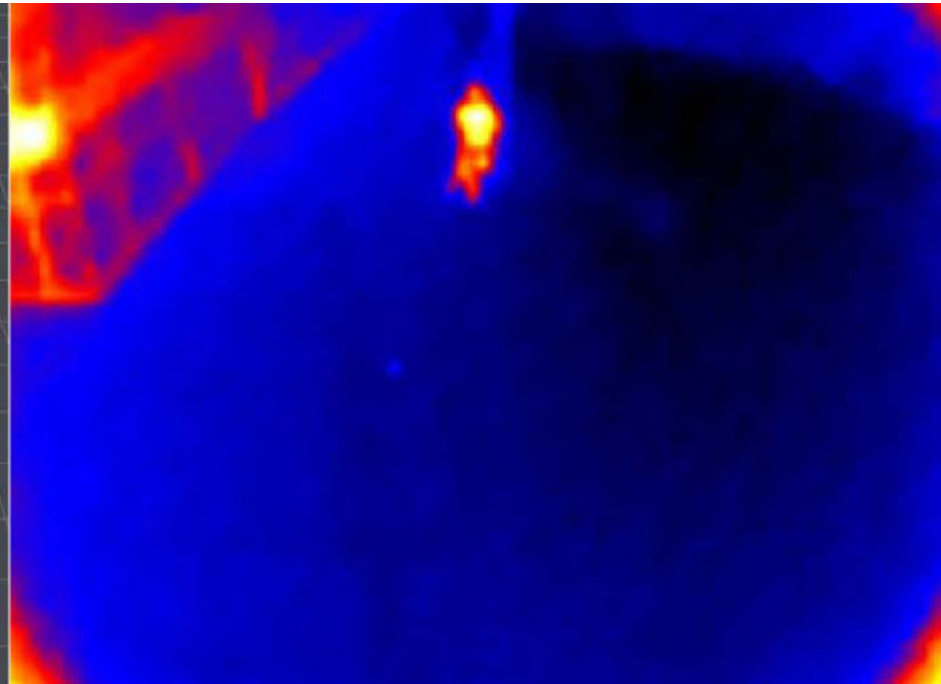
Research partners:

OST - Ostschweizer Fachhochschule

ADEC

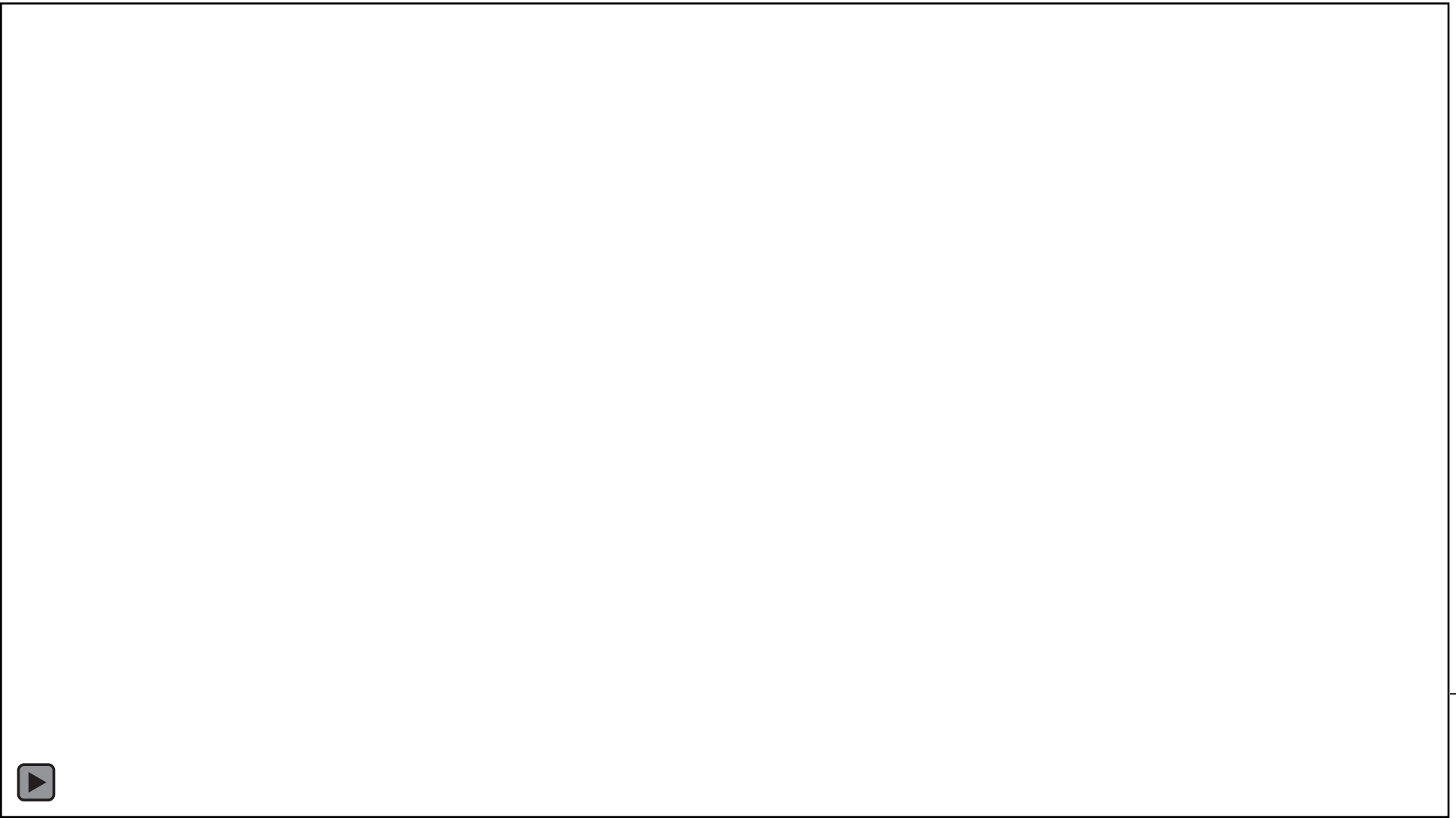






Executive functions training (EFT) system based on real-time computer vision (CV) and video projection (VP)

- **Lakers Sport AG**



- Joint project with Physiotherapy @ SG

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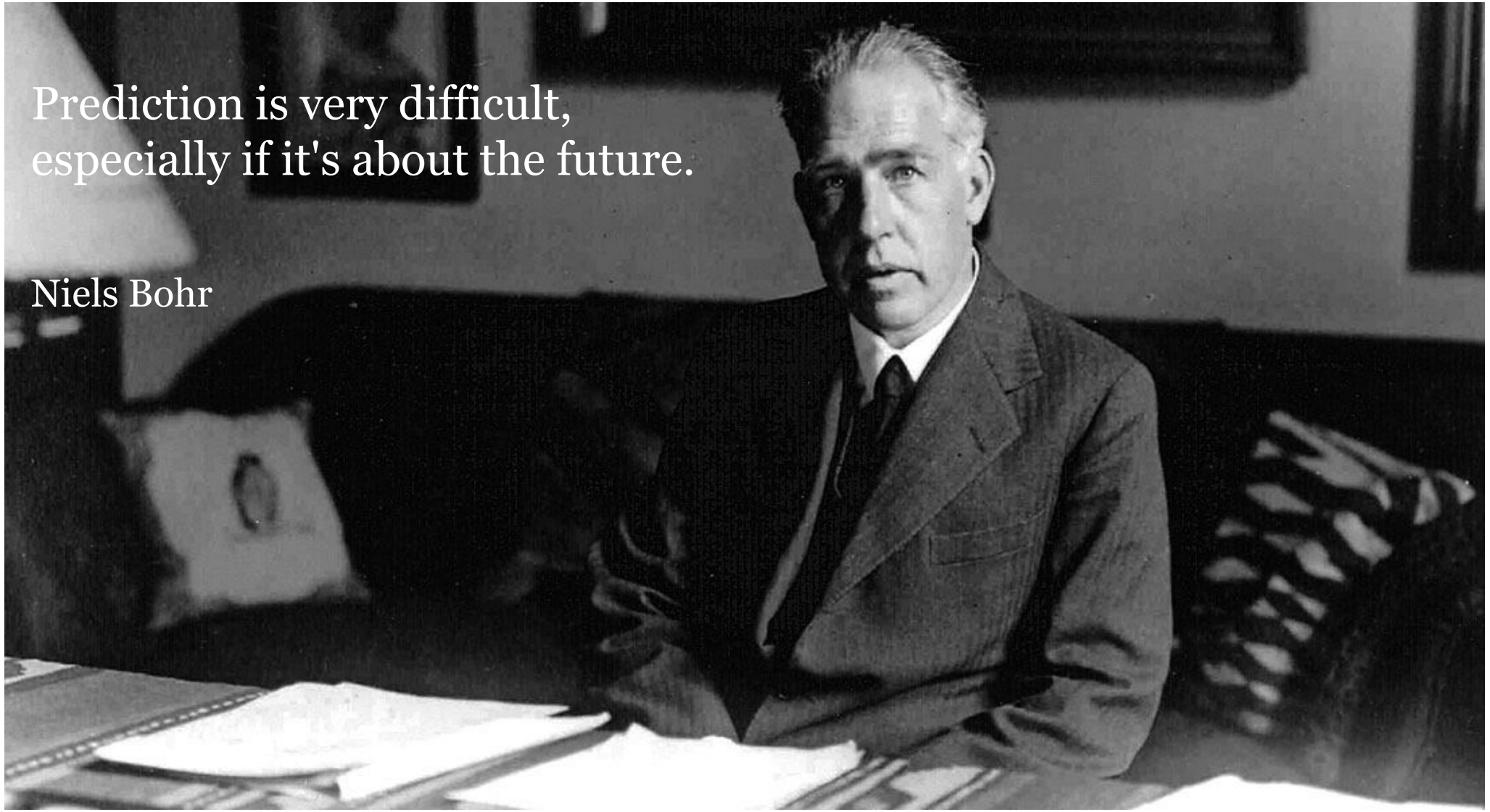
Quo Vadis?



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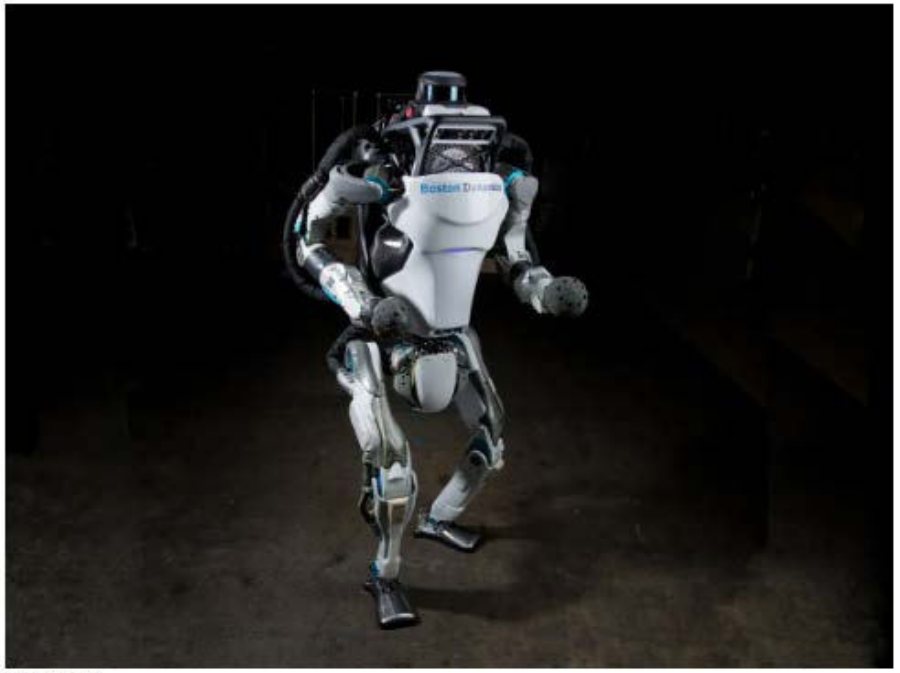
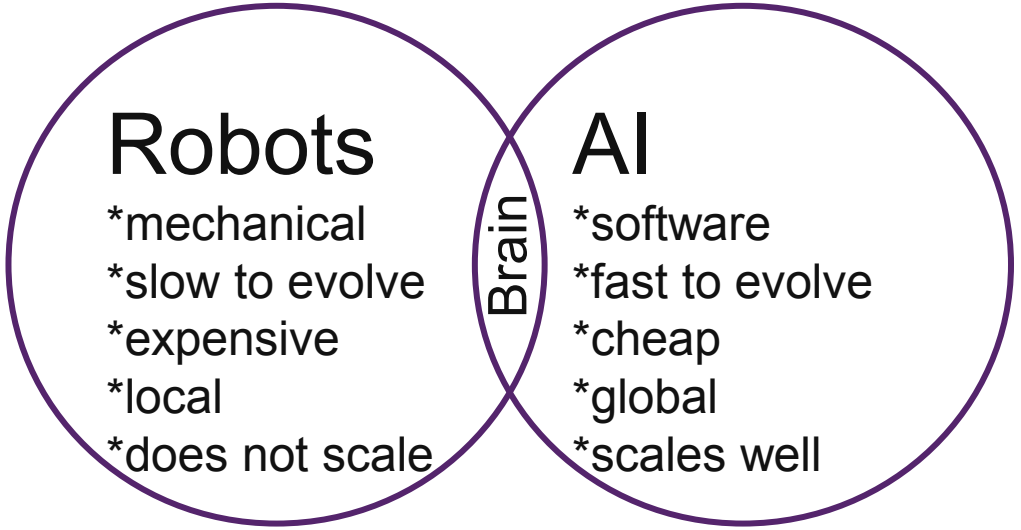
Robots and AI are very different fields!

Watch Boston Dynamics' Humanoid Robot Do Parkour

A new video of Atlas, the company's two-legged robot, shows off its agility as it bounds up a platform.



BOSTON DYNAMICS



THOUSANDS OF AI AUTHORS ON THE FUTURE OF AI

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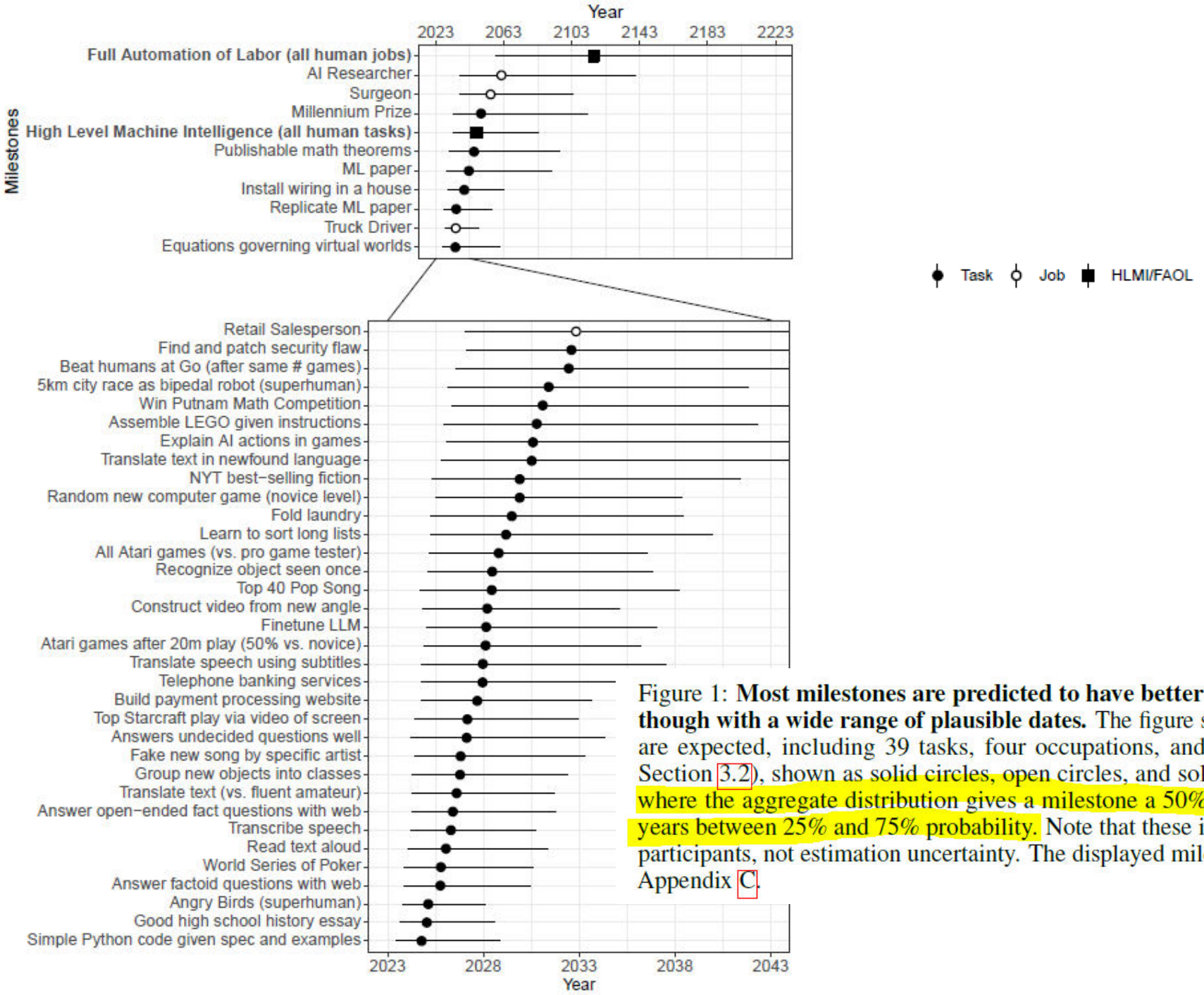

Figure 1: **Most milestones are predicted to have better than even odds of happening within the next ten years, though with a wide range of plausible dates.** The figure shows aggregate distributions over when selected milestones are expected, including 39 tasks, four occupations, and two measures of general human-level performance (see Section 3.2), shown as solid circles, open circles, and solid squares respectively. Circles/squares represent the year where the aggregate distribution gives a milestone a 50% chance of being met, and intervals represent the range of years between 25% and 75% probability. Note that these intervals represent an aggregate of uncertainty expressed by participants, not estimation uncertainty. The displayed milestone descriptions are summaries; for full descriptions, see Appendix C.

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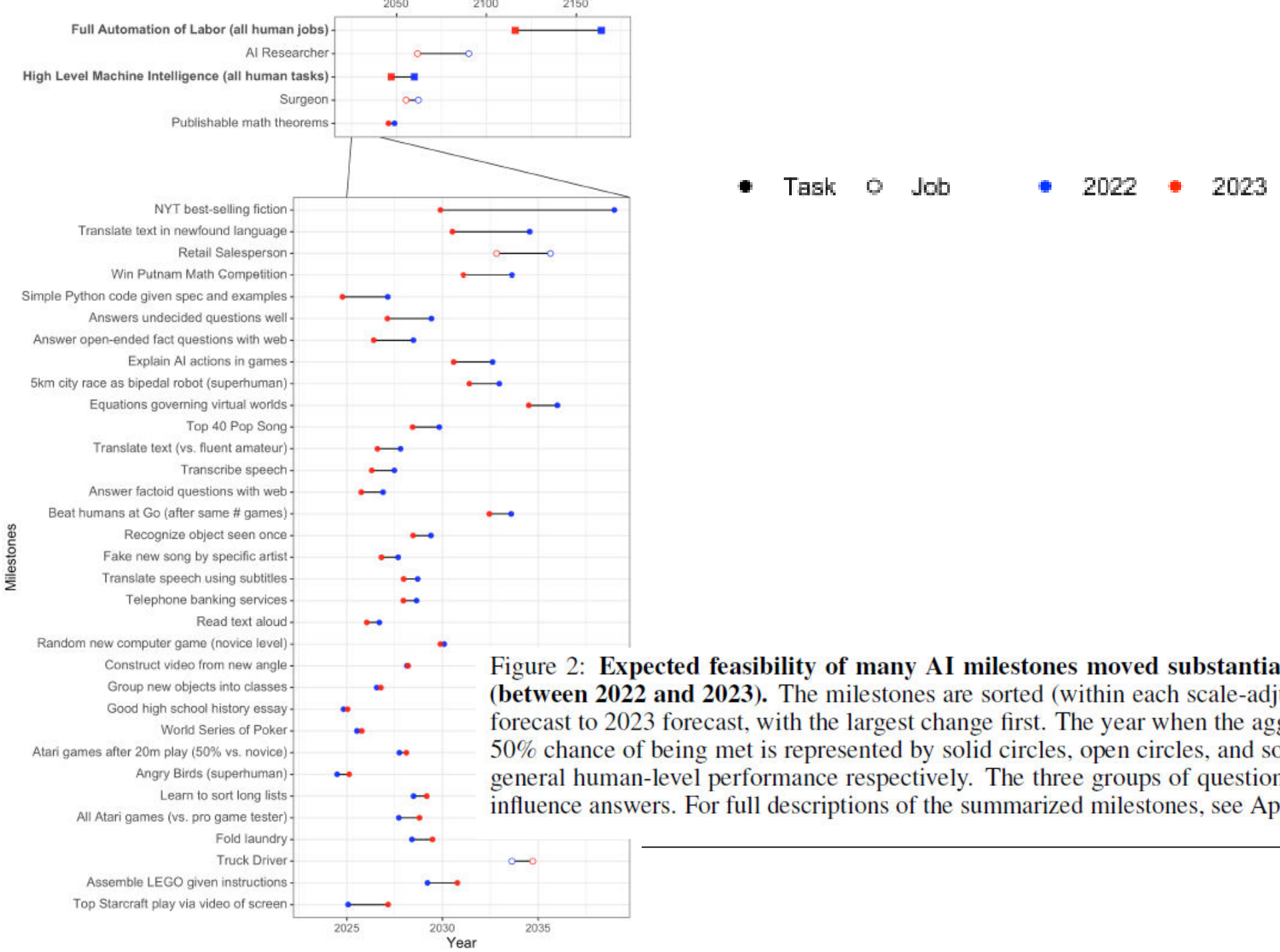


Figure 2: **Expected feasibility of many AI milestones moved substantially earlier in the course of one year (between 2022 and 2023).** The milestones are sorted (within each scale-adjusted chart) by size of drop from 2022 forecast to 2023 forecast, with the largest change first. The year when the aggregate distribution gives a milestone a 50% chance of being met is represented by solid circles, open circles, and solid squares for tasks, occupations, and general human-level performance respectively. The three groups of questions have different formats that may also influence answers. For full descriptions of the summarized milestones, see Appendix C.

Wir können Sie unterstützen!

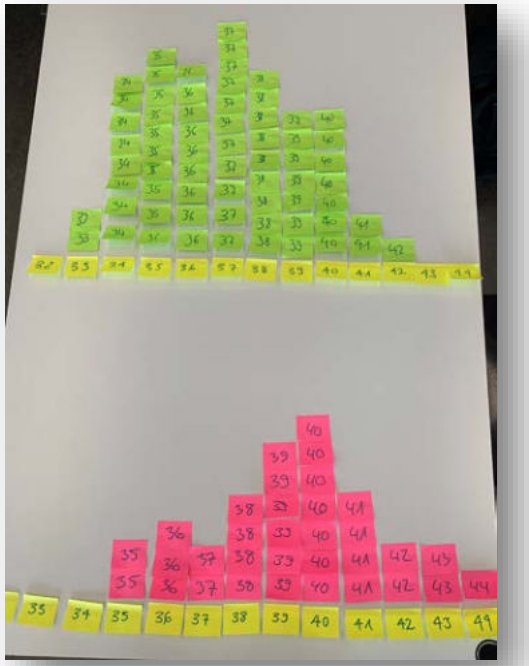
Angebot der OST

20. Februar 2024

OST
Ostschweizer
Fachhochschule

Angebot der OST

- CAS-Lehrgang AI
  - Start: September 2024
- Inhalt
  - **Solide AI-Grundlagen**
    - Innovatives didaktisches Konzept
  - **Harvard Business Review**
    - AI-Business Cases
  - **AI-Business Case entwickeln**
    - Mit Coaching von ICAI-Expert:innen



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CAS AI

CAS Artificial Intelligence (AI)

Artificial Intelligence verändert die Welt – der **CAS Artificial Intelligence (AI)** bietet Ihnen die Möglichkeit, von Anfang an ganz vorne mit dabei zu sein und Ihre Karriere voranzutreiben. Erwerben Sie Kompetenzen im Bereich der AI-Technologien, ohne höhere Mathematik- und Programmierkenntnisse zu haben.

Sie müssen keine Weltklasse-Mathematikerin und auch kein Weltklasse-Programmierer sein, um AI-Technologien zu verstehen und von diesen zu profitieren. Der **Zertifikatskurs (CAS) Artificial Intelligence (AI)** führt Sie in die Grundlagen der AI-Technologien ein. Unter anderem lernen Sie die klassischen Ansätze des maschinellen Lernens kennen, setzen sich mit künstlichen neuronalen Netzen sowie Deep Learning auseinander und erhalten Einblicke in das Reinforcement Learning.

Sie erwerben die Kompetenzen, in ihrem Unternehmen notwendige Veränderungen durch AI zu erkennen und einzuleiten. Zudem erfahren Sie, wie Sie Ihre Anspruchsgruppen auf dem Weg in die AI-Zukunft mitnehmen können. Im Rahmen dieses Kurses profitieren Sie von der Data Science Erfahrung des **Interdisciplinary Center for Artificial Intelligence (ICAI)** der OST – Ostschweizer Fachhochschule. Das ICAI-Team ist seit mehr als zwei Jahrzehnten erfolgreich in der AI-Forschung und AI-Lehre tätig.

Weitere Informationen

Weiterbildung an der OST: Einblick per Mausklick

Zu den nächsten Online-Infoanlässen

Nächste Durchführung

Nächster Start geplant im September 2024

Jetzt anmelden

Downloads

Terminplan

Auf einen Blick

Abschluss

Certificate of Advanced Studies CAS in Artificial Intelligence (AI) (12 ECTS-Punkte)

Schwerpunkte

- Harvard Business Review Perspektive der Künstlichen Intelligenz (AI)
- Grundlagen der fundamentalen AI-Technologien
- Unabhängiges AI-Gruppenprojekt

Nutzen

In diesem Zertifikatskurs lernen die Teilnehmenden, den Einfluss von AI auf die Wirtschaft und Gesellschaft zu verstehen. Sie haben Kenntnisse der fundamentalen AI-Technologien, erkennen neue AI-Möglichkeiten und können AI-Projekte entwickeln. Die Teilnehmenden erkennen die Veränderungen, die in einem Unternehmen aufgrund von AI notwendig werden und können solche Veränderungen einleiten.

Dauer

12 Präsenztage, berufsbegleitend

(Anzahl Präsenztage variiert je nach Lehr- und Lernform. Verbindlich ist der aktuelle Terminplan.)

Kosten

CHF 9900.– inkl. Unterlagen, Leistungsnachweisen und Zertifikat