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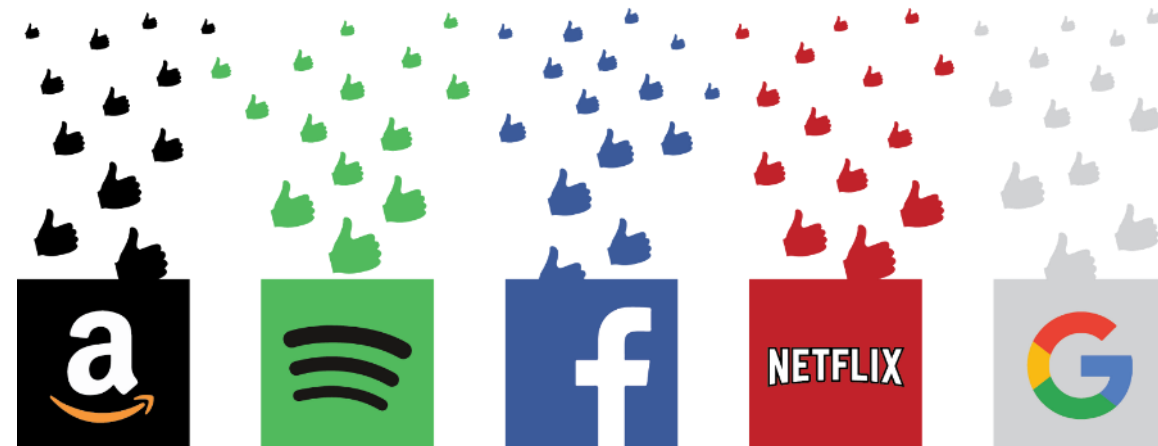


Artificial Intelligence for society

Idiap, 29.03.2023

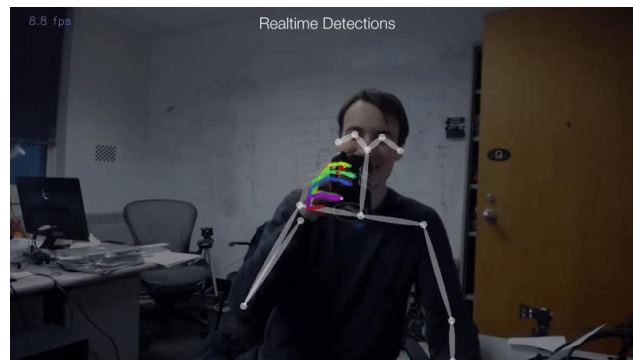
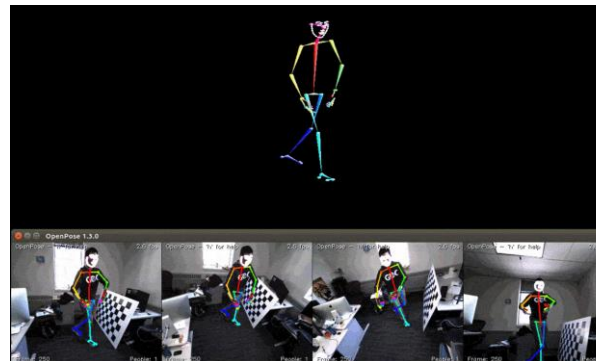
Dr Joël Dumoulin - Technology Transfer Officer – joel.dumoulin@idiap.ch

AI is part of our daily lives



Examples Body pose estimation

- Example: OPEN POSE (2016)
 - <https://github.com/CMU-Perceptual-Computing-Lab/openpose>



Examples

Large Language Models (LLM)

- **Example: GPT-3 (2020)**

- <https://github.com/openai/gpt-3>
- Autoregressive language model that uses deep learning to produce human-like text
- Developed by OpenAI
- 175 billion parameters
- An April 2022 review in The New York Times described GPT-3's capabilities as being able to write original prose with fluency equivalent to that of a human.

<https://www.nytimes.com/2022/04/15/magazine/ai-language.html>

Examples

Image generation

- DALLE-2 (2022)

- Developed by OpenAI, <https://openai.com/dall-e-2/>
- Advanced neural network based system
- Can generate creative, realistic visuals and art from a simple language description
- Can mix concepts, characteristics, and styles

- Other similar projects

- Midjourney, <https://www.midjourney.com/home/>
- Stable diffusion, <https://stability.ai/blog/stable-diffusion-public-release>

Examples

Image generation



<https://www.midjourney.com/showcase/>



«Spaceship,
painting by van Gogh»
*Joël Dumoulin,
via Midjourney*

An AI-generated artwork's state fair victory fuels arguments over 'what art is'



The AI-generated artwork entered by Jason Allen into the Colorado State Fair
Image: [Jason Allen via Discord](#)

<https://www.theverge.com/2022/9/1/23332684/ai-generated-artwork-wins-state-fair-competition-colorado>

/ 'I'm not going to apologize for it,' said the man who submitted the piece

By **JAMES VINCENT**

Sep 1, 2022, 6:23 PM GMT+2 | ☐ 0 Comments



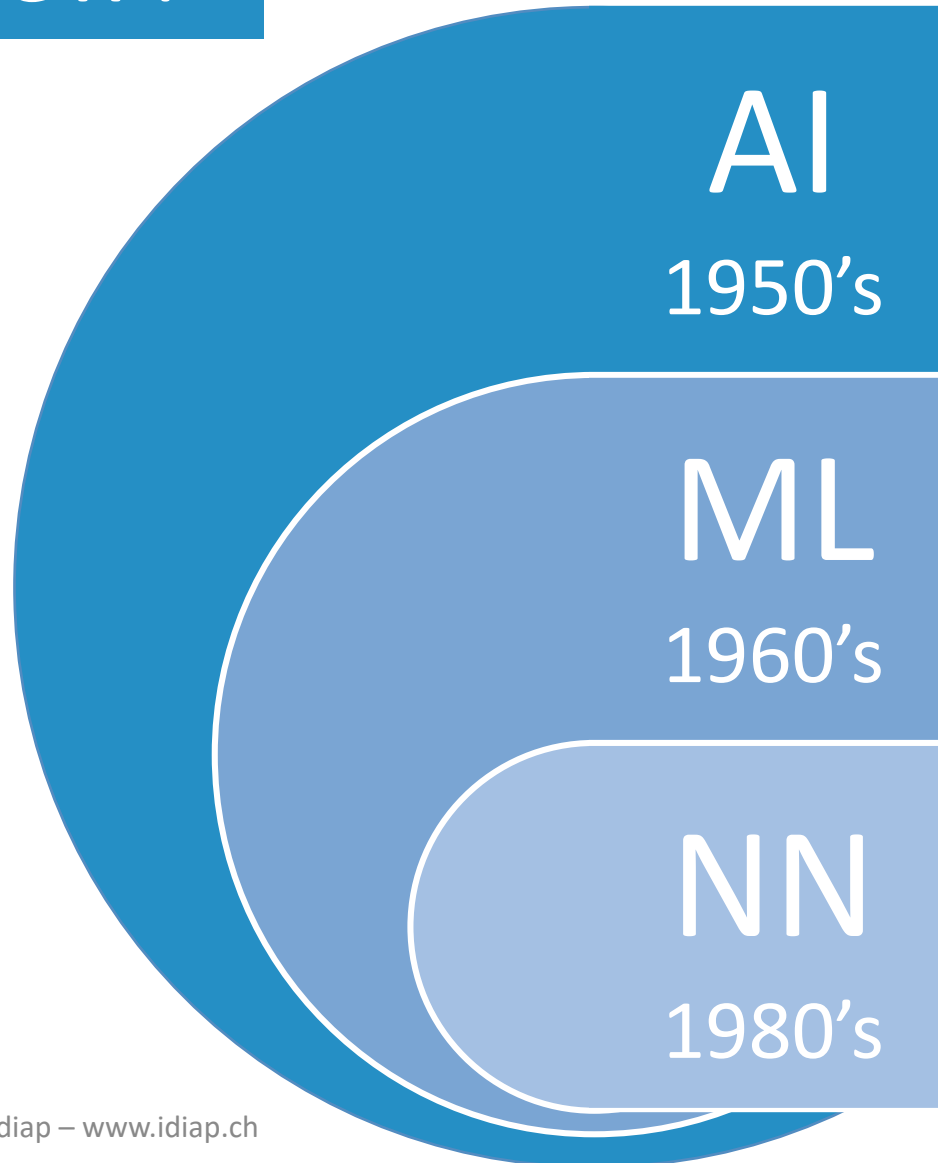
Why?

→ New opportunities !

*“In the **last five years**, the field of AI has made **major progress** in almost all its standard sub-areas, including **vision**, speech recognition and generation, natural **language** processing, image and video **generation**, multi-agent systems, planning, decision-making, and integration of vision and motor control for **robotics**.”* - *Stanford: One Hundred Year Study on AI*

<https://ai100.stanford.edu/2021-report/standing-questions-and-responses/sq2-what-are-most-important-advances-ai>

Is it new?



Making intelligent machines that have the ability to achieve goals like humans

Computer's ability to learn without being explicitly programmed

Brain inspired computation

Is it new?

25 years ago, Deep Blue's win was seen as symbolically significant, a sign that **artificial intelligence** was **catching up to human intelligence**, and could defeat one of humanity's great intellectual champions.

Deep Blue vs. Kasparov



Deep Blue
IBM chess computer

Garry Kasparov
World Chess Champion

First match

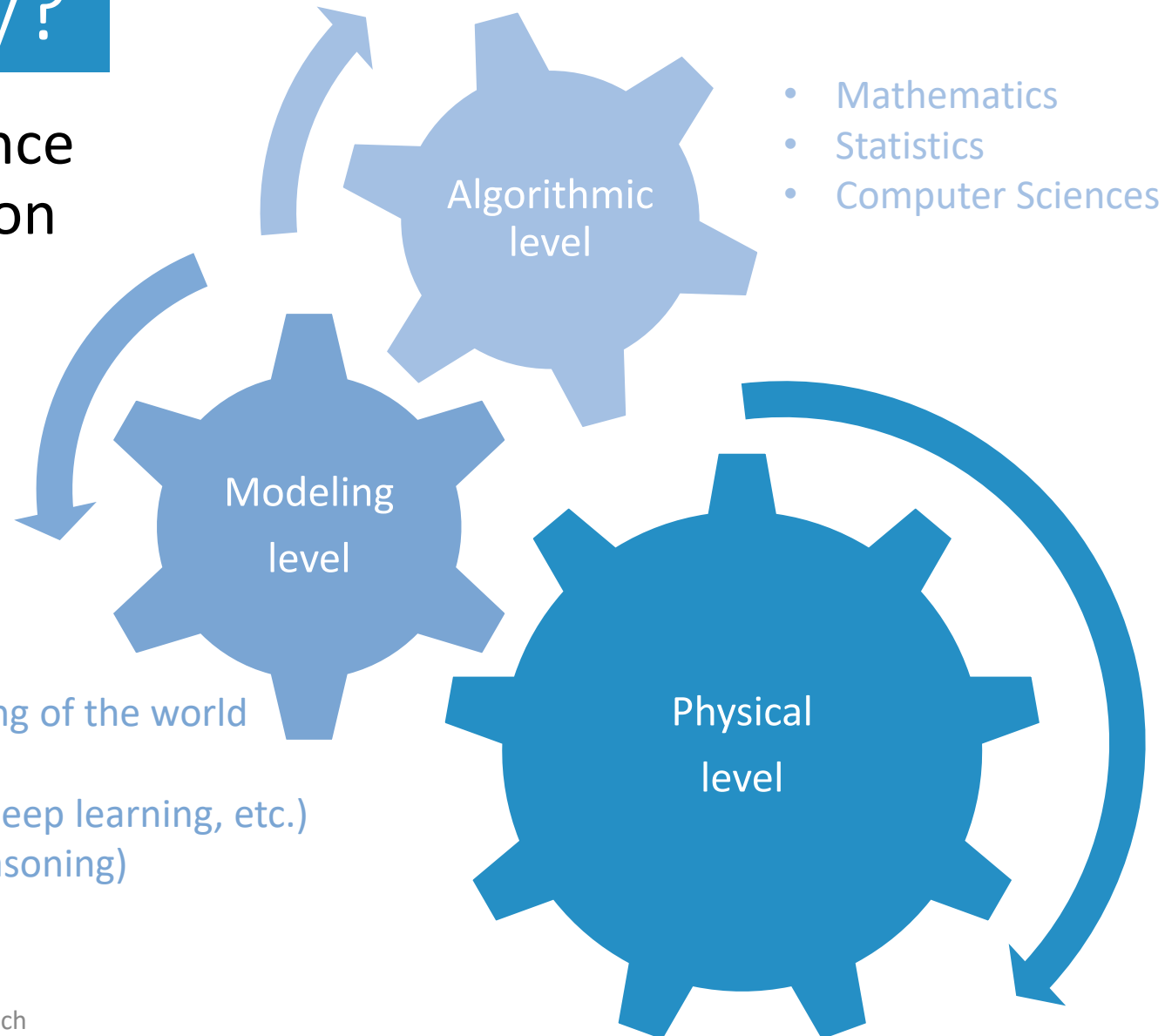
- February 10–17, 1996: held in Philadelphia, Pennsylvania
- Result: **Kasparov**–Deep Blue (4–2)
- Record set: First computer program to defeat a world champion in a *classical game* under tournament regulations

Second match (rematch)

- May 3–11, 1997: held in New York City, New York
- Result: **Deep Blue**–Kasparov (3½–2½)
- Record set: First computer program to defeat a world champion in a *match* under tournament regulations

Why today?

- Unique convergence of several trends on top of 50 years of research



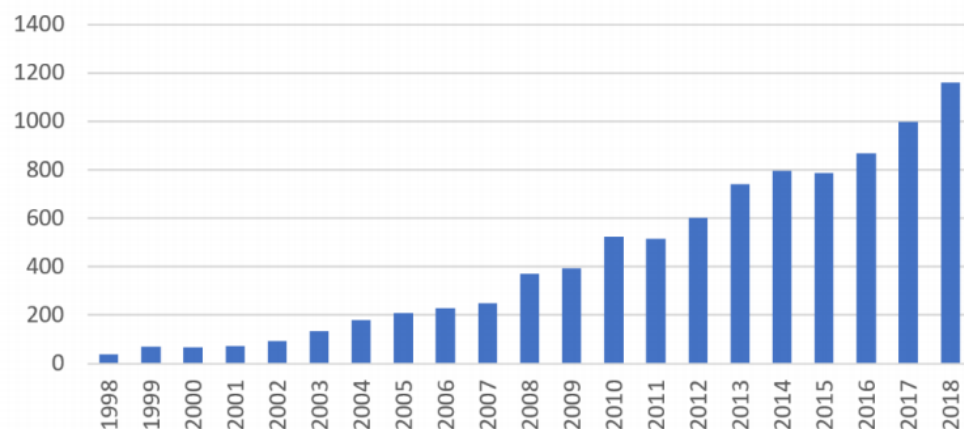
- Statistical modeling (modeling of the world variability)
- Artificial Neural Networks (Deep learning, etc.)
- Symbolic modeling (logic reasoning)

- Computational power (GPU)
- Storage capacities (big data, unstructured data, etc.)
- Data availability, Internet, social networks, etc.
- Involvement of big corporations

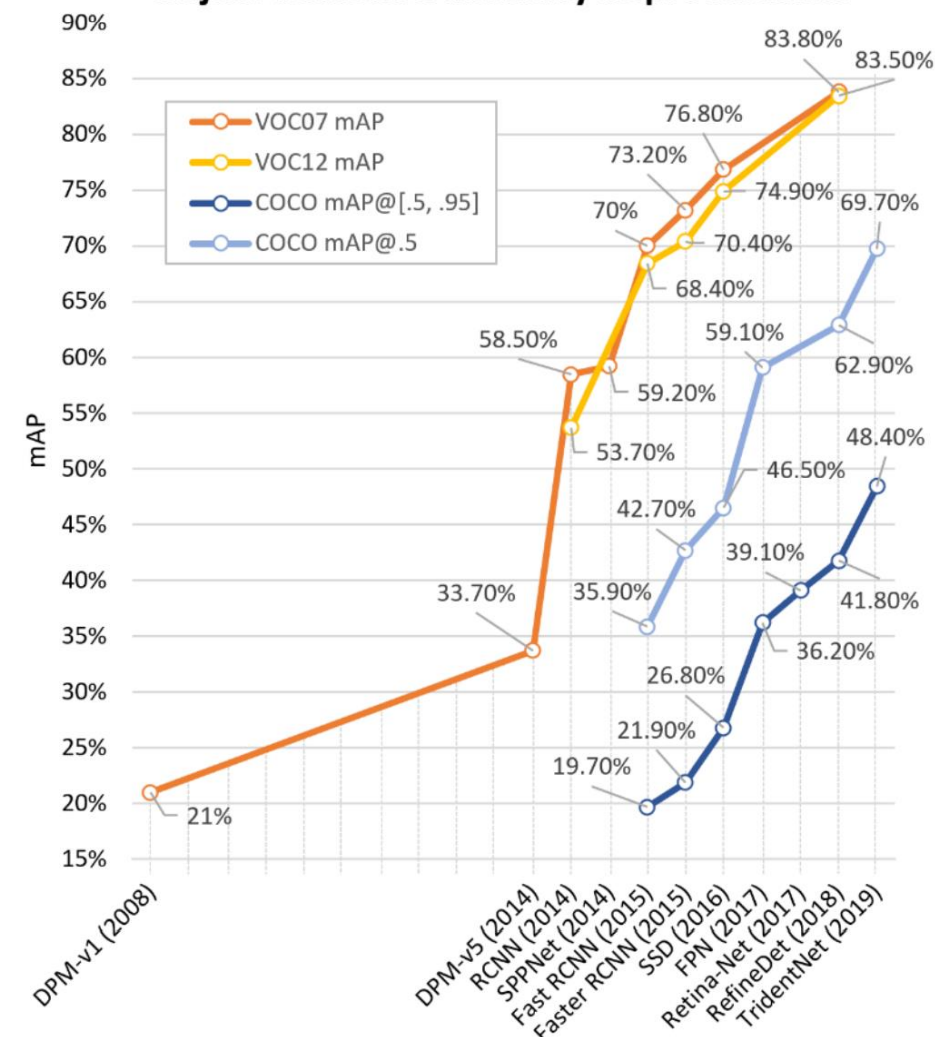
Example Object detection

Object Detection in 20 Years: A Survey Zhengxia Zou
and Zhenwei Shi and Yuhong Guo and Jieping Ye (2019)

Number of Publications in Object Detection



Object detection accuracy improvements



MS-COCO-17

164k images and 897k annotated objects from 80 categories

Challenges Cost / Energy consumption

Training compute (FLOPs) of milestone Machine Learning systems over time

n = 121



Challenges

Cost / Energy consumption

- CO2 impact

- “In a *2019* study, a group of researchers estimated that *training a single deep learning model* can generate up to 626,155 pounds of CO2 emissions—roughly equal to the *total lifetime carbon footprint of five cars*. As a point of comparison, the average American generates 36,156 pounds of CO2 emissions in a year.”

<https://www.forbes.com/sites/robtoews/2020/06/17/deep-learnings-climate-change-problem>

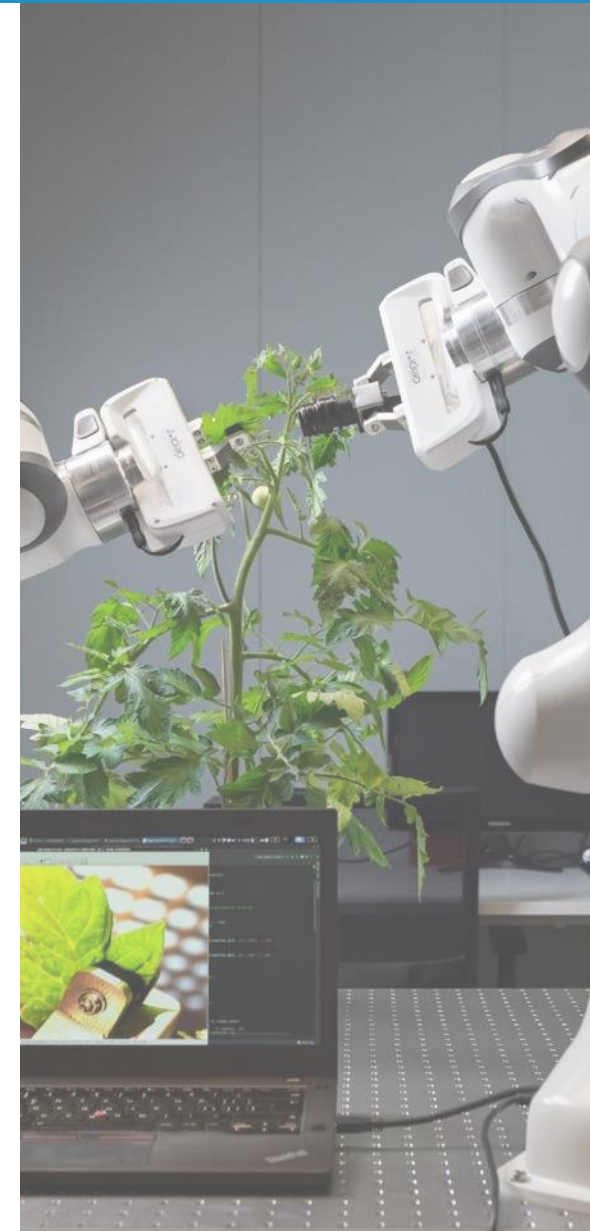
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- What would it cost you to train PaLM using cloud computing (and you're not Google)? Something around *\$9M to \$17M*.

<https://blog.heim.xyz/palm-training-cost/>

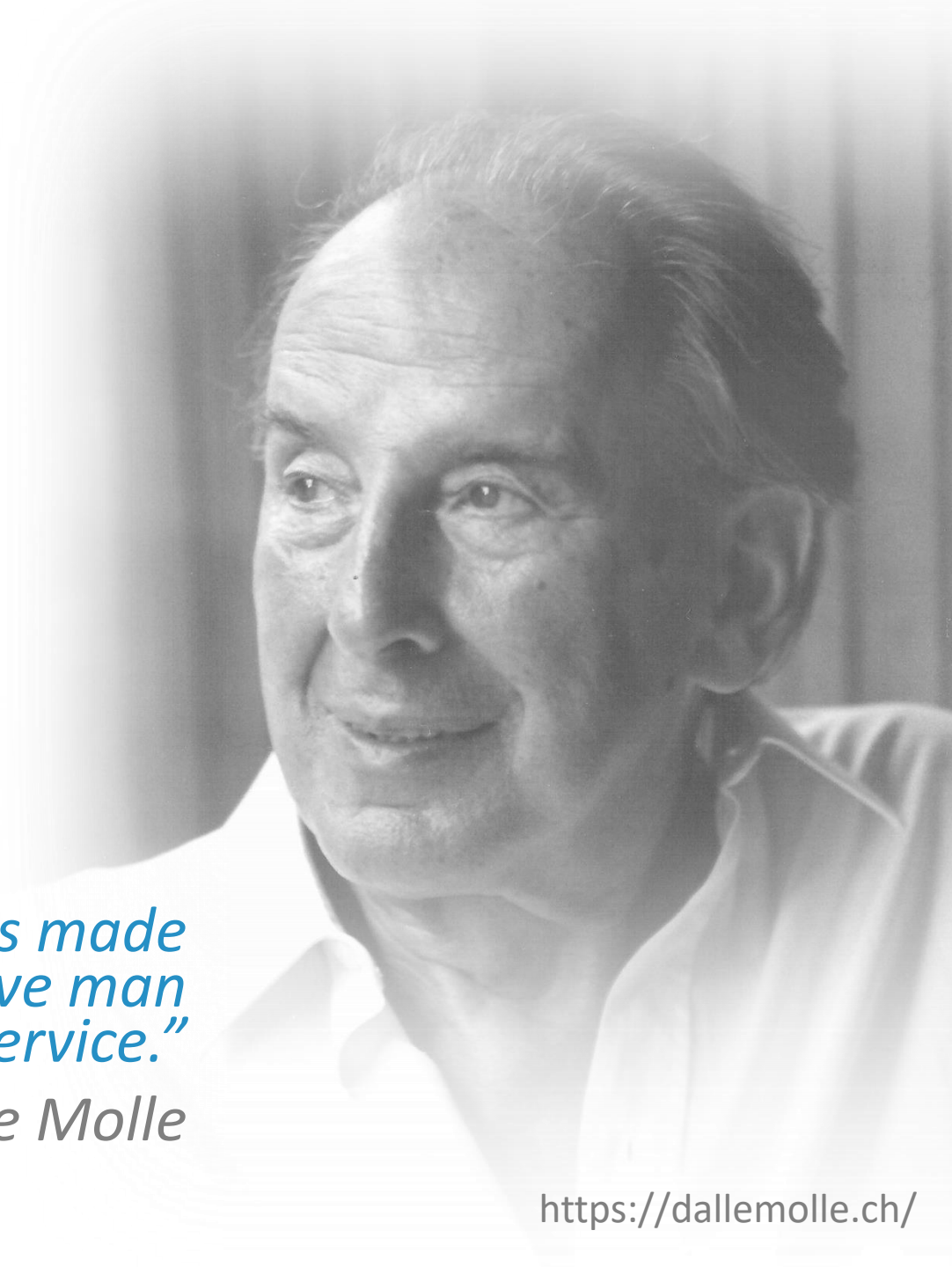


- Independent not-for-profit Research Foundation
- Created in Martigny, in 1991 by A. Dalle Molle
 - City of Martigny | State of Valais | EPFL | University of Geneva | Swisscom
 - IDIAP: Institut Dalle Molle d'**Intelligence Artificielle** Perceptive
- Funding: Public (< 50%) / Competitive (~ 40%) / Industry-based (~ 10%)
- Joint Development Plan with EPFL
- +170 employees, 33 nationalities, 50 PhD students
- 13 research groups covering a broad range of AI research areas
 - + 3 CRGs fostering interdisciplinary and industry oriented research
 - + a dedicated R&D engineers team to bridge the gap between academia and industry
- 3 highlights examples
 - Torch → PyTorch
 - Recapp + KeyLemon → voice search for the smart remote control of Swisscom TV
 - Swiss Biometrics Center → Fido alliance certification (among the first 3 labs in the world)



*“Scientific progress in general and progress made
in computing in particular should not enslave man
but, on the contrary, be at his service.”*

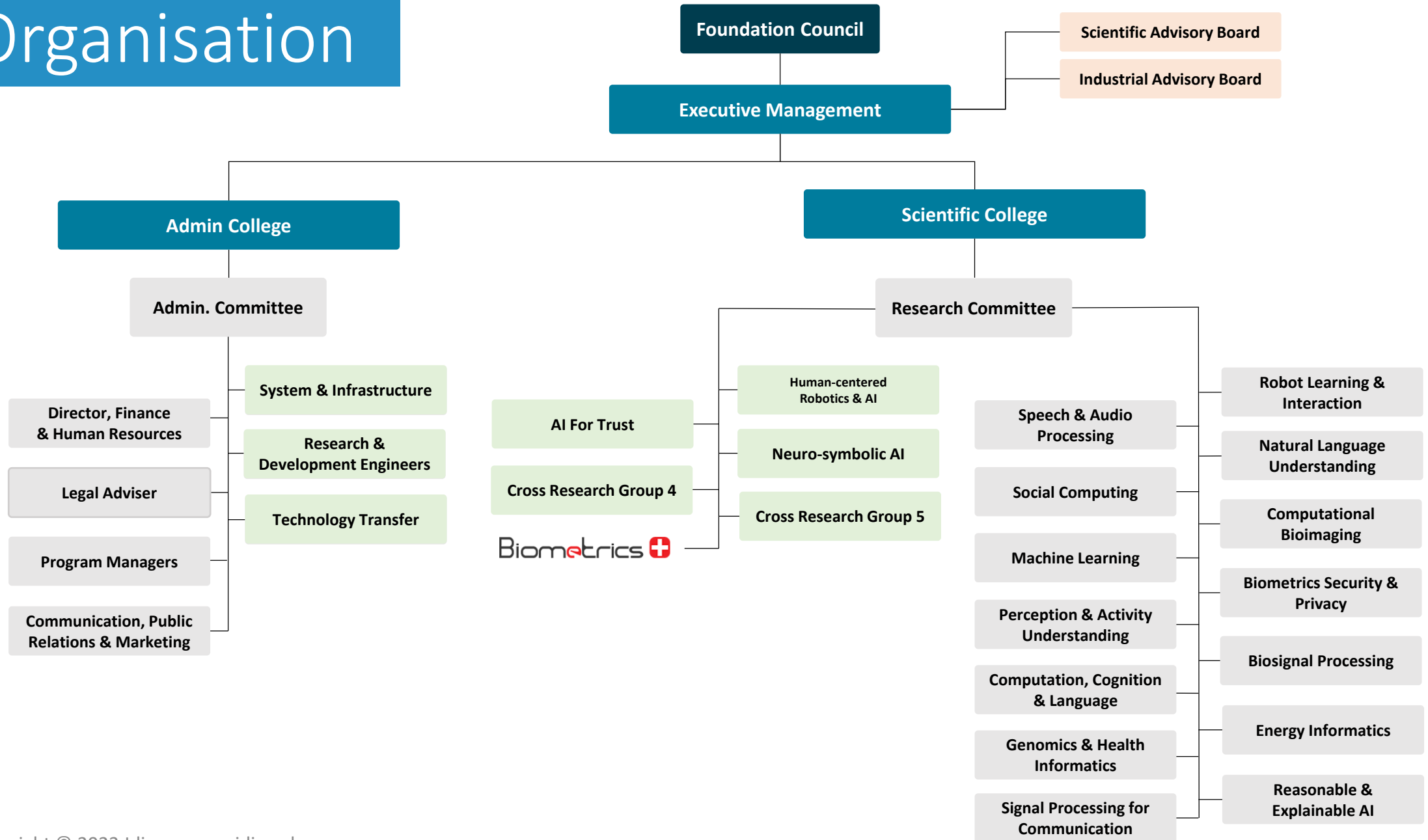
Angello Dalle Molle



Idiap recent activities examples

- Assisting robots for elderlies / disabled people
- Help to diagnose autism in children and accompany them
- Automatic sign language recognition technology
- Speech analysis for early detection of neurodegenerative diseases
- Classifying neurons for a better understanding of Stephen Hawking's disease
- Bias mitigation (fairness) and responsible datasets creation for biometrics purposes
- AI based simulation tool for district heating networks
- And many more exciting projects!

Organisation

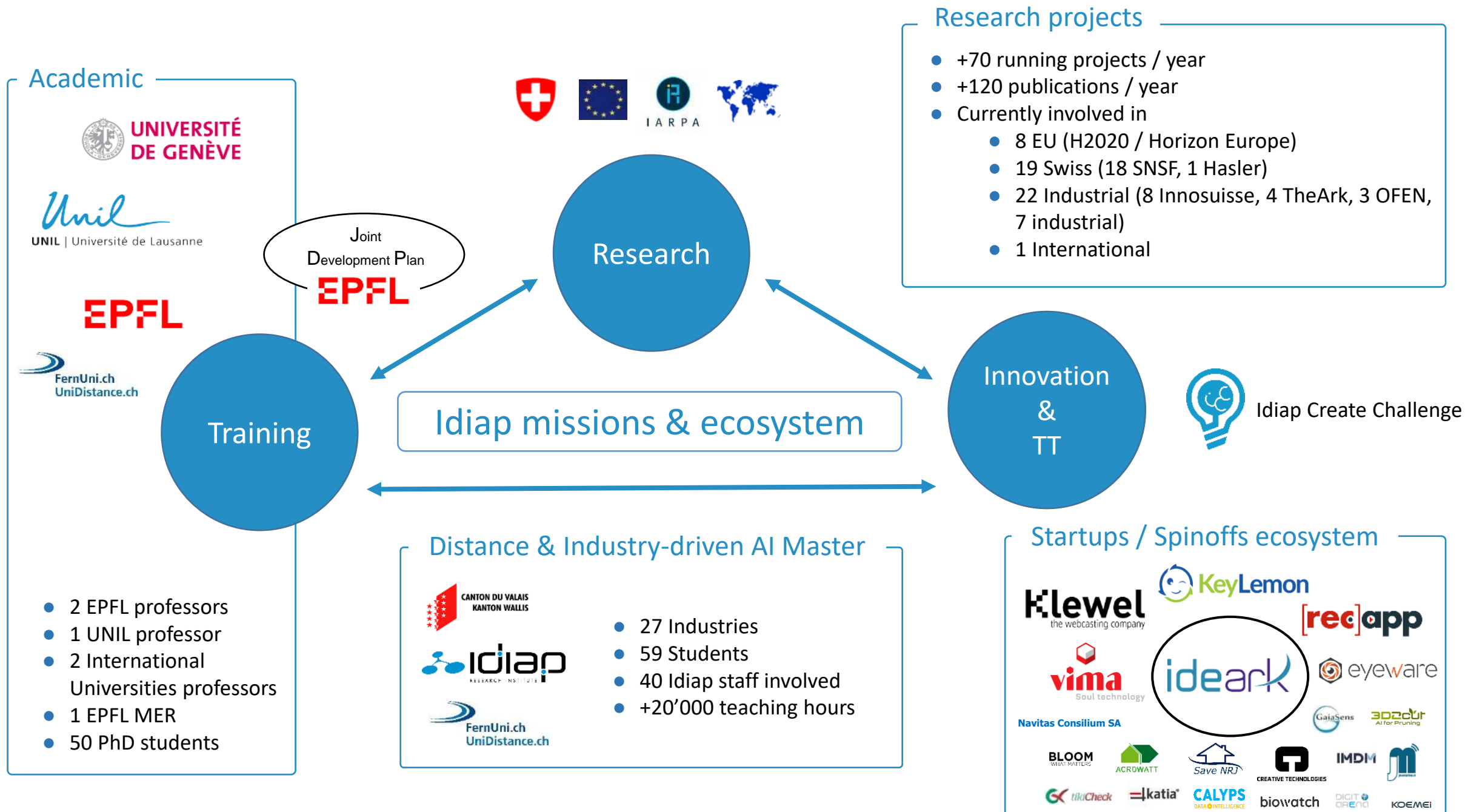


Research & Development engineers

- Main goal = bridge the gap between academia and industry
 - Internal support → development needs, software maintenance, open-sources software distribution
 - Academic projects → prototypes
 - Industrial projects → turning research results into industry requirements
- 17 people
 - Average of 9 years at Idiap
 - Mix between PhDs, Masters, Bachelors and Engineers
 - Involved in more than 100 projects since 2008
 - Worked more than 900 person months on projects since 2008

IT Infrastructure

- A server room in our premises with 12 racks, half of which are dedicated to scientific calculations
- A distributed computing system usable from all workstations which includes
 - 160 GPU compute nodes dedicated to computing
 - 330 CPU compute nodes dedicated to computing
- A storage space of more than 600TB used by researchers including
 - +800 research databases representing more than 120TB
- 640'000 hours of computation in 2022 (>72 years) divided into more than 8M different experiments
- In 2022 72% GPU / 28% CPU (tendency to replace the CPU by the GPU)

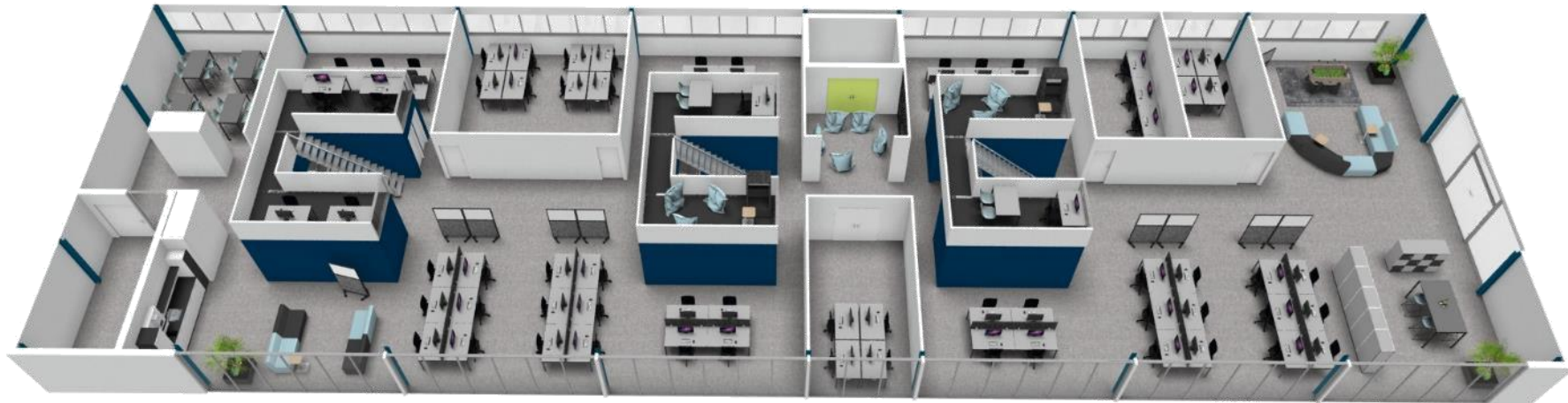


Tech Transfer in numbers

(January 2023)

- Meet with 50+ companies (1/4 from Valais) each year
- 160 industrial projects submitted since 2010
 - 18/year on average in the last 4 years
- 24 industrial projects currently active (+1/3 of all active projects)
 - 8 Innosuisse
 - 3 OFEN
 - 3 Armasuisse
 - 3 The Ark
 - 7 industrial
- 10 patents
 - 7 granted
 - 3 pending
- 10 Spin-offs

- IdeArk personalized services for start-ups and spinoffs
 - Incubator → 800m² space, coaching, networking, help to find funding
 - Accelerator → research institute network, technology valorisation, IP
 - Innovation → help to identify business opportunities
- 13 startups, 10 spinoffs





Idiap Create Challenge

<http://www.createchallenge.org/>

A 9-day AI SUPER HACKATHON to transform your ideas into prototypes!

- 12th Edition, 16-24 Aug 2023
- How it works?
 - 9 days immersive program
 - 8 teams selected
 - Networking, office space, experts, lectures, teaching and more
 - You just need motivation, creativity, team spirit, innovation skill
- Awards by Ideark and Idiap



Public funding

- European fundings
 - Horizon Europe
 - EUREKA
- National fundings
 - SNSF
 - Innosuisse
 - OFEN
 - Hasler Stiftung
- Cantonal fundings
 - The Ark



HASLERSTIFTUNG



Industrial collaboration opportunities

- Public funding (The Ark, Innosuisse, OFEN, EU)
- Research Mandate
- PhD thesis sponsorship
- Framework agreement
- Master AI
- Gifts for Research
- Sponsoring
- CITER Affiliation

Innosuisse projects

«Leverage your innovation»



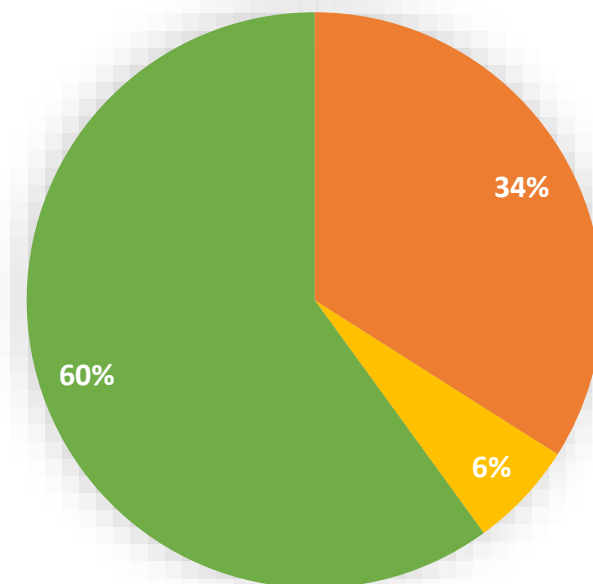
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Innosuisse – Swiss Innovation Agency

- Supports science-based innovation projects
 - Carried out by companies (particularly SMEs), working with research institutions.
- Your project must
 - Meet a market need
 - Provide economic benefits or create social value
- How?
 - Innosuisse covers research partner's salary (between 40% to 60%)
 - Company matches the remaining part of the budget
 - At least 10% of Innosuisse's funding in cash

Budget



Company contribution

Company cash contribution

Innosuisse funding

- Focus first on the problems you want to solve
 - You know your business better than anyone
- Then talk with specialists
 - They will need you as much as you will need them
- Do not underestimate the time for achieving results
 - AI.EXE does not exist!
 - Go step by step
- Internalize AI competencies
 - Improve projects life cycle

You want to develop your activities in artificial intelligence...

... but you don't know where to begin ?

YOU LACK OR NEED

EXPERT GUIDANCE



KNOW-HOW



SKILLED EMPLOYEES





+2300

Students

+400 Employees

5

Faculties

Masters

6

9

Bachelors



+70

Running research
projects /year

+170

Employees

16

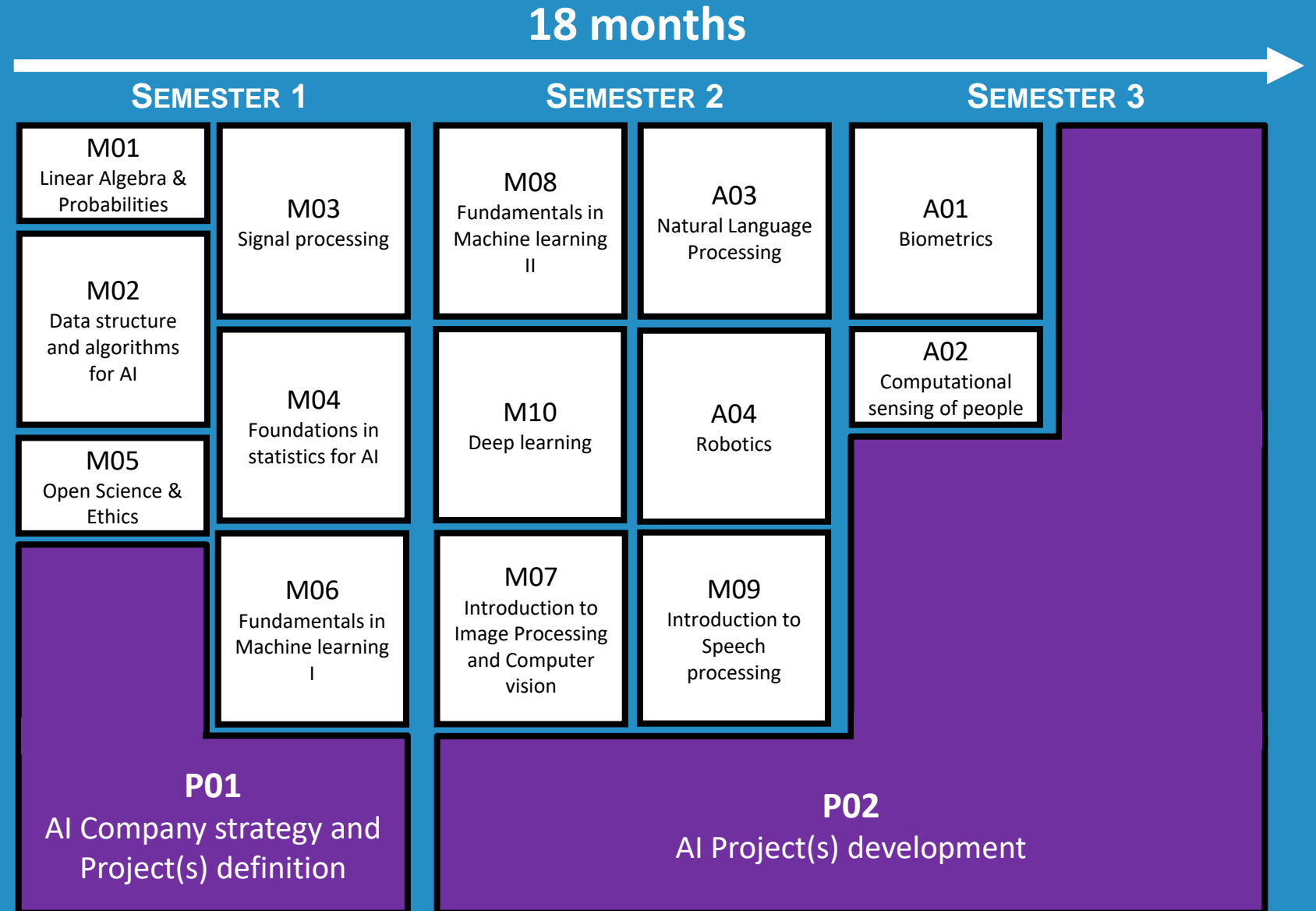
Research groups

33 Nationalities

+120

Publications /year

Program



Use case

MACHINERY
SERVICES
PACKAGING
COATING
INSPECTION



“Artificial intelligence helps our production plant to be even more competitive”

Jacques Thomasset, R&D director

- Who

- Swiss SME, world leading supplier of equipment offering innovative laminate and seamless plastic tube packaging production solutions

- Problem

- Aesthetic control of welding on laminated products

- Results

- Solution easy and quick to integrate
- Detecting all kinds of manufacturing defects
- Learning on few samples

Use case



"Today, the pharmaceutical industry has difficulty meeting the demand of hospitals. Making our drug supply more reliable thanks to AI certainly increases our competitiveness, but it also solves a public health problem."



Christophe Martin, Quality Director, Merck Serono

- Who

- International group with +60k employees across 66 countries active in sectors like healthcare, life sciences and electronics

- Problem

- Assessing the severity of a manufacturing incident in a medicine production unit

- Key figures

- 18 months to develop this project
- CHF 80'000 invested in the project
- 15'000 hours/year saved by the quality unit thanks to this AI solution

Discover what they say and more on <https://www.master-ai.ch/>



This initiative is exactly what the economy needs, not only given the shortage of skilled labor, but also the pace of technological change.

Dr. Sara Carnazzi Weber

Head of Swiss Sector and Regional Analysis, [Credit Suisse](#)



Artificial intelligence helps our production plant to be even more competitive. Thanks to this program, we are implementing a visual recognition project to inspect our products quality.

Jacques Thomasset

R&D director, [AISA Automation Industrielle SA](#)



I put the masters courses into practice as part of a project using machine learning to detect side effects during treatment for latent tuberculosis.

Colombine Verzat

Student, Master in AI

Take home message

"Idiap, a one-stop shop for artificial intelligence"

Excellence: +30 years of experience in AI

Flexibility: many ways to collaborate

Tailor-made: Master AI supporting industries



Visit us!

- Exhibition at the museum “Musée de la main” (Lausanne)

- Get your portrait drawn by a robotic arm
- Can you train an AI system?
- Play with facial recognition
- Will AI recognize your air guitar style?
- And more!

<https://www.museedelamain.ch>





Q&A

Thanks for your attention