30 YEARS idiap
RESEARCH INSTITUTE

ANNUAL REPORT 2021

Idiap thanks

the authorities and its founding members

AVEC LE SOUTIEN
DE LA **VILLE DE**
MARTIGNY

CANTON DU VALAIS
KANTON WALLIS

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'économie,
de la formation et de la recherche DEFR
Secrétariat d'Etat à la formation,
à la recherche et à l'innovation SEFRI

www.martigny.ch

www.vs.ch

www.sbfi.admin.ch

Fondation
Dalle Molle
Pour la qualité de la vie

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www.dallemolle.ch

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as well as its partners for their support

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Swiss Confederation

Innosuisse – Swiss Innovation Agency

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UniDistance.ch

www.innosuisse.ch

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"Idiap's development promises a bright future for the region"

Anne-Laure Couchepin Vouilloz
President of the Foundation Council

Thirty years ago, artificial intelligence's various applications resembled science fiction. Today, Idiap not only contributes to standards for these technologies, it also participates in their transmission to the economy, both local and international.

Idiap's thirtieth anniversary, which we celebrated in 2021, allowed the Institute to welcome a broad public and to showcase its research in an interactive manner, but also to organize—in partnership with the Dalle Molle Foundation—an international scientific conference. The occasion of these celebrations also gave Martigny photographer Claude Dussez the opportunity to take a more personal look at the Institute through a series of portraits of its staff. A sample of these black-and-white portraits, which provide a unique perspective on the people who put artificial intelligence at the service of society, appear in this report, and can also be admired at the Institute in an exhibition open to the general public.

Having taken over the presidency of the Idiap Research Institute's Foundation, and also as president of the city of Martigny, I am proud to see the extent to which the Institute contributes to the standing of both this region and of research. This accomplishment illustrates the need for structures outside of major centers—in direct contact with the needs of the economy and of society. The strong support afforded to Idiap's work by the federal and cantonal authorities is further proof of the logic and the necessity of this approach.

The growth predicted for the next few years will have to be accompanied by reflections regarding, in particular, the growing need for office space and for computing power. At the same time, the notion of sustainable development should obviously also be addressed. Beyond the question of their technical capacity, could the necessary infrastructures be shared to the benefit of others? And is it possible to recover and reuse heat from the computation infrastructure? Many such questions are already being considered.

Idiap has always been an essential part of the story of Martigny. The current development trajectory of the Institute promises an even more encouraging future. Which is why I am particularly pleased to be part of this next chapter in that story.

I wish you a pleasant read, as you discover this vision of the future.

"From experience, one has to see far, and set oneself the most difficult of challenges"

Hervé Bourlard
Director, Idiap

E ven though 2021 saw us celebrating our thirtieth anniversary, the year remained resolutely focused on the future, and on its challenges. Our research program for the period 2021-24 is ambitious, as society has the right to expect from an institute financed largely by public funds. This demand for quality research that meets the needs of society has its challenges—research moves slowly, and makes mistakes—but also its opportunities.

As we pursue our development, in addition to strengthening our fundamental research teams we are setting up transverse research groups. Their goal is to implement multidisciplinary projects that respond in a more targeted, efficient manner to current expectations with regard to the application of artificial intelligence.

Despite our fourteen highly effective research groups and the increasingly interdisciplinary nature of our researchers, integrating the kind of tools we develop remains a challenge well known in academia. To achieve that integration, and to respond effectively to society's needs, we need people who can be counted on to maintain a vital overview while at the same time developing their own areas of research. Finding

these people is no easy task. But of the four transverse research groups envisaged, we hope to have the first two in place by the end of this year.

From experience, one has to see far, and set oneself the most difficult of challenges if one is to stay a step ahead in research and anticipate the needs of industry. In its 30 years of existence, this approach has enabled Idiap to become an essential player in the international artificial intelligence field. As I pen this, my last message as director of the Institute, I would like to thank all the teams who have shared this vision of excellence and placed their trust in me during my 25 years as its head. I am confident in our teams' ability to maintain this pioneering spirit.

This annual report presents a summary of this spirit and of our vision. I hope it will inspire you to participate in future developments in artificial intelligence.

overview

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Thoughts on the Institute

Sébastien Marcel
Head of the Biometric Security
& Privacy research group

"My career at Idiap has allowed me to establish a standard."

Thanks to a long-term open source strategy, in his more than 20 years at Idiap Marcel has made transparency and reproducibility the norm in the traditionally rather discreet domain of biometrics.
→ *More on page 26.*

Lonneke van der Plas
Head of the Computation, Cognition &
Language research group

"My nomination as a professor by the University of Malta strengthens common interests with regard to technologies that serve languages that are traditionally low on research resources, such as Maltese or Swiss German."

The first female professor at Idiap, van der Plas furthers the Institute's tradition of research that serves society. This particular focus is also evident in her colleagues' project to transcribe Swiss German dialects.
→ *More on page 30.*

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Mattéo Oggier
Apprentice at Idiap

"I'd like to pass the Swiss secondary school diploma. And why not come back to Idiap, because enjoy working here."

Inspired by the Swiss apprenticeship system to create its applied Master's in Artificial Intelligence, the Institute has also decided to train apprentices in the traditional manner.
→ *More on page 36.*

Idiap, at a glance

Idiap's missions

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                    ┌─────────────────────────────────┐
                    │    Idiap Research Institute      │
                    └─────────────────────────────────┘
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Research	Innovation	Education

Research groups	Cross research groups

Research & development engineers

Research partners

Swiss National Science Foundation

HASLERSTIFTUNG

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Technology transfer & industrial relations

Innosuisse

ideark

the ark
www.theark.ch

Biometrics

cem

Public institutions & NGOs

Private companies

Applied Master in IA | T-Tech Fondation
AI Venture SA

Teaching

EPFL

UNIVERSITÉ DE GENÈVE

Unil
UNIL | Université de Lausanne

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34 nationalities are represented at Idiap

Stateless
5 robots

Switzerland
39%

Europe
27%

Asia
18%

Middle East
8%

Americas
6%

Africa
2%
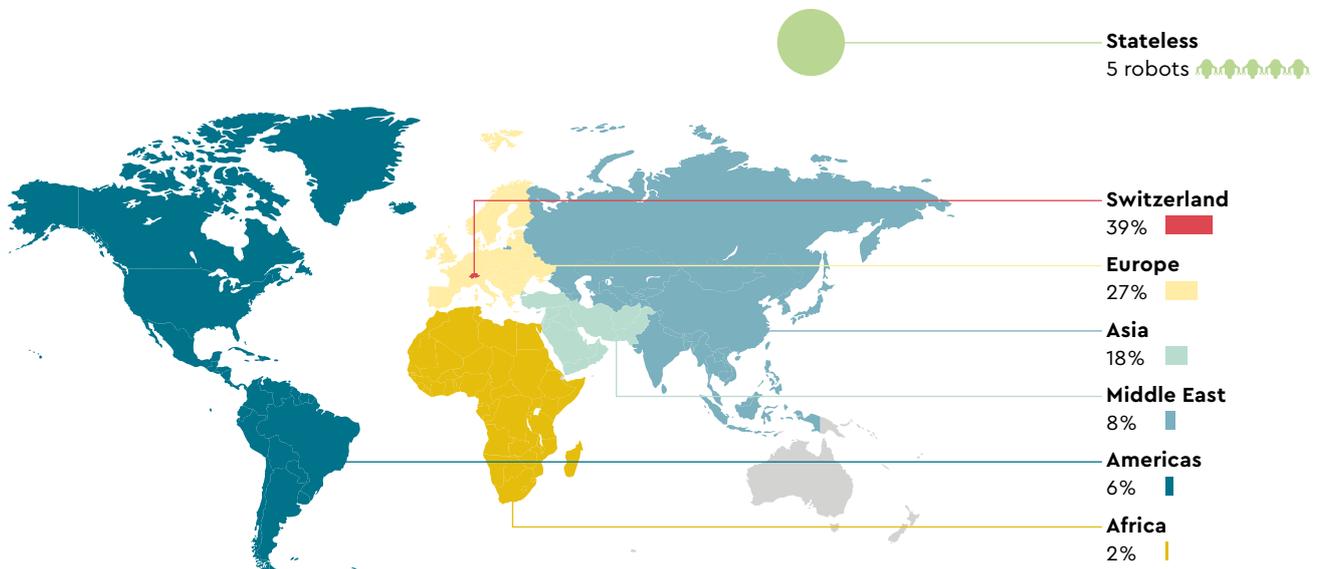
Human resources
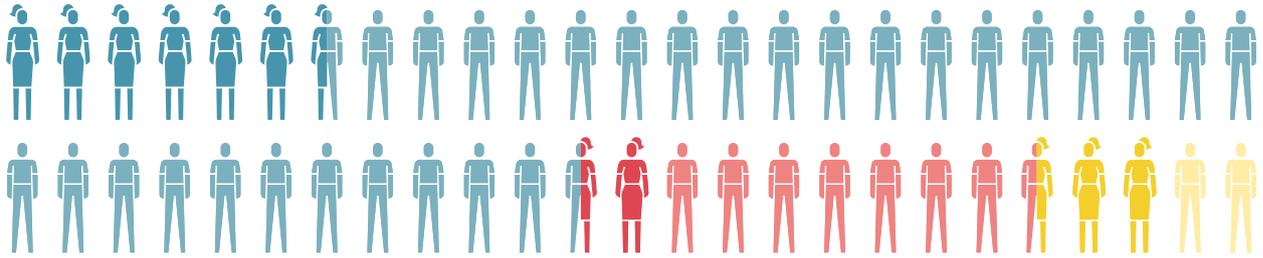
153 individuals in total and more than **50** posts in the start-up ecosystem

🔵 **Scientific staff**

- **18** permanent professors/ researchers
- **58** research assistants
- **24** postdocs
- **1** trainees/visitors
- **7** students

17.6% women
82.4% men

🔴 **Engineers & technical staff**

- **16** R&D engineers
- **11** system collaborators
- **4** technical assistants/students

14.8% women
85.2% men

🟡 **Administrative staff**

- **14** collaborators

57.1% women
42.9% men
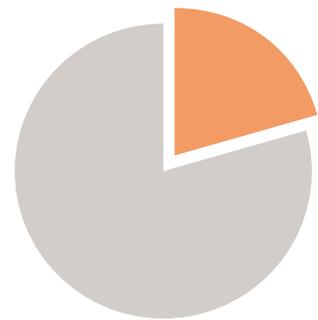
20.8% of Idiap employees are women, **79.2%** are men

Publications and patents in 2021

Contributions to 169 peer-review publications

106
conference articles

8
theses completed

53
scientific articles

6
patents recognized

2
book chapters

2
further patents filed

5,311
LinkedIn followers
↗ 22% in 2021

1,848
Twitter followers
↗ 16% in 2021

2,200
visitors, including **1,000** for Idiap's 30th anniversary

Financing

2% other

52% research projects

46% public funds
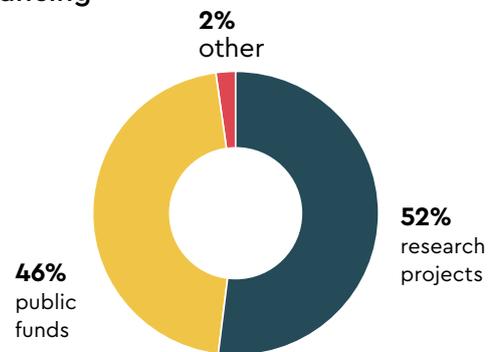
Submission and financing of research projects in 2021

70 projects submitted in 2021	82 active projects in 2021
EU 22, CH 27, IND 17, INT 4	EU 14, CH 28, IND 37, INT 3
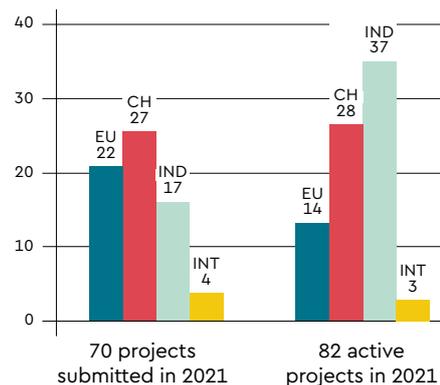
CH: Switzerland   EU: European Union   IND: Industrial   INT: International

organization

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Governance structure

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                          ┌──────────────────┐
                          │ Foundation Council│
                          └──────────────────┘
┌──────────────┐                                    ┌──────────────┐
│   Industry   │                                    │  Scientific  │
│Advisory Board│                                    │Advisory Board│
└──────────────┘         ┌──────────────┐           └──────────────┘
                         │  Executive   │
                         │  management  │
                         └──────────────┘
┌──────────────────┐   ┌────────────┐  ┌───────────────┐  ┌──────────────┐
│Diversity Promotion│  │Admin College│ │Scientific     │  │Data & Research│
│    Committee      │  └────────────┘  │College        │  │Ethics Committee│
└──────────────────┘                   └───────────────┘  └──────────────┘
                       ┌────────────┐  ┌───────────────┐  ┌──────────────┐
                       │Support     │  │Cross Research │  │Research      │
                       │Services    │  │Groups Committee│  │Groups Committee│
                       └────────────┘  └───────────────┘  └──────────────┘
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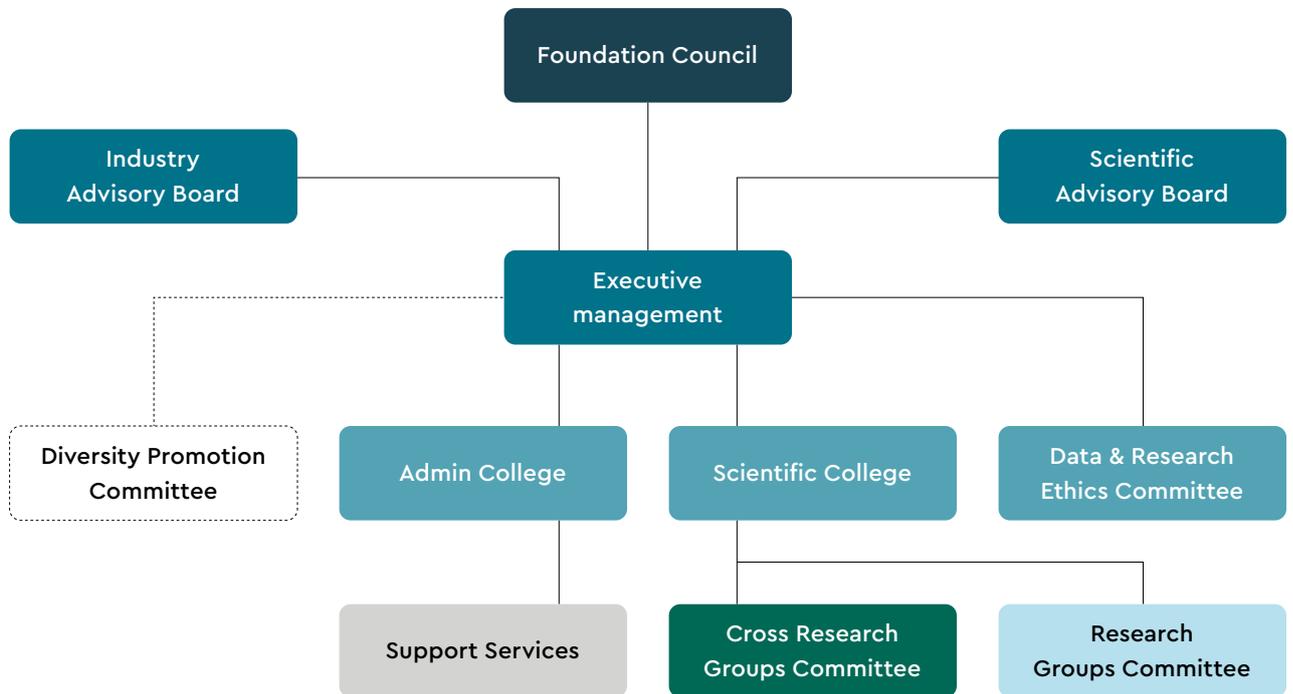
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Operational management

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┌──────────┐
│ Director │
└──────────┘
                        ┌───────────────┐              ┌──────────────────┐
                        │Deputy Director│              │Financial Director│
                        └───────────────┘              └──────────────────┘
┌───────────────┐   ┌──────────────────┬──────────────┐  ┌──────────────────┐
│Research groups│   │Research &        │System &      │  │Finances &        │
└───────────────┘   │development       │infrastructure│  │humain resources  │
┌───────────────┐   │engineers         │              │  └──────────────────┘
│Cross          │   ├──────────────────┼──────────────┤  ┌──────────────────┐
│research groups│   │Technology        │Legal services│  │Secretariat       │
└───────────────┘   │transfert office  │              │  └──────────────────┘
                    ├──────────────────┼──────────────┤
                    │Program           │Communication,│
                    │managers          │public relations│
                    │                  │& marketing   │
                    └──────────────────┴──────────────┘
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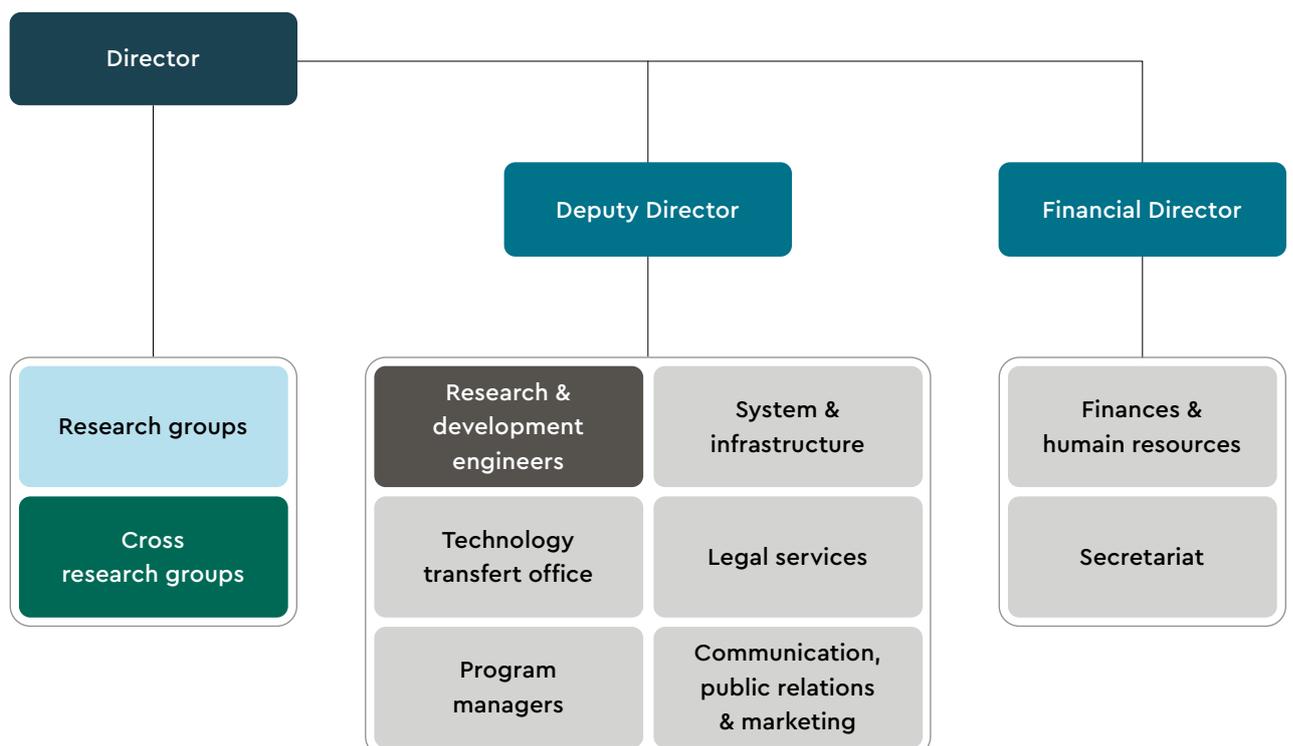
14 research groups

Speech & Audio Processing

Prof. Hervé Bourlard (third from left),
Dr. Phil Garner, Dr. Petr Motlicek, Dr. Mathew Magimai-Doss
H-indexes: PG: 30, PM: 27, HB: 69, MMD: 31

Speech processing has for many years been one of Idiap's major research themes.

Statistical automatic speech recognition; voice synthesis and the generic processing of audio information (source localization; microphone networks; speaker segmentation; information indexing; very-low-bit-rate speech coding; background noise analysis).

Biometric Security & Privacy

Prof. Sébastien Marcel
H-index: 61

The automatic recognition of individuals through the use of behavioral and biological characteristics is the foundation stone of computer biometrics.

Development of image processing and pattern recognition algorithms for face recognition (2D, 3D, and near infrared); speaker recognition; antispoofing; study of emerging biometrics modalities (electrophysiology and veins); open science thanks to our own open source library.

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Biosignal Processing

Dr. André Anjos
H-index: 27

The analysis of biomedical sensor data for medical or research purposes lies at the heart of the research carried out by the Biosignal Processing group.

Analysis of e-health data; detection of human biological signals for medical and scientific applications; use of machine learning techniques; data acquisition and analysis; open science.

Computational Bio Imaging

Prof. Michael Liebling
H-index: 25

The technique of computational imaging and biomedical image analysis lies at the heart of the group's imaging research.

Development of algorithms for deconvolution and super-resolution in optical microscopy; three-dimensional tomographic reconstruction; more generally, combination of unusual detection methods and devices with computational software to produce images ideally suited to the observation and quantification of complex, living biological systems.

Computation Cognition & Language

Prof. Lonneke van der Plas
H-index : 17

Human languages are essential to how artificial systems, such as apps and robots, interact with users.

The group studies and develops systems that automatically capture information from noisy, complex signals, with a preference for methods inspired by human cognitive processes thus making interaction more natural and flexible and automatic learning from these signals more efficient.

Energy Informatics

Dr. Jérôme Kämpf
H-index: 29

Information and communication technologies help us to fight climate change and to increase the proportion of renewable energy and the number of distributed energy sources.

Creation of smarter energy systems; global optimization of energy efficiency; scenarios of energy transition including intelligent control and adjustment mechanisms for building retrofitting; production and storage of renewable energies in the context of climate change.

Genomics & Health Informatics
Dr. Raphaëlle Luisier
H-index: 10

Artificial intelligence technologies such as statistics, machine learning, and data visualization could further unlock the potential of genetics for health.

Genomics, bioinformatics, RNA biology, neuroscience, data science, and data visualization, all related to cellular imaging, genomic data, and neurodegenerative diseases, and studied in collaboration with molecular neuroscience and bioengineering experts.

Machine Learning
Dr. Damien Teney
H-index: 16

The development of new statistical learning techniques, principally for computer vision, is the basis of the group's work.

Computational properties of statistical learning; automatic image analysis, particularly the automatic extraction of significance; object detection; tracking of people and biological structures.

Natural Language Understanding
Dr. James Henderson
H-index: 28

Deep learning models of the syntax and meaning of text are used for machine translation, natural language inference, and summarization.

Neural machine translation; summarization; information retrieval and extraction; text classification; attention-based deep learning models of language understanding; representation learning for modeling abstraction and natural language inference.

Perception & Activity Understanding
Dr. Jean-Marc Odobez
H-index: 48

The analysis of human activities from multimodal data is useful for surveillance, behavior analysis, human–robot interfaces, and multimedia content analysis.

Development of algorithms based on computer vision and learning and data fusion methods in order to detect and track objects and people, to represent and characterize their state, and to model sequential data and interpret them in the form of gestures, behaviors, and social relations.

Reasoning & Explainable AI
Dr. Andre Freitas
H-index : 19

The group investigates how the combination of latent and explicit data can enable the next generation of explainable, data-efficient, safe AI systems.

Domains in which the group is active include natural language and abstractive inferences, explanation generation, explainable question answering, scientific inference, neuro-symbolic models, semantic control and probing, sentence and discourse representation, open information extraction, knowledge graphs, and AI applications in cancer research.

Robot Learning & Interaction
Dr. Sylvain Calinon
H-index: 48

Human-centric robotic applications exploit multimodal sensory information and develop intuitive learning interfaces.

Develop statistical approaches for encoding movements and behaviors in robots evolving in unconstrained environments; models with multiple roles (recognition, prediction, reproduction); learning strategies (imitation, emulation, incremental correction, or exploration).

Signal Processing for Communication
Dr. Ina Kodrasi
H-index : 15

The aim of the group is to create digital signal processing and machine learning algorithms to improve communication for people with hearing or speaking impairments.

This entails the development of algorithms for speech, audio, and multimodal signals to automatically detect speaking and hearing impairments, to provide speaking and hearing assistance, and to improve the communication experience in the presence of undesired interference.

Social Computing
Dr. Daniel Gatica-Perez
H-index: 70

The integration of theories and models from informatics and the social sciences makes it possible to detect, analyze, and interpret human and social behavior.

Behavioral analysis of face-to-face interactions; crowd-sourcing and the large-scale treatment of urban data; smartphones and social networks.

Foundation Council

The Foundation Council is responsible for the economic and financial management of Idiap. It defines the Institute's structure, appoints its director, and—more generally—ensures Idiap's development and defends its interests.

Anne-Laure Couchepin Vouilloz, President
President of the city of Martigny

Antoine Geissbühler
Professor at the University of Geneva and Vice-Rector

Jan S. Hesthaven, Vice-President
EPFL Professor, Vice-President for Academic Affairs

Jordi Montserrat
Venturelab Regional Director

Stéphane Marchand-Maillet, Vice-President
Associate Professor at the University of Geneva's Faculty of Sciences

Yves Rey
Head of the Service des Hautes Écoles (SHE) of Valais

Marc-André Berclaz
Managing Director of EPFL Valais–Wallis

Dan Tomozei
Research Director at Data, Analytics & AI, Swisscom

Patrick Furrer
Scientific collaborator at swissuniversities

International Advisory Board

The Advisory Board is composed of members of the scientific community selected by Idiap's management for their exceptional skills and avant-garde vision. Although their role is strictly advisory, their support is frequently sought and proves valuable when making decisions regarding research, training, and technology transfer.

Dr. Alex Acero
Senior Director at Apple, Cupertino, CA, USA

Prof. Klaus-Robert Müller
Professor of Computer Science, TU Berlin, Director, Bernstein Focus on Neurotechnology, Berlin, DE

Dr. Alessandro Curioni
IBM Fellow, Vice President Europe and Director IBM Research – Zurich, Zurich Research Laboratory, CH

Prof. Stefan Roth
Professor of Computer Science and Chair of the Department of Computer Science at TU Darmstadt, DE

Dr. Georges Kotrotsios
Vice President of Strategic Relations at the Centre Suisse d'Électronique et de Microtechnique SA (CSEM), CH

Prof. Matthew Turk
President of the Toyota Technological Institute at Chicago (TTIC), USA

Prof. Anil K. Jain
Distinguished Professor, Department of Computer Science & Engineering, Michigan State University, USA

Prof. Mihaela van der Schaar
John Humphrey Plummer Professor of Machine Learning, Artificial Intelligence and Medicine at the University of Cambridge, UK

Prof. Neil Lawrence
DeepMind Professor of Machine Learning at the University of Cambridge, UK

Prof. Stefan Wrobel
Professor of Computer Science at the University of Bonn and Director of the Fraunhofer Institute for Intelligent Analysis and Information Systems (IAIS), DE

Dr. Fabienne Marquis Weible
Director of the Swiss Association for Horological Research, Engineer at EPFL, CH

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Employees

Scientists

David Alonso Del Barrio, Master's Student

Niccolò Antonello, Postdoctoral Researcher

Paul Arzul, AI Master's Student

Karim Assi, Research Intern

Patrick Audriaz, AI Master's Student

Chantal Basurto Davila, Postdoctoral Researcher

Melika Behjati, Research Assistant

Sushil Bhattacharjee, Research Associate

Alexandre Bittar, Research Assistant

Roberto Boghetti, Research Assistant

Loïc Bommeli, Student

Annie Bornet, Student

Emma Bouton-Bessac, Research Intern

Rudolf Braun, Research Associate

Victor Bros, Research Intern

Lara Brudermüller, Research Intern

Sylvain Calinon, Senior Research Scientist

Davide Carminati, Research Intern

Haolin Chen, Research Assistant

Nara Oslo Clerc, Research Intern

Laurent Colbois, Research Assistant

Andrei Coman, Research Assistant

Louise Coppieters, Research Assistant

Evann Courdier, Research Assistant

Tiago de Freitas Pereira, Postdoctoral Researcher

Pavankumar Dubagunta, Research Assistant

Karl El Hajal, Master's Student

Gasser Elbanna, Student

Maël Fabien, Research Assistant

Martin Fajčík, Research Assistant

Fabio Fehr, Research Assistant

François Fleuret, External Research Fellow

Nyssa Foglia, Student

Gandal Foglia, Student

Magali Formaz, Student

Alessandro Fornaroli, Research Intern

André Freitas, Research Scientist

Julian Fritsch, Research Assistant

Philip Garner, Senior Research Scientist

Daniel Gatica-Perez, Senior Research Scientist

Thomas Gaudillere, Research Intern

David Geissbühler, Research Associate

Anjith George, Research Associate

Lara Gervaise, Master's Student

Louis Gevers, Trainee

Hakan Girgin, Research Assistant

Mathieu Giroud, Student

Anshul Gupta, Research Assistant

Nadia Hadjmbarek, Student

Garance Haefliger, Trainee

Weipeng He, Postdoctoral Researcher

James Henderson, Senior Research Scientist

Enno Hermann, Research Assistant

Valentin Honorez, Master's Student

David Imseng, Research Associate

Anubhav Jain, Trainee

Parvaneh Janbakhshi, Research Assistant

Julius Jankowski, Research Assistant

Seyed Mohammad Mahdi Johari, Research Assistant

Selen Kabil, Research Assistant

Jérôme Kämpf, Senior Research Scientist

Rabeeh Karimi Mahabadi, Research Assistant

Angelos Katharopoulos, Research Assistant

Driss Khalil, AI Master's Student

Hamed Khatam Bolouri Sangjiooei, Master's Student

Hamid Khodabakhshandeh, Research Assistant

Abbas Khosravani, Postdoctoral Researcher

Haeeun Kim, Master's Student

Ina Kodrasi, Research Scientist

Pavel Korshunov, Research Associate

Ketan Kotwal, Research Associate

Vedrana Krivokuca, Research Associate

Thibaut Kulak, Research Assistant

Florian Labhart, Research Associate

Inga Lang, Research Intern

Gianrocco Lazzari, Postdoctoral Researcher

Teguh Lembono, Research Assistant

Cindy Leyvraz, Master's Student

Michael Liebling, Senior Research Scientist

Yu Linghu, Master's Student

Julian Linke, Trainee

Tobias Löw, Research Assistant

Raphaëlle Luisier, Research Scientist

Aurel Mäder, Master's Student

Srikanth Madikeri, Research Associate

Mathew Magimai Doss, Senior Research Scientist

Florian Mai, Research Assistant

Sébastien Marcel, Senior Research Scientist

Léo Marcel, Student

François Marelli, Research Assistant

Andreas Marfurt, Research Assistant

Angel Martinez Gonzalez, Research Assistant

Benoit Massé, Postdoctoral Researcher

Kyle Matoba, Research Assistant

André Mayoraz, AI Master's Student

Lakmal Meegahapola, Research Assistant

Lesly Miculicich, Postdoctoral Researcher

Loris Millius, Student

Amir Mohammadi, Postdoctoral Researcher

16

Alireza Mohammadshahi, Research Assistant
Antonio Morais, Master's Student
Zohreh Mostaani, Research Assistant
Petr Motlicek, Senior Research Scientist
Adolf Niederberger, AI Master's Student
Iuliia Nigmatulina, Research Assistant
Mahdi David, Research Intern
Jean-Marc Odobez, Senior Research Scientist
Hatef Otroshi Shahreza, Research Assistant
Arnaud Pannatier, Research Assistant
Shantipriya Parida, Postdoctoral Researcher
Jung Park, Research Intern
Oliver Joseph Paul, Research Intern
Giuseppe Peronato, Postdoctoral Researcher
Trung Phan, Postdoctoral Researcher
Florian Piras, Research Intern
Niccolò Polvani, Research Intern
Ravi Prasad, Postdoctoral Researcher
Amrutha Prasad, Research Assistant
Tilak Purohit, Research Assistant
Huajian Qiu, Master's Student
André Rabello Dos Anjos, Research Scientist
Mattia Racca, Postdoctoral Researcher
Geoffrey Raposo Lameck, AI Master's Student
Amirreza Razmjoo Fard, Research Assistant
Sina Sajadmanesh, Research Assistant
Chloé Salamin, Trainee
Saeed Sarfjoo, Postdoctoral Researcher
Eklavya Sarkar, Research Assistant
Dominic Schmidli, Master's Student
Bastian Schnell, Research Assistant
Suhan Shetty, Research Assistant
Rémy Siegfried, Postdoctoral Researcher
João Silverio, Postdoctoral Researcher
Prabhu Sivaprasad, Research Assistant
Marco Sousa Ewerton, Postdoctoral Researcher
Suraj Srinivas, Research Assistant
Samy Tafasca, Research Assistant
Neha Tarigopula, Research Assistant
Damien Teney, Research Scientist
Mokanarangan Thayaparan, Research Intern
Yong Joon Thoo, Research Intern
Boyang Ti, Research Intern
Marco Tognoli, Research Intern
Sandrine Tornay, Postdoctoral Researcher
Alex Unnervik, Research Assistant
Marco Valentino, Research Intern
Lonneke van der Plas, Research Scientist
Juan Camilo Vasquez-Correa, Trainee
Michael Villamizar, Research Associate
Esaú Villatoro Tello, Research Associate
Bogdan Vlasenko, Postdoctoral Researcher
Sargam Vyas, AI Master's Student

Apoorv Vyas, Research Assistant
Teng Xue, Research Assistant
Xinyi Zhang, Master's Student
Marie Zufferey, Postdoctoral Researcher
Juan Pablo Zuluaga Gomez, Research Assistant

Engineers & technical staff

Philip Abbet, Senior R&D Engineer
Samuel Aymon, System Engineer
Olivier Bornet, Head of R&D Team
Olivier Canévet, Senior R&D Engineer
Daniel Carron, R&D Engineer
Guillaume Clivaz, Senior R&D Engineer
Bastien Crettol, Data Manager
Yannick Dayer, R&D Engineer
William Droz, Senior R&D Engineer
Frank Formaz, Head of System & Infrastructure
Samuel Gaist, Senior R&D Engineer
Theophile Gentilhomme, Senior R&D Engineer
Pedro Gil Ferreira, System Administrator
Mélanie Huck, Senior R&D Engineer
Salim Kayal, Senior R&D Engineer
Ragip Limani, Caretaker
Nazifa Limani, cleaning & Caretaker's assistant
Jérémy Maceiras, R&D Engineer
Christine Marcel, Senior R&D Engineer
Alexandre Nanchen, Senior R&D Engineer
Mattéo Oggier, Apprentice
Danick Panchard, R&D Engineer
Florian Piras, Junior Developer
Louis-Marie Plumel, Senior System Administrator
Vincent Pollet, R&D Engineer
Nazmije Shala, cleaning & Caretaker's assistant
Vincent Spano, Webmaster
Flavio Tarsetti, Senior R&D Engineer
Laurent Tomas, Senior System Administrator
Colombine Verzat, R&D Engineer

Administrative staff

Maxime Bourlard, Communication Officer
Elisa Bovio, Program Manager
Laura Coppey, Administrative Assistant
Justine Darioly, Program Manager
Joel Dumoulin, Technology Transfer Officer
Nicolas Filippov, Head of Communication
François Foglia, Deputy Director
Ed Gregg, external consultant
Barbara Huguenin, Program Manager
Marie-Constance Kaiflin Landelle, Legal Adviser
Sylvie Meier, Office & HR Senior Administrator
Yana Ogay, Apprentice
Aurélie Rosemberg, Visitor
Christophe Rossa, Financial Manager

finances

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Balance sheet (CHF)

ASSETS	31.12.2021	31.12.2020
Cash	5 797 782	6 221 594
Accounts receivable	322 159	606 226
Accrued income and other	1 520 225	1 155 224
TOTAL CURRENT ASSETS	**7 640 166**	**7 983 043**
Equipment	636 700	570 224
Other assets	1 142 246	1 142 246
Patents and licenses	9	6
Financial assets	10 000	10 000
TOTAL NON-CURRENT ASSETS	**1 788 955**	**1 722 476**
TOTAL ASSETS	**9 429 121**	**9 705 519**

LIABILITIES	31.12.2021	31.12.2020
Accounts payable	126 193	84 372
Accrued expenses	4 965 585	5 114 587
Provisions	768 538	768 538
TOTAL FOREIGN FUNDS	**5 860 316**	**5 967 497**
Share capital	40 000	40 000
Research funds reserve	1 554 478	1 734 278
Special reserve	1 600 000	1 600 000
Retained earnings	363 744	355 489
Net income	10 583	8 255
TOTAL OWN FUNDS	**3 568 805**	**3 738 022**
TOTAL LIABILITIES	**9 429 121**	**9 705 519**

Profit and loss statement (CHF)

INCOME	2021	%	2020	%
Swiss Confederation Art. 15	3 221 800	23.5	2 527 300	20.0
Canton of Valais	2 513 013	18.3	2 250 000	17.8
City of Martigny	700 000	5.1	700 000	5.5
Capital and donations	85 924	0.6	77 712	0.6
Competitive funding	**6 520 737**	**47.5**	**5 555 012**	**44.0**
Swiss National Science Foundation	2 487 045	18.1	2 037 286	16.2
EU	1 393 911	10.1	1 145 440	9.1
Innosuisse	886 686	6.5	1 289 801	10.2
Others (The Ark, Hasler, industrials, bio, US, Valais Ambition)	2 179 649	15.9	2 325 584	18.4
Third-party contributions (non-competitive)	**6 947 291**	**50.6**	**6 798 111**	**53.9**
Interest	1 432	0.0	15 900	0.1
Subletting	168 868	1.2	170 193	1.3
Other incomes	52 935	0.4	49 755	0.4
Profit/exchange loss	47 510	0.3	25 252	0.2
Divers incomes	**270 745**	**2.0**	**261 100**	**2.1**
TOTAL INCOME	**13 738 773**	**100.0**	**12 614 223**	**100.0**

CHARGES	2021	%	2020	%
Personnel (including social deductions)	11 781 411	85.8	10 631 009	84.3
Operational costs	2 126 579	15.5	2 140 681	17.0
Dissolution of reserves	-179 800	-1.3	-165 722	-1.3
TOTAL EXPENDITURES	**13 728 190**	**100.0**	**12 605 968**	**100.0**
OPERATING PROFIT/LOSS	**10 583**		**8 255**	

Accounting analysis 2021

I n 2021, Idiap's most recent phase of growth is corroborated by the balance sheet for the financial year. The milestone of CHF 13 million in revenues has been reached, including an increase of almost one million francs in public contributions. Earnings amount to CHF 10,583. The year 2022 is expected to see further budget growth.

Federal, cantonal, and municipal subsidies

(In thousands of Swiss francs)

YEARS	2018	2019	2020	2021
Confederation	2 334	2 420	2 527	3 221
Canton	2 000	2 000	2 250	2 513
Municipality	700	700	700	700

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Distribution of funding sources

- Swiss Confederation
- Canton of Valais
- City of Martigny
- Capital and donations
- Swiss National Science Foundation
- EU
- CTI/Innosuisse
- Others (US, The Ark, Hasler, industrials, biometrics lab, Valais Ambition)
- Other incomes
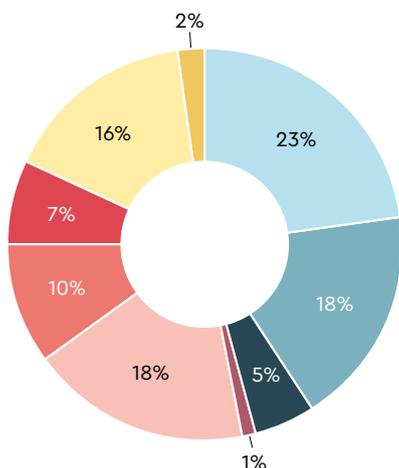
## Distribution of costs

- Personnel expenses
- Operating expenses

research

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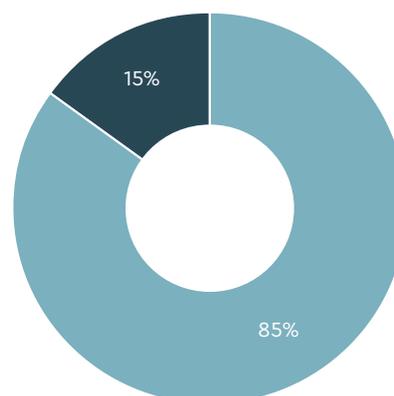
SNSf FanFare submitted accepted
VS Biometrics Center 2016 accepted
Hasler VeriFake submitted accepted
SNF Sinergia HANDY rejected
SNF Mobile Vein rejected   LIES-SO + IDIAP
IND Mxxx   no news (NDA never received)
H2020 EMMA   submitted rejected

Tabula Rasa!
Reality under attacks ?

SONY DEFIANCE submitted
SNF FanFare2 WiP

Idiap Not eligible: too late for
cancelled
accepted ✓ ORCA 2. ???
IND "Tangent" URCA   Program open soon ? No news
No news

H2020 BU ENTIRE2 submitted Rejected
GRO 2018 rejected
COST BISBA submitted

CTI SUVA   discussion no news
CTI VEINTREE submitted rejected preparation ?
CTI 3DFANE pending   IDIAP + OneVisage no news
CTI BIOWAVE 2 submitted rejected resubmitted accepted

Ping Sec PRIZE
Sep 7 2018
cancelled SUPERB
H2020
Id
H2020 IDIAP

H2020 SPE
H2020 SYF

SNF Sin
An

NSF/SNSF PIRE   Check next deadline ?
H2020 TRIBE   rejected resubmitted rejected
H2020 BESI   (AIT, MPU, IDI, ...)
H2020 SEC   IDI, LEAs and al

not eligible max SNF
proposal submitted

SNF
IND

DON'T
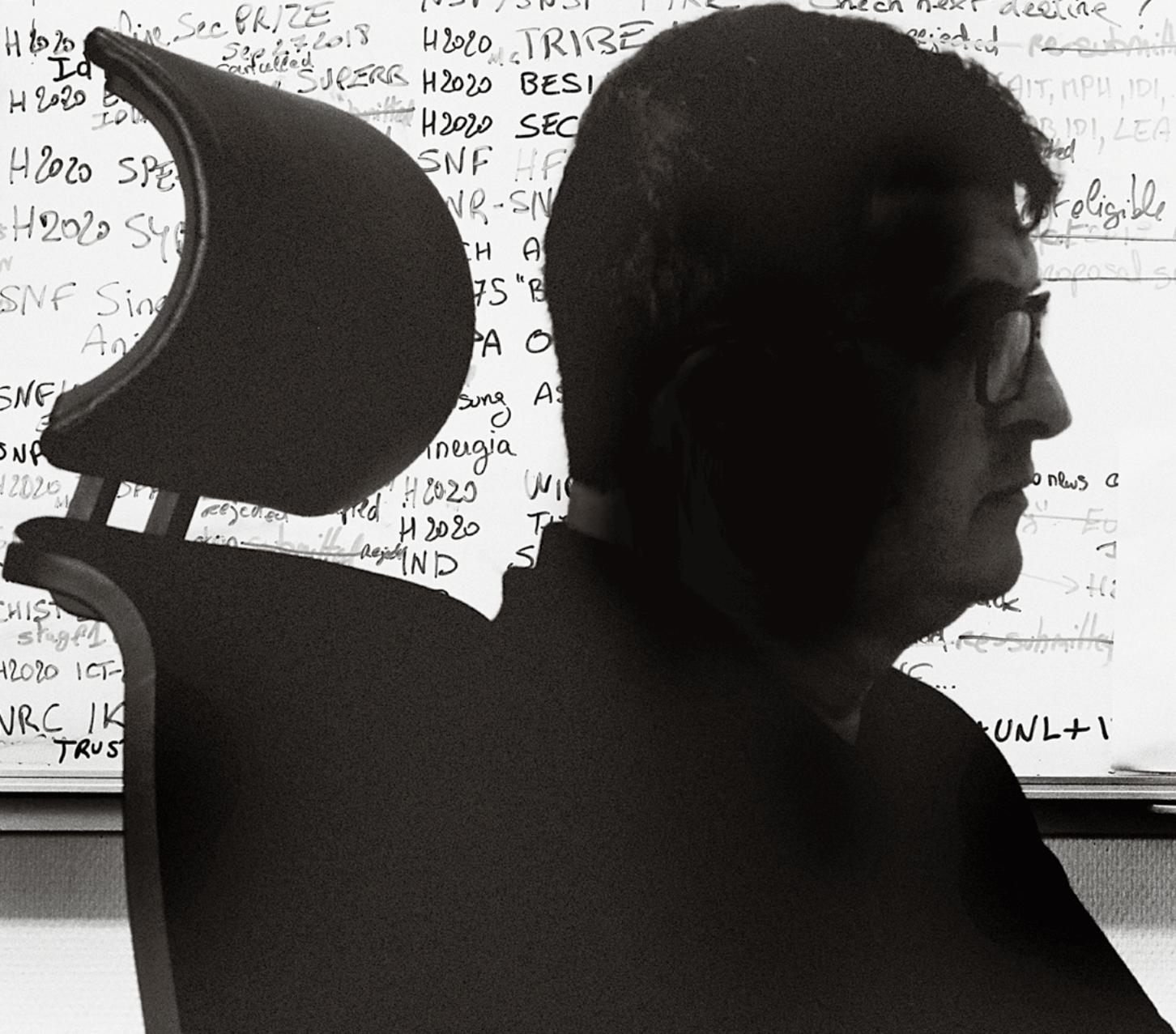
"My career at Idiap has allowed me to establish a standard"

Since his arrival at Idiap 20 years ago, Sébastien Marcel has reshaped the contours of the biometry research community. Following several major projects and thanks to extensive hard work, the researcher has been able to lay the foundations for a new biometric standard.

S ébastien Marcel leads Idiap's Biometric Security & Privacy research group. For two decades he has grown Idiap's biometrics competences, in the process creating a world-renowned, dedicated research and testing center. Marcel reflects on his unique professional journey.

How did you come to join the Institute?

I arrived in Martigny on a Sunday in November 2000, and found everything closed. I wasn't sure what to expect: reports of terrible floods in Valais were all over the media. Thankfully, Martigny was spared. During my PhD, in a France Telecom lab—today, Orange Labs—I had worked on artificial neural networks applied to gesture recognition in computer vision. A very futuristic topic at the time, 10 years prior to Microsoft's Kinect. The leader of that lab was none other than the father of Ronan Collobert [editor's note: an Idiap researcher who developed the software reference Torch]. He told me about Idiap, and he advised me to ask Joshua Bengio to be a committee member for my thesis, given my research theme. In Montreal, Joshua redirected me to his brother, Samy, who was... at Idiap. So it was quite natural

for me to apply to the Institute once I had finished my PhD. Hervé Bourlard—already Idiap's director—invited me to give a presentation at the Institute, and a job offer followed hot on its heels.

Which research areas did you develop following your arrival?

When I arrived, we had no specialist in computer vision. So I naturally continued my thesis research, applying it in the framework of a European project in the area of... biometrics. The aim was to use artificial neural network techniques in facial recognition. And that's how our skills in facial recognition developed, in collaboration with—among others—the machine learning team led at the time by Samy Bengio, now a researcher at Google Brain. The attribution of new European projects, and the National Center of Competence in Research IM2, financed by the Swiss National Science Foundation, helped to consolidate this first phase.

The turning point came in 2008, with the European project MOBIO on mobile biometry, which we coordinated. The goal was face and voice recognition on mobile telephony. Today, biometrics is everywhere on mobile devices, but back then this was another somewhat visionary topic; the iPhone didn't even exist when we submitted the project. The team, meanwhile, was slowly but surely growing. And shortly after, in 2010, we created the biometrics research group, and were awarded the coordination of the European project Tabula Rasa, which focused on antispoofing [editor's note: methods of preventing biometric identity theft]. This project put us in the spotlight, especially with businesses, and we became a leader in the field.

How have you managed to do public research in a domain in which private business plays such a key role?

With Tabula Rasa we broke a taboo. Spoofing was for spy movies, not for research you could speak about openly. Two years later, in 2012, the European project BEAT—which we also coordinated—played another pivotal role, creating a platform offering robust open-source tools for biometry. The aim was to create a

standard. And that's why, in 2016, we also decided to create the biometrics center, which was made possible thanks to the support of the State of Valais and the city of Martigny, and their belief in the project. Our expertise was quickly recognized, and we obtained FIDO [editor's note: an international benchmark consortium] and Android accreditations to certify biometrical systems with respect to their standards. We also joined an American collaborative research initiative, the CITeR. Today, the needs and requests are so numerous, we sometimes struggle to keep pace.

> "There were a lot of opportunities in the private sector. But I probably wouldn't have had the same freedom."

Wouldn't it have been easier to conduct all this research in the private sector?

Sure there were a lot of opportunities in the private sector. But I probably wouldn't have had the same freedom. My vision involved a long-term open-source strategy to ensure transparency and the

reproducibility of the work carried out. This path has certainly been the longer and harder one as the mechanisms for financing research aren't perfect, but in the end it has paid off. My choices have allowed me to create a standard. For example, the tools and databases developed in BEAT are references, and are still being developed and updated. The early years weren't always easy, and sometimes the way forward required a certain intuition. But this degree of freedom and the opportunity to work toward long-term goals have, today, made the difference. And this way of working would not have been possible elsewhere. Thanks to its infrastructures and to the opportunities it offers, Idiap is a sort of best of both worlds—the public and the private.

So, what's next?
Things are evolving naturally, including with projects on deep fakes, but also with more time dedicated to teaching. The ability to share knowledge and expertise—thanks to courses at the University of Lausanne, EPFL, or in Idiap's applied Master's in Artificial Intelligence—is another long-term investment that the Institute makes possible.

More information about the Center for Biometrics Research and Testing.

Contributions to the field of signal processing recognized

The prestigious IEEE James L. Flanagan Speech and Audio Processing Award has been conferred jointly on Idiap's Professor Hervé Bourlard and Professor Nelson Morgan of the University of Berkeley (USA). Bourlard is the first Swiss to receive the distinction.

Alongside his American counterpart, Professor Bourlard has become a reference in the field for his pioneering work in modeling speech signals using so-called hidden Markov models. This work was further developed using artificial intelligence, and in particular neural networks, linear algebra, and statistics. Bourlard's contribution, in part the product of nearly 40 years of collaboration with Professor Morgan, comprises more than 400 scientific publications.

The recognition of his peers
"Some years ago, Idiap was fortunate to have Professor James Flanagan as a member of its International Advisory Board. Receiving, today, the prize that bears his name is an immense honor, for both the Institute and myself," explains Hervé Bourlard. The distinction is all the more prestigious because it is awarded by the Institute of Electrical and Electronics Engineers (IEEE), the largest professional association

of engineers in the fields of telecommunications, computer science, and electronics—the IEEE is the authority in its fields.

The Award was presented to Bourlard and Morgan in May 2022, during the IEEE's annual conference, in Singapore.

Classifying neurons, and a better understanding of the disease that afflicted the late theoretical physicist Stephen Hawking

Our Genomics & Health Informatics research group, in collaboration with the Francis Crick Institute in London, has revealed a new computational analysis method for classifying images of healthy motor neurons and those affected by amyotrophic lateral sclerosis (ALS). This technological breakthrough gives us a deeper understanding of the disease, and is helping guide lab research.

Understanding neurodegenerative diseases is an ever-present challenge for research and for medicine. ALS—which, famously, afflicted the renowned physicist Stephen Hawking—is one such disease. The condition is characterized by the progressive death of so-called motor neurons, which control muscles, and results in paralysis. Understanding the process or processes responsible for the death of these neurons requires the study of thousands of parameters, which together define the healthy or the sick status of a cell. And while this is beyond the abilities of humans, powerful artificial intelligence tools are up to the task.

A database of more than 150,000 images

To understand what is happening to the neurons you need data—tremendous amounts of data. Rickie Patani and Jasmine Harley of London's Francis Crick Institute, which specializes in medical research and biomedical discovery, have built a unique database of more than 150,000 images of motor neurons. The images were created using fluorescence microscopy. Thanks to the application of a set of colors, different parts of each neuron can be distinguished, including dendrites and the nucleus. The cells have also been subjected to different stress conditions, for example by inducing a thermal shock. And it has been shown that under certain stress conditions, a healthy cell can look like a cell affected by ALS.

Intelligent classification and recognizing affected neurons

The database allowed scientists at Idiap to create a model that makes it possible to distinguish whether a motor neuron is affected or not. Thanks to deep learning–based artificial intelligence, the model enables an analysis of various factors related to different parts of the cell. *"To be effective, the model must also have enough varied information in the data set,"* explains Colombine Verzat, Idiap development engineer and coauthor of the study.

Unlike previous methods, this new model allows images to be analyzed directly, pixel by pixel, without having to focus on just a part of the cell or to concentrate only on one specific feature. All of which makes the method unbiased. *"Artificial intelligence tools are particularly exciting because they allow us to manipulate huge masses of data and to extract key information—both tasks that surpass the human brain,"* comments Raphaëlle Luisier, head of the Genomics & Health Informatics research group.

Guiding future research

The idea is to leverage the power of large image databases to quickly test hypotheses about how a disease works. Today, for example, experts studying ALS know that it is principally certain proteins in the cell that indicate whether a neuron is affected. But this study shows that another part of the motor neuron, the neurites, is also affected by ALS. Which could guide further research into the influence of this particular cellular structure on the disease. The ultimate goal is to improve our knowledge of the condition, and to facilitate the discovery of a treatment, which thus far does not exist.

Read the scientific paper.

AI and an app to understand young people's drinking habits

Idiap researchers publish the results of a study showing that analyzing images and audio from voluntarily recorded videos helps to determine with greater objectivity the context of alcohol consumption among young people.

It's 2022. And as the terraces finally reopen and the thoughts of young people turn to partying, being able to measure the influence of context on their drinking habits is more vital than ever to our understanding of the impact of social and sanitary policies. But studies based on self-evaluation can be problematic. *"Data from self-evaluations is not very reliable due to forgetfulness bias, which leads us to forget, already after a few days, the details of what we consumed, and due to social desirability bias, which leads to the underreporting of behaviors considered socially undesirable,"* explains Florian Labhart, research associate in public health at Idiap and lead author of the study. To circumvent these drawbacks, the project Dusk2Dawn—supported by the Swiss National Science Foundation—developed new data collection methods regarding alcohol consumption and its context.

The researchers used algorithms to determine ambient light levels, noise levels, and the number of individuals present. The aim was to determine whether such elements can be more effective than subjective self-reporting in establishing reliable correlations between alcohol consumption and the consumption environment. To validate the method's efficacy, the researchers asked participants to describe the environment and to record 10-second in situ videos, which were later viewed and annotated by human assistant researchers. This allowed the validation of the results provided by the algorithm. A range of ethical processes ensured participants' privacy.

A smart use of a smartphone

To make the best possible use of the data harvested by the app, researchers manipulated it using artificial intelligence, in particular analyzing audio and video information. *"This approach, based on smartphone sensors, is not only novel, we have shown that it produces reliable and relevant results,"* Labhart explains.. *"So, even if the algorithm estimates a higher level of noise than that estimated by participants, a comparison of the measurement methods shows that noise level and consumption are significantly correlated with one another, and are associated with alcohol consumption in a similar manner."*

The study shows that in private venues, noisier, more crowded, and darker environments are more prone to increase alcohol consumption. And that the same is true in public venues. Finally, as expected, a comparison with the annotated data reveals that participants' self-evaluations are sometimes less reliable than the methods used in the study.

Better policies thanks to an interdisciplinary approach

Launched in 2017, Dusk2Dawn aims to provide useful tools and information to public health decision makers, enabling them to elaborate efficient, science-based drinking prevention strategies vis-à-vis young people. *"This study illustrates the potential of collaborations between researchers in public health and in computer science to improve our knowledge of the context of drinking habits and of methods for securing relevant data,"* concludes Daniel Gatica-Perez, head of Idiap's Social Computing research group.

Read the scientific paper.

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innovation

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Swisscom TV Box learns to transcribe Swiss German dialects

The Idiap Speech & Audio Processing group, in collaboration with Swisscom, takes a multi-dialect approach to improve Swiss German speech recognition on the voice assistant of the Swisscom TV Box.

In Switzerland, standard German, as spoken in Germany, is in a so-called diglossic relationship with the Swiss German dialects spoken in German-speaking Swiss cantons. German is thus used in specific social and political contexts. Standard Swiss German, also called "Swiss German" or Schweizer Schriftdeutsch, is a mix of standard German and the written form of German officially used in Switzerland. It is employed in books, newspapers, and all official publications. This standard Swiss German is not, however, spoken. Writing in Swiss German has emerged only recently, notably due to electronic messaging and chats. Hence, orthographic conventions for the varieties of Swiss German simply do not exist.

Standard Swiss German differs from standard German at all levels of linguistic analysis: the vocabulary, pronunciation, orthography, and even the syntax changes. This phenomenon is referred to as "Helvetism." Each Swiss German dialect also has its own particular characteristics. Fortunately, Swiss German is the best-studied of all central European dialect fields.

Most scientific research uses a phonetic transcription system called Dieth to transcribe Swiss German dialects. The system uses standard German spelling as a starting point, but deviates where that standard proves incoherent or if it lacks precision vis-à-vis the description of various Swiss dialects. Thus, dialect variations lead to words being pronounced and transcribed differently depending on the region. To establish the identity of a term and all its written variations, each variation must be standardized in a unique form. Automatic speech recognition is thus, for Swiss German, a considerable challenge.

Automating variant analysis

Idiap researchers, in collaboration with Swisscom's AI group, have conceived a multi-dialect approach to word generation for Swiss German in order to study existing variants. If their model comes across a term it does not recognize, it has to distinguish whether the term is a dialect variation or a new word altogether. Thanks to a database containing different variants, the model automatically learns to differentiate between a dialect term and a new word. The model is then also able to transcribe the word into standard Swiss German. This approach—employed at Idiap using Swiss German multi-dialect data extracted from the Swisscom TV Box voice assistant—shows a significant improvement in automatic speech recognition performance, in particular for dialects that are rarely the subject of study.

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Four new researchers join the effort to shape the future of AI

Idiap grows its research capacities, hiring four new group leaders. The two women and two men will work on high-potential topics in artificial intelligence (AI) and on making further progress in areas that already contribute to the Institute's reputation.

The Institute's expansion continues, with the arrival in Valais of four new permanent researchers. Three will be tasked with leading new research groups, ensuring that Idiap remains at the forefront of innovation and of international research.

Idiap is delighted to announce that **Ina Kodrasi** will lead the new Signal Processing for Communication group. An expert in signal processing, this is a return to our institute for Kodrasi as she worked here previously as an associate researcher. Proof positive that Idiap strives to offer its employees a long-term vision, and optimal conditions for their professional development.

Today's AI technologies are not very transparent and can be difficult to understand. Data processing using methods such as machine learning or neural networks often constitutes a mystery, a "black box." One of the main challenges for the head of the new Reasoning and Explainable AI group, **Andre Freitas**, will be to understand existing artificial intelligence mechanisms and how the algorithms and techniques used produce the desired results.

Further developments, in one of Idiap's established fields of expertise

The Idiap Research Institute has long been renowned for its work on language and speech. Further strengthening the Institute's capabilities in these areas, **Lonneke van der Plas** will lead the brand new Computation, Cognition & Language research group. An expert in multilingual language processing and

computer semantics, she will further explore topics whose applications—such as speech recognition—benefit many on a daily basis.

The limits of our research are still a considerable way off, the case of machine learning being a particularly telling example. The mission of **Damien Teney** and his Machine Learning group is to further our work on this essential subject. Teney, a senior researcher at the Australian Institute of Machine Learning in Adelaide, takes over leadership of the group from François Fleuret. He has already worked with Carnegie Mellon University (USA), the University of Bath (UK), and the University of Innsbruck (Austria).

Idiap looks forward to seeing these four talented researchers further the bounds of scientific research and develop the innovations of tomorrow.

A transversal strategy at the service of society

In addition to hiring more researchers, as part of its 2021–24 research program, approved by the State Secretariat for Education, Research and Innovation (SERI), Idiap is setting up new structures, in the form of transverse research groups. While these groups will open up new horizons, their function is to facilitate the development of projects that respond more directly to the needs of society and industry, and that integrate the skills of several existing research groups.

"The goal is to be able to respond more effectively to the needs of society today," explains Hervé Bourlard, Idiap's director. In the context of healthcare, for example, it will be possible to analyze the movements of a patient undergoing rehabilitation, while facilitating communication with that patient in his or her native tongue thanks to automatic translation, and ensuring that patients' personal data is secured using biometrics—all tasks that require multidisciplinary skills combined with a firm grasp of the bigger picture.

The strength of our Institute lies in a functional ecosystem that facilitates the transfer of technology from the world of research to companies. In addition to a service dedicated to industrial collaborations, with UniDistance Idiap has also set up an applied Master's program in Artificial Intelligence, working closely with its industrial partners. Idiap also has a start-up incubator (IdeArk), which will soon get its own investment fund (AI Venture SA)—all advantages for the mission and the projects of these new, cross-disciplinary groups.

"Despite the challenges of implementing these new entities, the goal is to have two in place by the end of 2022," Hervé Bourlard explains. *"This also means a real opportunity to set up a structure unique in Switzerland, dedicated to innovation".* By the end of 2024, four cross-disciplinary groups are expected to be in place.

Twelve million Swiss francs to drive more inclusive information and communication technologies

Despite the increasing number and range of communication channels, ensuring access to information for people with a disability remains a technological challenge. An international consortium of researchers and private- and public-sector partners, led by the University of Zurich and including the Idiap Research Institute, has been granted six million Swiss francs by Innosuisse to take up this challenge. A sum complemented by a further six million francs from private partners.

A simplified version of a text, a translation or a rendering in sign language, an audio description or subtitles—all essential services for many individuals. But despite the growing number of communication channels, providing such inclusive service offerings remains a challenge. To rise to that challenge, the project is bringing together a number of leading bodies, including the University of Zurich, the University of Applied Sciences in Special Needs Education (HfH), and—from the French-speaking part of Switzerland—the Idiap Research Institute and Icare.

Complementary competencies

"At Idiap, we specialize in the processing not only of spoken language, but also of sign language. In this project, we will apply both these competencies to the development of sign language–assessment applications in the framework of online learning methods and audio descriptions," Mathew Magimai-Doss, Senior Researcher in the Speech & Audio Processing group, explains. *"With machine learning tools,"* adds Julien Torrent, Innovation Manager at the Icare research institute, *"we could, for example, apply a more straightforward approach to text simplification for people with mental disabilities. Currently, text simplification processes imply numerous, complex iterative rules."*

Beyond scientific research, the consortium's aim is to develop transversal tools that can be used across different platforms and that are suited to users' different needs. Applications range from the provision of information regarding natural disasters to guaranteeing access to official documents. For this to be possible, it will be necessary to simplify a text to render it understandable while retaining its meaning, and to create subtitles or an audio description of images. And these are just some of the scientific and technological challenges that lie ahead for the project.

Technology implementation thanks to public and private partners

Not limited to academia, the project includes several partners that will be in charge of the practical implementation of the technologies developed. The Swiss Federation of the Deaf and a number of federal actors are also on board, including the Bureau for Equality for People with Disabilities, Swiss TXT (Swiss broadcasting), the Social Insurance Office, the Office of Public Health, the Office for Civil Protection, and MeteoSwiss. The private insurance company Zurich and the Austrian company Capito, which creates simplified texts, are also involved in the project. The aim? Ease of communication of essential information to people with a disability.

The project will begin in 2022 and will last four years under the aegis of Innosuisse's new Flagship initiative, the goal of which is to support systemic innovation. The project was among those selected following the first call, in January 2021.

Fake faces for more ethical biometrics

The lack of representativity in databases used to train facial recognition tools often creates biases in the tools themselves. A repository of "fake faces" could rectify these biases. Financed by the Hasler Foundation and under the supervision of the Idiap Research Institute, the project SAFER brings together the University of Zurich and the firm SICPA.

M ost of us have a photo of ourselves somewhere on the Internet. Researchers or software designers who wish to use these photos for facial recognition tools encounter numerous scientific or ethical challenges. *"To avoid biases, researchers not only need a vast number of different pictures, these pictures also need to be balanced in terms of people's gender, age, and origins,"* Sébastien Marcel, head of the Biometric Security & Privacy research group at Idiap, explains. *"And that's the main challenge: the image stock is rarely representative of a population's diversity, and when it is it's often impossible to use the images for another research project, due to personal data–protection regulations."* Thanks to the financial support of the Hasler Foundation, the project SAFER will create a stock of synthetic faces of people who do not actually exist, which can then be used to develop more ethical facial recognition tools.

Open source and technology transfer

The evolution of the legal framework, especially at the European level, and the reluctance even of big tech companies including the GAFAs to create biometrics databases and make them available for research pose a genuine challenge. By including several partners and by conducting research in a manner that renders it both open and replicable, the project's scientists aim to create a new scientific standard. The hope is that in future this approach will also prove useful for other biometrics domains, including voice recognition and fingerprinting, and that it will be more broadly applicable in domains that use machine learning.

Not limited to the realm of academia, the project will also integrate, from the outset, an industrial partner—SICPA. The company will play a key role in testing, evaluating, and using the software, the database generating methods, and the databases themselves, which will be developed by Idiap and the University of Zurich. This collaboration will ensure that the research carried out is not only replicable, but also applicable in practice.
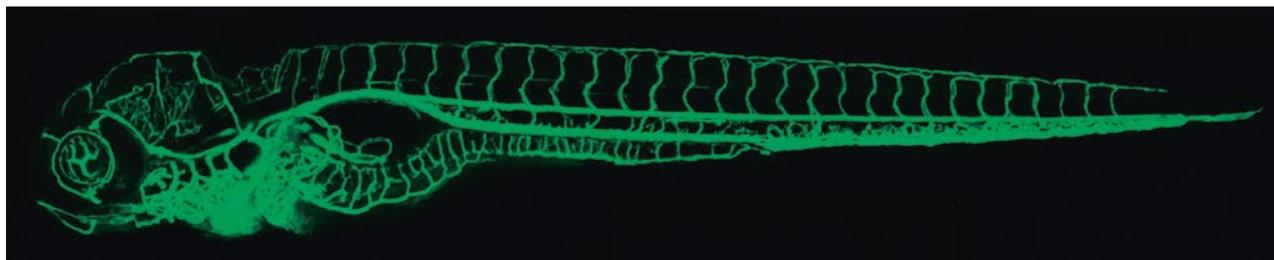
Planned to run for the next three years, the project includes a post for a PhD student at Idiap and another at the University of Zurich.

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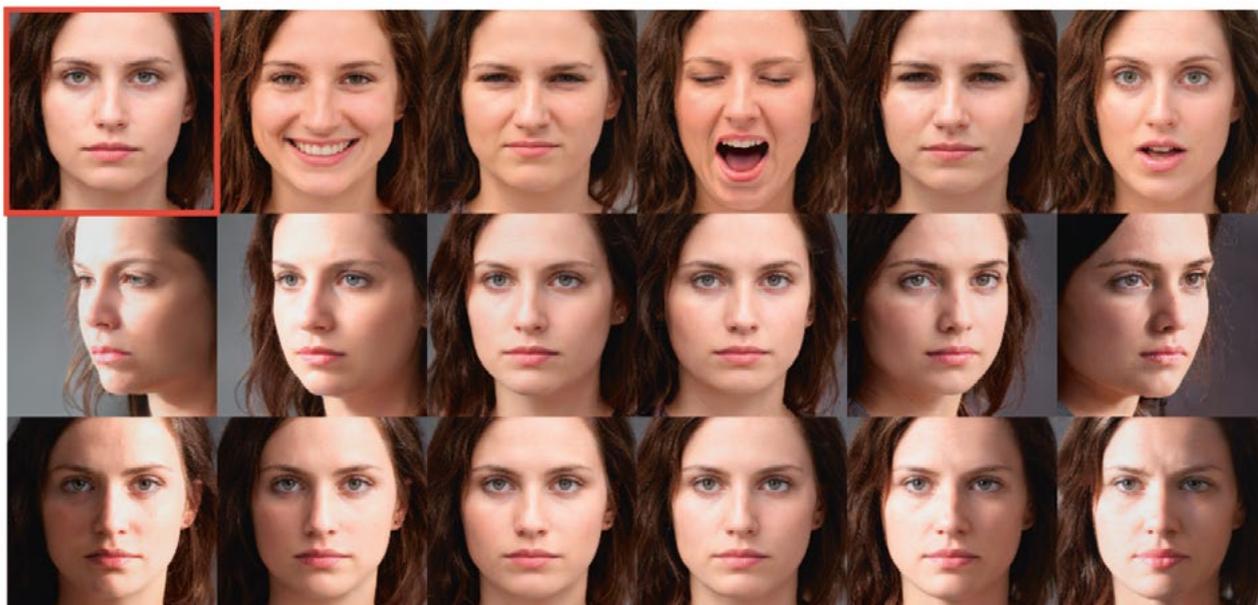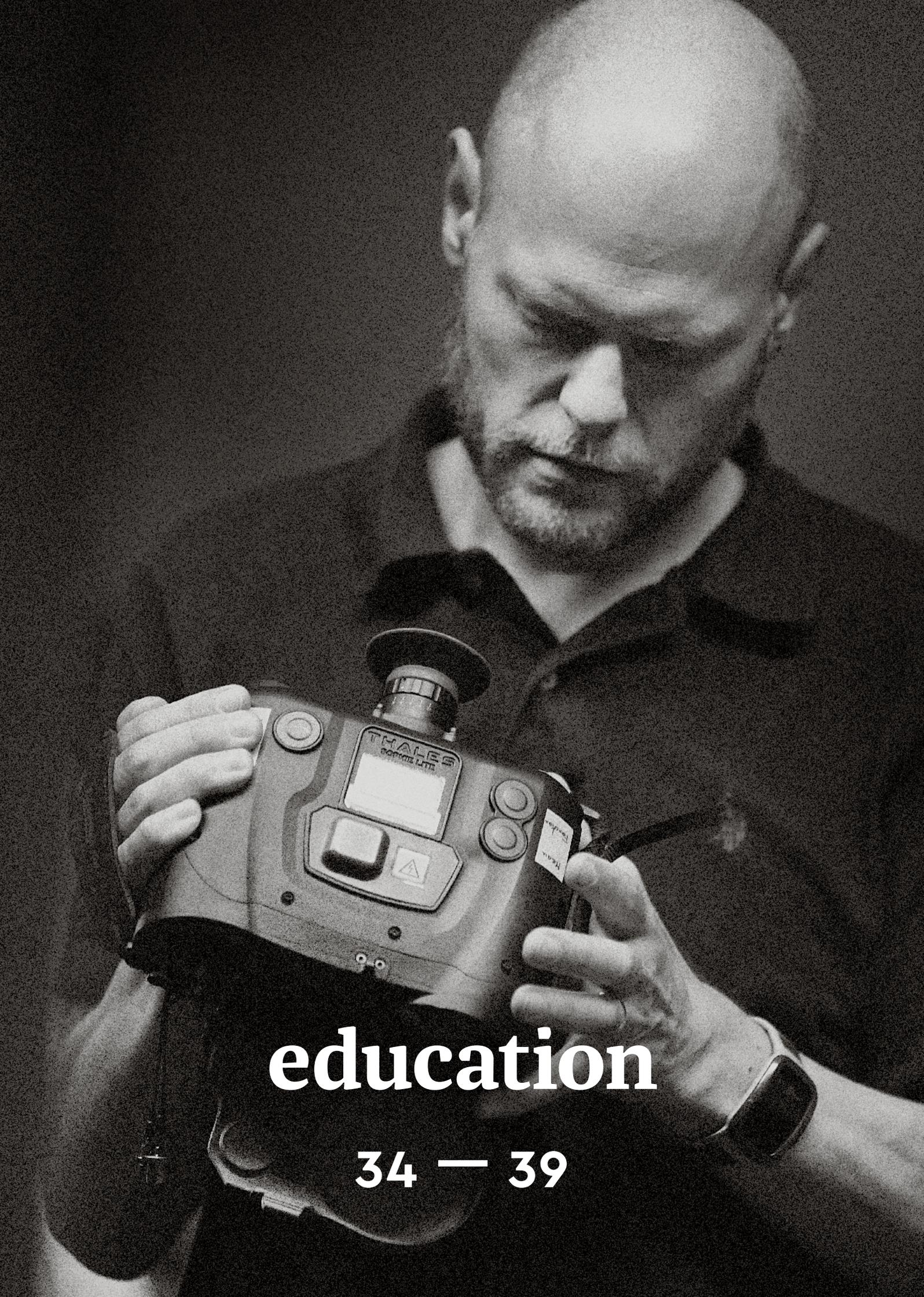
education

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Microscopy: To the heart of the image, thanks to algorithms

Observing ever smaller and smaller entities while maintaining the highest image quality possible requires ever more powerful microscopes, but also computational methods. This is the subject of Olivia Mariani's successfully defended thesis.

O livia Mariani has long been interested in the life sciences and research in biology. After a Master's degree in image processing, microscopy was the next logical step. Mariani looks back with us on her time and her work at Idiap.

What did you work on for your PhD?

My thesis focuses on imaging the heart of the zebra fish. It's a widely used animal model—microscopically small, and transparent. Which means that its heart, which has characteristics very similar to those of a human heart, can be studied in the living animal. Usually, using a microscope to study it gives you layered images, and often deformations, which we refer to as artifacts. Using a faster and thus a more expensive microscope can remedy this. Equally, we can use software to assist the microscope. This second method enables us to obtain better images, and to study fundamental biological processes such as cardiac abnormalities or tissue regeneration. So, as part of my research I developed several computational methods for assembling images of the moving heart in real time. The goal is that labs with slower scanning microscopes get better images without having to invest in a faster instrument.

Did you encounter any difficulties while working on the topic?

Obviously there were challenges. Learning to use the instruments for example. With digital reconstruction, images are obtained from several sensors, and must then be correctly assembled into a complete image. To reconstruct a full heartbeat sequence, it's also necessary to use images acquired over several beats. And you have to be able to identify usable images. Then you have to demonstrate that the reconstruction is successful, by comparing the digitally reconstructed result with an image from a faster microscope. Fortunately, there is such a microscope at Idiap in the lab of Michael Liebling [editor's note: head of the Computational Bio imaging group and Mariani's thesis supervisor].

What accomplishment are you most proud of with regard to your thesis?

To have participated in the creation of a tool that made it out of the lab. When we started there was no software of this kind. Today, our software is freely available to all, on Idiap's website. There are, of course, still some improvements to be made, including data size, and accuracy in the faster heartbeat phases. But it's perfectly applicable for and works very well with a steady rhythm.

How would you describe your years at Idiap?

It was really nice. There are plenty of very competent people there and the latest instruments are available for research. Technical assistance is also very responsive and efficient. And even if the colleagues I interacted with most were those in my own office or on the same floor as me, Idiap organizes activities that allow you to meet and learn more about those colleagues you don't know so well or don't usually see around.

Olivia Mariani. "Computational methods for live heart imaging with speed-constrained microscopes." PhD thesis.

Idiap trains its first apprentices

Inspired by the Swiss apprenticeship system to create its applied Master's in Artificial Intelligence, the Institute has now decided to also train apprentices in the traditional manner. Yana and Mattéo, our first two apprentices, just started at Idiap.

One is pursuing a commercial apprenticeship in the Secretariat and Human Resources team; the other an informatics apprenticeship in the System and Infrastructure group. We met up with them a few days after they joined Idiap.

Why an apprenticeship at Idiap?

Mattéo: On finishing pre-professional school, I had the grades to choose between various different pathways. I finally decided to go with an apprenticeship because Idiap was the most interesting option for me. I'd already heard about the Institute and it was more appealing to me than having only theoretical courses at school.

Yana: It was a bit by chance that I discovered Idiap. A friend of mine forwarded me the ad, but I wasn't sure I would fit here—it's a scientific institute and sciences aren't my strong point. But during a trial placement in early summer I learned what the team was really doing, and I really liked it.

How were your first days at the Institute?

Yana: No surprises—thanks to the placement. My schedule is planned step by step to suit my classes, in economics, accounting, communications, and languages.

Mattéo: I'm not working a lot on computers; I need more theoretical knowledge before I start that. As working hours are flexible, I can help with the IT inventory, visiting the offices when people aren't using their computers.

And the future?

Mattéo: In about four years, I'd like to pass the Swiss secondary school diploma. And why not come back to Idiap? I enjoy working here.

Yana: I'm very excited to come to work, and I can imagine continuing working at Idiap after my apprenticeship.

Two Idiap researchers appointed professors

Lonneke van der Plas, head of the Computation, Cognition & Language research group, has been appointed professor by the University of Malta. Sébastien Marcel, head of the Biometric Security & Privacy research group, has been appointed professor at the School of Criminal Sciences of the University of Lausanne.

A senior lecturer at the University of Malta's Institute of Linguistics & Language Technology since 2014, Lonneke van der Plas has now become an associate professor there, making her Idiap's first female professor. *"Our institutions have a common interest in language technology,"* van der Plas explains. *"Their involvement in languages with relatively few research resources—such as Maltese or Swiss German—is an asset for the development of projects that seek to create tools adapted to these languages, including data labeling tools."* Some languages, even some with millions of speakers, still suffer from a lack of technologies dedicated to them, including orthographic correction. These shortcomings can create biases in favor of dominant languages such as English.

Beyond these common scientific interests, the appointment could strengthen the links between the two institutions with regard to the submission of research projects at the European level. *"This is excellent news for Idiap, and its desire to develop its academic networks and to see its team members in academic roles,"* explains Idiap's director, Hervé Bourlard.

Law and artificial intelligence

Given his numerous collaborations, including research projects and the delivery of Master's in Biometrics courses for the University, the nomination of Sébastien Marcel as a full professor at the prestigious school in Lausanne seems a natural choice. Among the best institutions active in the criminal sciences, the Vaud institution maintains its leading position by appointing a leading specialist in biometrics. *"I am proud to be a professor at the University of Lausanne, and also hope that this will increase the number of collaborative projects between the University and Idiap,"* Marcel explains. *"This coming together could, for example, lead to the creation of a joint laboratory in biometrics applied to the criminal sciences."*

As the School of Criminal Sciences is part of the Faculty of Law, Criminal Sciences and Public Administration of the University, there is also a strong interest in developing collaborations in broader fields, such as artificial intelligence and law. *"Of course, security issues related to biometrics are one aspect of our activities, but there are also obvious privacy issues,"* Marcel observes. *"Personal data is a particularly topical issue, and one that needs to be addressed from both a technical and a legal standpoint."*

Prizes and distinctions

At the end of each year, the Institute awards two honors: the Student Award and the Paper Award. Idiap's 2020 Awards went, respectively, to Parvaneh Janbakhshi and Suhan Shetty.

Parvaneh Janbakhshi joined the Institute in 2018 as a PhD student. During her PhD, she made significant contributions to the field of automated speech disorder analysis thanks to her innovative work. Her publications have been very well received by the research community, as evidenced by positive comments from reviewers and positive feedback at conferences. Parvaneh Janbakhshi is a member of the Speech & Audio Processing research group.

Suhan Shetty received the Idiap Paper Award for his paper, "Ergodic Exploration Using Tensor Train: Applications in Insertion Tasks," in which he demonstrates that robots can remedy limited visual abilities through tactile exploration. Suhan Shetty is part of the Robot Learning & Interaction research group.

The work of other researchers was also recognized:

IEEE James L. Flanagan Award, July 2021
Hervé Bourlard

Best Poster Award during the workshop "Towards Curious Robots: Modern Approaches for Intrinsically-Motivated Intelligent Behavior" at the IEEE International Conference on Robotics and Automation (ICRA 2021), June 2021
Thibaut Kulak

Best PhD Award at EUSIPCO 2020, January 2021
Ina Kodrasi

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Parvaneh Janbakhshi

Suhan Shetty

Theses completed

8 students published their theses in 2021.

Novel Methods for Incorporating Prior Knowledge for Automatic Speech Assessment

Pavankumar S. Dubagunta

Deep Learning Approaches for Auditory Perception in Robotics

Weipeng He

Learning Strategies and Representations for Intuitive Robot Learning from Demonstration

Thibaut Kulak

Computational Methods for Live Heart Imaging with Speed-Constrained Microscopes

Olivia Mariani

Efficient Depth-Based Deep Learning Methods for Multi-Party Pose Estimation

Angel Martínez-González

Modeling and Inferring Attention between Humans or for Human–Robot Interactions

Remy Siegfried

Gradient-Based Methods for Deep Model Interpretability

Suraj Srinivas

Explainable Phonology-Based Approach for Sign Language Recognition and Assessment

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