Strategic Focus Area
Personalized Health and Related Technologies

Swiss Personalized Health Network
SPHN

National Data Streams
Data analysis partners catalog

02.07.2021

Contents

Personalized Health and Related Technologies PHRT
CLP | Clausiusstrasse 45
CH-8092 Zürich
phrt-office@ethz.ch | www.sfa-phrt.ch

Swiss Personalized Health Network SPHN
Haus der Akademien | Laupenstrasse 7
CH-3001 Bern
nds@sphn.ch | www.sphn.ch
A project of SAMW and SIB

Institute for Medical Informatics, BFH; MIDATA Cooperative (S. Bignens and S. Napolitano)

Name and affiliation

Institute for Medical Informatics I4MI, Bern University of Applied Sciences BFH, Prof. Serge Bignens

MIDATA Cooperative, Zurich, Stefano Napolitano

Contact person

Serge Bignens: serge.bignens@bfh.ch

Stefano Napolitano: stefano.napolitano@midata.coop

Short description of the portfolio and available skills/services

Structured data acquisition, dynamic and granular consent management, secured data storage, data protection and GDPR compliance, FAIR principles, integration of mobile health applications (FHIR API), identity management (OAuth 2.0), collection of patient reported outcome measures (PROM), aggregation on user level of multi-modal data, data Anonymization/Pseudonymization, study management, interfaces with clinical information systems, interface to national electronic patient record (EPR), interfaces for data exchange with BioMedIT secure infrastructure, co-applicant and member of SPHN, PHRT and SDSC projects.

Further info at: www.midata.coop

Swiss Data Science Center (F. Perez-Cruz)

Name and affiliation

Swiss Data Science Center (EPFL, ETH Zurich and PSI)

Contact person

Fernando Perez-Cruz <Fernando.perezcruz@sdsc.ethz.ch>

Guillaume Obozinski <guillaume.obozinski@epfl.ch>

Short description of the portfolio and available skills/services

The Swiss Data Science Center has a team of experience data scientists working on machine learning, statistics, optimization and signal processing and we have cooperated with over 70 groups in 50+ projects across all domains. We would like to have this opportunity to present the kind of work that SDSC can do for the projects that would be submitted for this call and see if there are ways in which our scientists can work with the different consortia.

Institute for Data Science (I4DS), FHNW (S. Suter)

Name and affiliation

Institute for Data Science (I4DS), FHNW

Contact person

Prof. Dr. Susanne Suter, susanne.suter@fhnw.ch

Short description of the portfolio and available skills/services

The I4DS has broad experiences and expertise from around 50 employees in the fields of complex algorithmic problems, machine learning and deep learning. In collaboration with companies, the I4DS has successfully carried out CTI, Innosuisse, SNF and other projects with a focus on algorithms and machine learning.

Prof. Dr. Susanne Suter is building up an applied research group at the I4DS around “data-driven predictive systems” with a focus on MedTech applications analyzing sensor data and images. Suter has worked as a computer scientist with data processing, data prediction and data analysis in numerous bio-medical application projects with a high degree of innovation since 2003, both in research and private industry.

Services to offer:

- Data-driven predictive system development using machine learning or deep learning
- Data quality analysis
- Fast data streaming in real-time
- Explainable artificial intelligence approaches
- Prototype development
- Image and sensor data
- MedTech applications
- Software as medical device compliance analysis for learning-based applications
- Innosuisse or other third-party-funded collaborations
- Student projects

Center for Data Analytics (CeDA), University of Basel (I. Dokmanić)

Name and affiliation

Center for Data Analytics (CeDA) at the University of Basel

Contact person

Geoffrey Fucile, geoffrey.fucile@unibas.ch

(presentation at the workshop by Prof. Ivan Dokmanić)

Short description of the portfolio and available skills/services

CeDA is a scientific support unit which specializes in statistical modeling, machine learning, artificial intelligence, and data visualization. Our team has expertise in molecular life sciences (*omics), signal processing and networks, as well as natural language processing and other applications of deep neural networks.

Institute of Interactive Technologies, University of Zurich (A. Çöltekin)

Name and affiliation

Human Computer Interaction, Visualization and Extended Reality unit, Institute of Interactive Technologies, UAS NW (FHNW) Switzerland

Contact person

Prof. Dr. Arzu Çöltekin (http://coltekin.net/arzu/), arzu.coltekin@fhnw.ch

Short description of the portfolio and available skills/services

I lead both SNF and Innosuisse funded research projects on data-driven personalized health. Our team has research experience, data science (statistics, machine learning), graphics/visualization, human computer interaction and programming expertise.

Institute for Medical Technology and Medical Informatics, FHNW (D. Brodbeck)

Name and affiliation

University of Applied Sciences and Arts Northwestern Switzerland (FHNW), Institute for Medical Engineering and Medical Informatics, Research Group ”Medical Decision Support Systems”

Contact person

Prof. Dr. Dominique Brodbeck, dominique.brodbeck@fhnw.ch

Short description of the portfolio and available skills/services

Data can only play an important role for medical decisions if it is accessible to users – patients, doctors, or researchers/planners. Our group specializes in the design, implementation, and maintenance of medical decision support systems.

Our focus is on making data accessible through highly-interactive, data-rich, and visual applications. Our skills range from data wrangling/cleaning, to analysis, information architecture & visualization. Based on a user-centered approach, we design, implement and maintain applications that foster exploratory data analysis.

Our team consists of experienced visualization specialists and software developers, who have a track record of successfully completed software projects in the realm of medical informatics. Our portfolio ranges from traditional desktop applications (Windows, MacOS, or Linux), to mobile apps (iOS or Android), to web applications that run in any browser.

Selected projects:

- Visual analysis of patient flows on a hospital campus (linked views: organization, time, feature space, physical space (3D))

- Interactive visualization tool for large-scale heterogeneous time series (discrete log events, continuous high-frequency values, time intervals)

- Animated time-lines for workflow optimization in radiology operations

- User interface to access live data streams from bedside-monitors and clinical information systems in the ICU (intensive care unit)

AMIS Plus – Swiss Myocardial Infarction Network (T. Lüscher)

Name and affiliation

AMIS plus consortium of 28 Swiss hospitals involved in the acute management of myocardial infarction.

Contact person

Professor Thomas F. Lüscher cardio@tomluescher.ch, University of Zurich

Short description of the portfolio and available skills/services

Acute myocardial infarction (AMI) and its complications such as heart failure, arrhythmias and sudden death remain the most important cause of morbidity and mortality in Switzerland. The state-of-the-art management is primary percutaneous coronary intervention (PCI), but as important is secondary prevention with antiplatelet and lipid-lowering drugs and novel therapeutic strategies under investigation. AMIS Plus involves 28 hospital throughtout Switzerland that treat patients with AMI and documented 280 parameters of such patients including in-hospital outcomes and in part 1-year follow-up. The registry has recruited 65'000 patients over two decades and is partly funded by the BAG and by industry. Overall is underfunded to allow for high quality data as is standard in the UK and Scandinavia. The registry is run by a steering committee of 18 academic cardiologists, a quality officer and a professional data center with 7 part-time employees (see www.amis-plus.ch). The members have published extensively over the years and currently focus on artificial intelligence with an experienced research team to personalize outcomes based on the wealth of data using validated algorhythms and as a tools for future interventional trials (research committee). To assess, document and improve outcomes of AMI should be a major focus in Switzerland.

Swiss Multi-Omics Center (SMOC), PHRT (P. Pedrioli)

Name and affiliation of the service unit/research group

ETH PHRT Swiss Multi-Omics Center

Contact person (name and email)

Sandra Goetze smoc@ethz.ch; presentation during workshop by P. Pedrioli

Short description of the portfolio and available skills/services

The ETH PHRT Swiss Multi-Omics Center provides a single entrypoint to the services and expertise of the national PHRT centers for Clinical Genomics, Proteomics and Metabolomics.

The center has been designed from the ground up to meet the needs of clinical multi-omics research and provides:

- Matched and harmonized digitization of clinical biospecimens at the level of DNA, RNA, proteins, metabolites, and lipids.
- Standardized workflows for processing of large clinical cohorts.
- Clinical grade DNA and RNA sequencing (ISO 151189 accredited).
- Integration, visualization, and analysis of omics data mapped onto biological networks and pathways.
- Handling of sensitive clinical data according to established SPHN/BioMedIT best practice guidelines.
- Access to a multi-disciplinary team of bench and data scientists to help refine all aspects of the multi-omics project.
- Small scale studies for optimizing clinical cohort experimental design and generating proof of concept data.
- Support in writing the relevant sections of grants and publications.
- Integration with the SPHN/BioMedIT secure IT infrastructure for data lineage tracking, data management, data sharing, secondary and tertiary analysis

Neurocritical Care Unit, University Hospital Zurich (E. Keller)

Name and affiliation

Neurocritical Care Unit, Dept. of Neurosurgery and Inst. of Intensive Care Medicine, University Hospital Zurich

Contact person

Emanuela Keller, Emanuela.keller@usz.ch

Short description of the portfolio and available skills/services

At the Neurocritical Care Unit, University Hospital Zurich the IT infrastructure ICU Cockpit has been established as an integrated IT platform for computer assistance in intensive care and emergency medicine, with a focus on multimodal neuromonitoring. Data from multiple biosensors with a time-resolution of up 500 Hz are systematically collected. Currently, data from more than 1000 patients (more than 8000 patient days, about 500 billion data points). Based on the multimodal data, algorithms for false alarm reduction, automated analysis of EEG (electroencephalography) signals and the prediction of secondary brain injuries have been developed. A graphical user interface (GUI) has been recently designed to display results from algorithms and treatment recommendations at the bedside in the ICU. The models are currently validated in a clinical study.

Research Group Neher, Biozentrum University of Basel (R. Neher)

Name and affiliation of the service unit/research group

Research Group Neher, Biozentrum, Unibas

Contact person (name and email)

Richard Neher, richard.neher@unibas.ch

Short description of the portfolio and available skills/services

Evolution and spread of pathogenic bacteria and viruses. In the past, we have analyzed both intra-host dynamics of infections, as well as the spread of pathogens at the local, national, or global level.

Elevator pitches

1. Swiss Data Science Center – Fernando Perez-Cruz
2. Institute for Data Science, FHNW – Susanne Suter
3. Center for Data Analytics, University of Basel – Ivan Dokmanić
4. Human Computer Interaction, FHNW – Arzu Çöltekin
5. Medical Decision Support Systems, FHNW – Dominique Brodbeck
6. AMIS Plus, University of Zürich – Thomas Lüscher
7. Clinical Proteotype Analysis Center, ETH PHRT – Patrick Pedrioli

1 - Swiss Data Science Center
Fernando Perez-Cruz

SDSC

COLLABORATION FOR NDS WITH SDSC

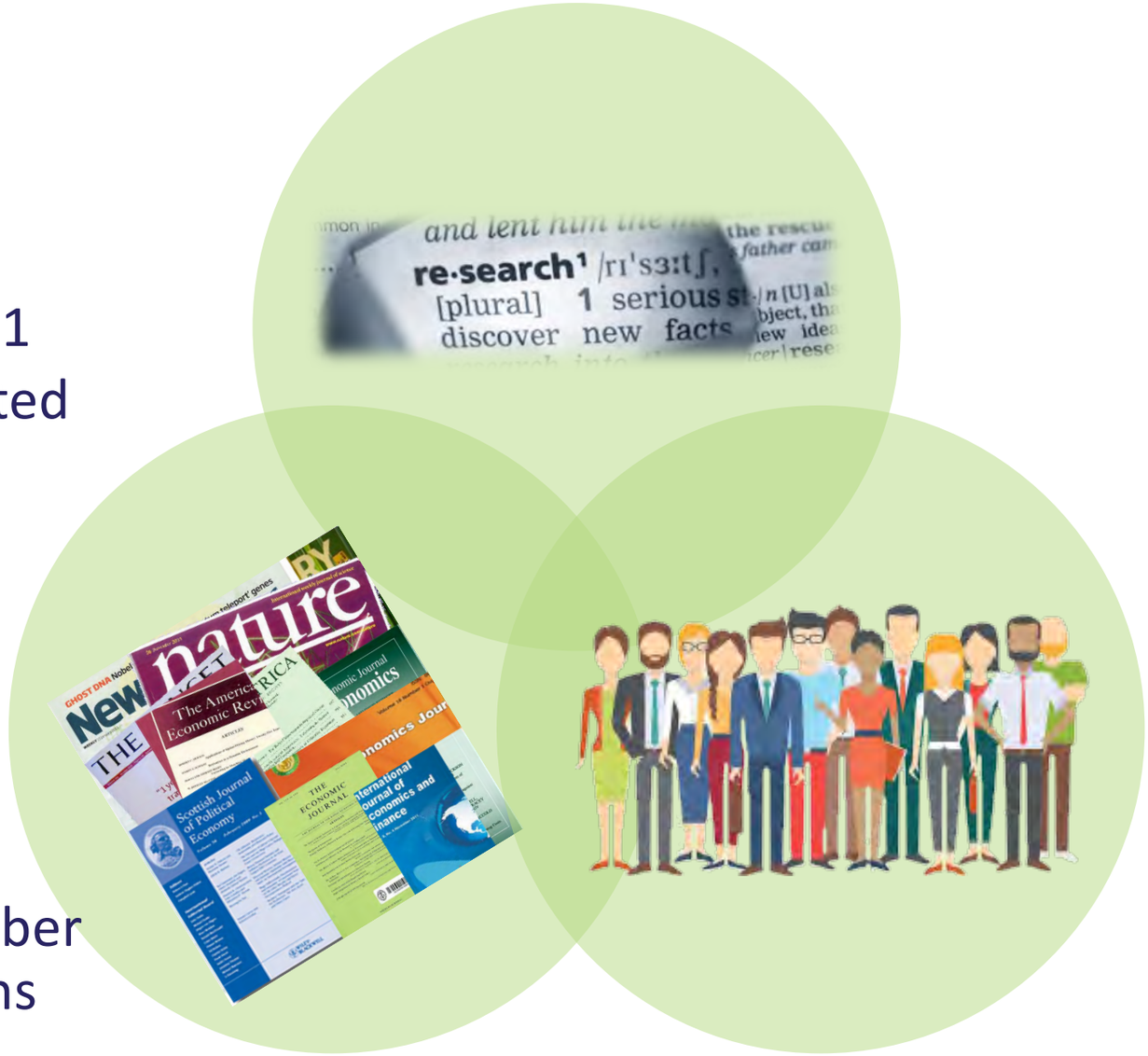
Prof. Fernando Perez-Cruz

Jun 21st 2021

Who We Are at SDSC Academic Team

Projects:

- 51 total
- 15 completed
- 12 to start in 2021
- Over 200 submitted



Increased Number of Publications

A diverse team of 25 people

SDSC

SDSC Expertise and Proposal

- **23 PhDs** with expertise:
  - Machine Learning
  - Statistics
  - Signal Processing
  - Optimization
- **Excellent** interactions with PIs:
  - 30% of PIs engage before submitting a proposal to our call.
  - SDSC is **now** clearly viewed as a **scientific partner**, *not* as a *funding agency*.
- Proposal for **Collaboration**:
  - We can help define the **Data Science** needs for the NDS call.
  - We can become the trusted partner for delivering in the ML modeling and coding.
  - We can co-fund (**50%**) of our data scientist working on these projects.
  - Reach out at: fernando.perezcruz@sdsc.ethz.ch

SDSC

2 – Institute for Data Science, FHNW
Susanne Suter

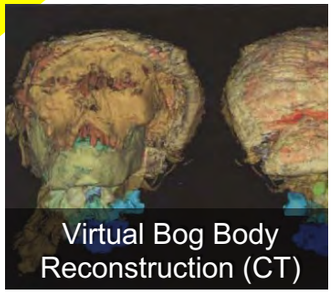
University of Applied Sciences and Arts Northwestern Switzerland

member of swissuniversities

Strategic Focus Area Personalized and Related Technologies

Data-driven Predictive Systems

Prof. Dr. Susanne Suter, susanne.suter@fhnw.ch
Institute for Data Science (I4DS)

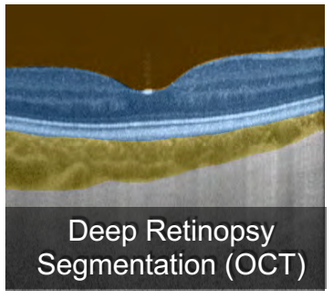

Virtual Bog Body Reconstruction (CT)

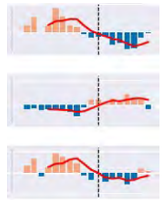
Intensive Care - 24/7 Patient Monitoring

from working with dead patients as a researcher…


Bio-medical Stress Markers (X-rays)

… to working with living patients as software engineer and project manager


Deep Retinopsy Segmentation (OCT)


Wearable Patient Data Processing

… to FHNW starting new MedTech projects as professor

SPHN is a project of SAMW

Universität Zürich

project of ETH BOARD

SCS

UniversitätsSpital Zürich

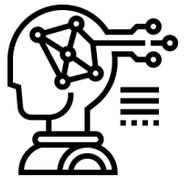
IOB Institute of Molecular and Clinical Ophthalmology Basel

zhaw digital health lab

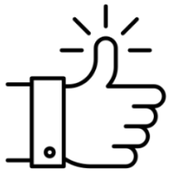
Universitätsspital Basel

Services to Offer by I4DS: Data-driven Predictive Systems in MedTech

- Data science / data preparation / data quality review
- Machine learning / deep learning / explainable artificial intelligence
- Fast data streaming in real-time
- Images and sensor data
- Software as medical device compliance review for learning-based applications



- Third-party-funded collaborations
- Student projects



Prof. Dr. Susanne Suter, susanne.suter@fhnw.ch, FHNW in Brugg-Windisch

3 – Center for Data Analytics, University of Basel
Ivan Dokmanić

CeDA: Center for Data Analytics | SPHN&PHRT, 6/21

What does CeDA do?

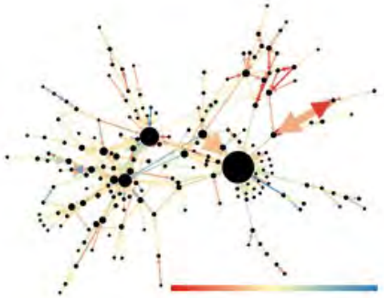
- **enable** cutting-edge **data analytics** across the UniBas ecosystem
- seize transdisciplinary data-enabled opportunities as a **partner in research**

Why is CeDA here?

- we are interested in being the **data partner** on proposals
- a triple win: for the consortium (stronger proposal), for the analyst (embedded with data nerds but working with domain experts), for CeDA (expanding portfolio, assimilating new expertise)

Women's Brain Project

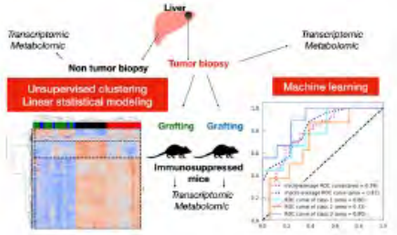
Towards precision medicine: unravelling sex differences



Politics in the era of social media: NLP and network analysis

Estimating education and skill requirements from job ads

Insights into interviews from family-based healthcare interventions



High-dimensional classification of liver cancer immunity phenotypes

Contact: Dr. Geoffrey Fucile – CeDA coordinator – geoffrey.fucile@unibas.ch

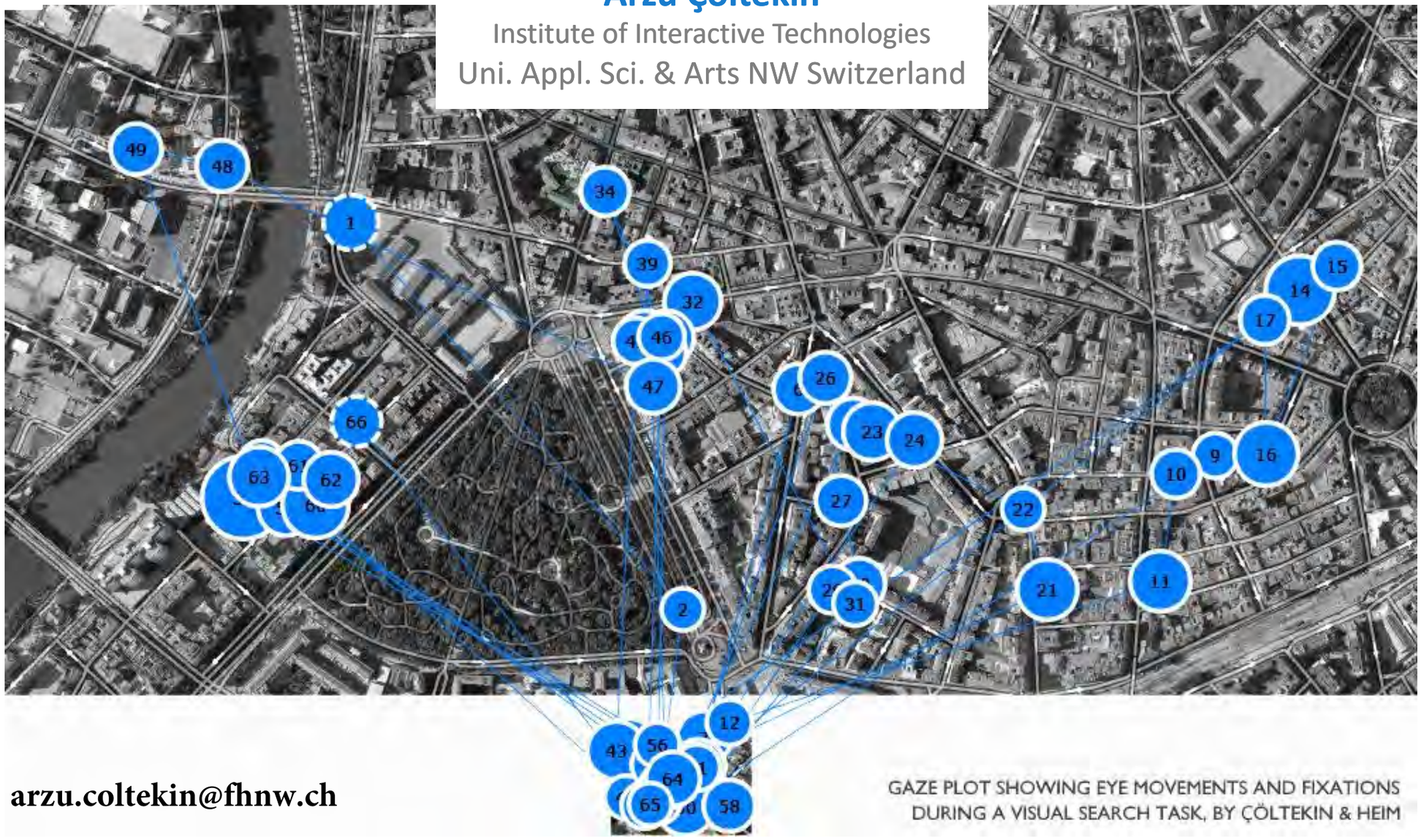
Universität Basel

4 – Human Computer Interaction, FHNW
Arzu Çöltekin

21st of June 2021

Personalized health research

Arzu Çöltekin
Institute of Interactive Technologies
Uni. Appl. Sci. & Arts NW Switzerland

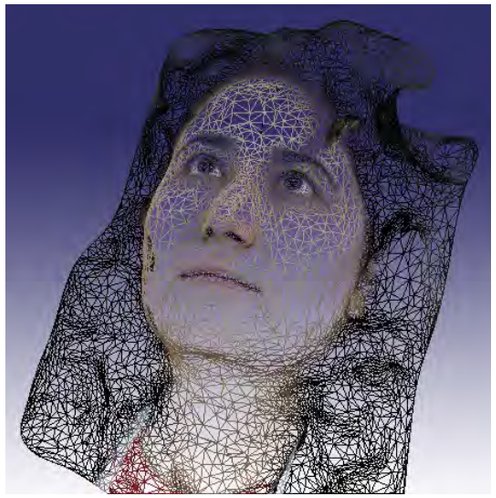


GAZE PLOT SHOWING EYE MOVEMENTS AND FIXATIONS DURING A VISUAL SEARCH TASK, BY ÇÖLTEKIN & HEIM

arzu.coltekin@fhnw.ch

About me

- Professor of Computer Science
  Human-Computer Interaction & Extended reality
  University of Applied Sciences & Arts
  Northwestern Switzerland ($\mathbf{n}|w$)



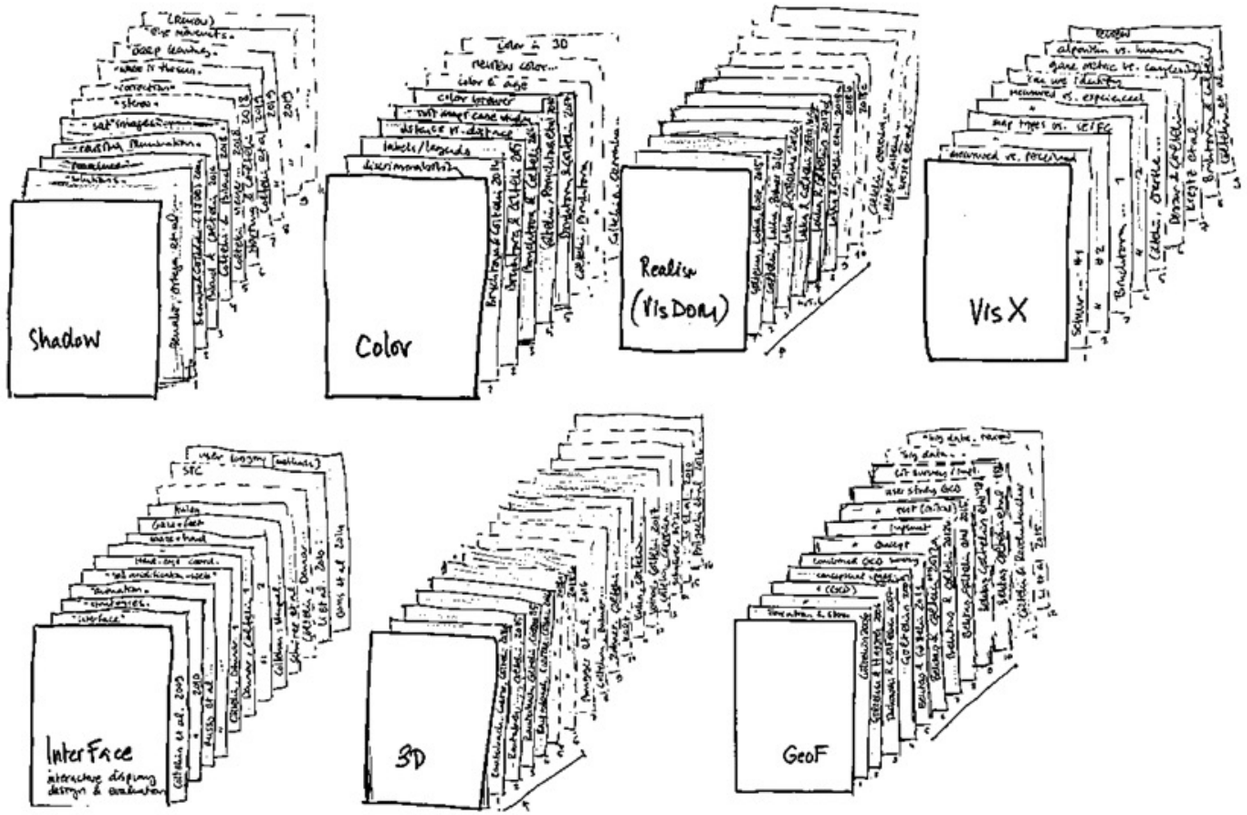
Empirical data collection and analysis, hypothesis testing, machine learning/AI

Strong interest in vision research (eye movements), aging and cognitive health (visual and spatial memory, learning)

Overview of research projects

Çöltekin & team

UZH projects, most still active



FHNW projects

VR as labs in education

CollabMR
Spatial decision making with XR displays

MR/serious games / CUIs for prediction, prevention & rehabilitation age-related cognitive issues (POCD)

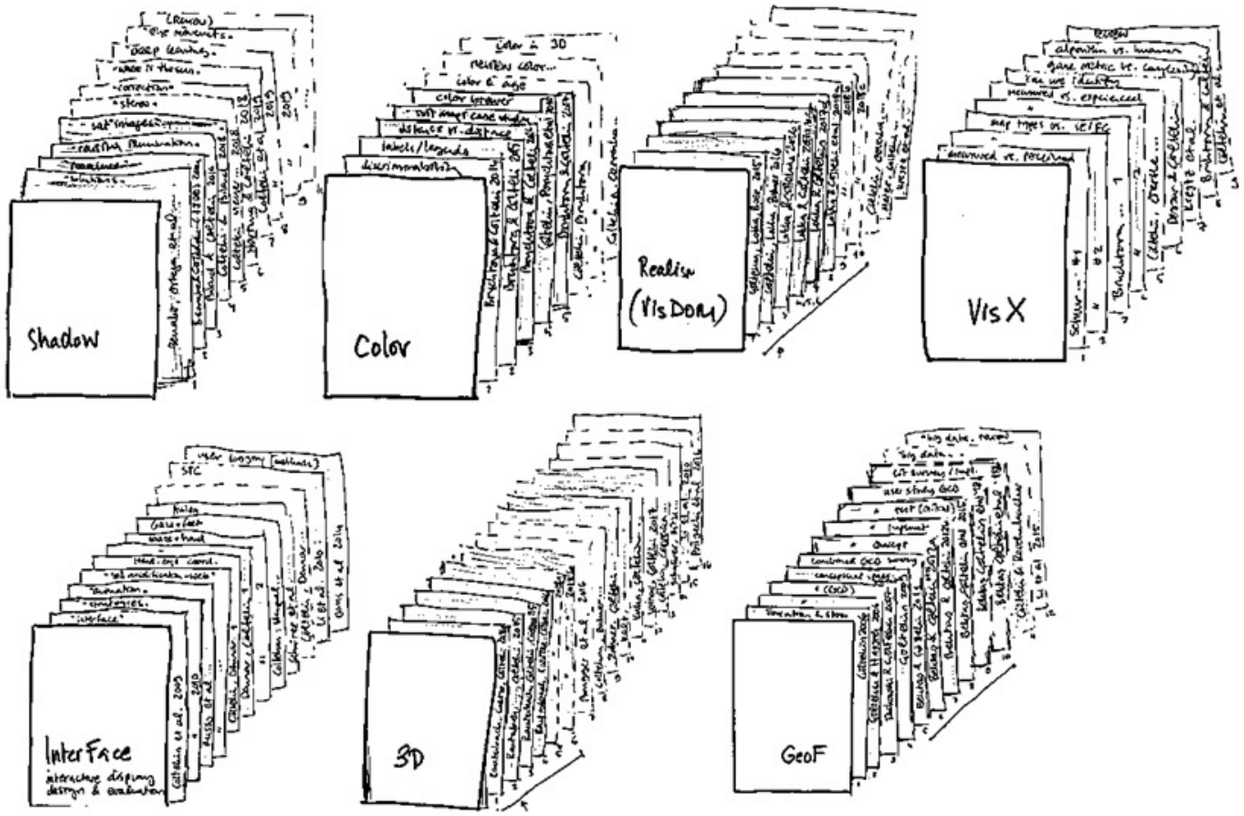
+8 smaller funded projects:

- Traffic
- XR content
- Smart cities
- Interface
- VR for ML
- POCD Brazil
- Chronic care

Image2XR
automation of XR content creation & perceptual examination of visual quality

Overview of research projects

Çöltekin & team



UZH projects, most still active

FHNW projects

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Image2XR
automation of XR content creation & perceptual examination of visual quality

Virtual trainer

Team

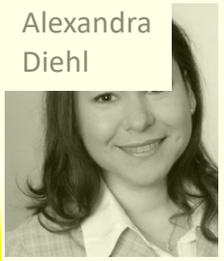
Post-docs


Alzbeta Brychtová


Guiseppe Marbach


Marin Tomasic


Agnieszka Wilk


Alexandra Diehl


Ugo Molteni


Leticia Moguel


Martin Lacayo

PhD graduates


Alzbeta Brychtová


Victoria Rautenbach


Tommy Burke

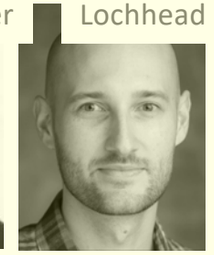

Kenan Bektaş


Ismini Lokka

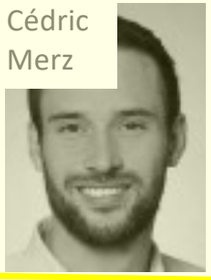
Current PhD candidates

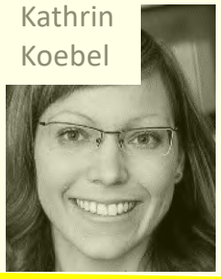

Alireza Amiraghdam


Raimund Schnurer


Ian Lochhead

Collaborators


Cédric Merz


Kathrin Koebel


Joelle Keller


Alex Schneiter


Cloe Huesser


Louis Baumgartner

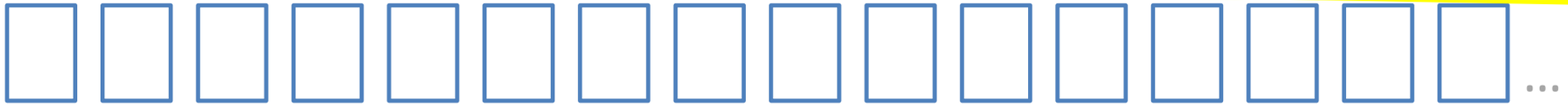

Madhumitha Murali


Thierry Figini


Daniel Vegh


Marco Burri


Fernando Millan



40+ MSc projects, other collaborators

Our health & HCI projects

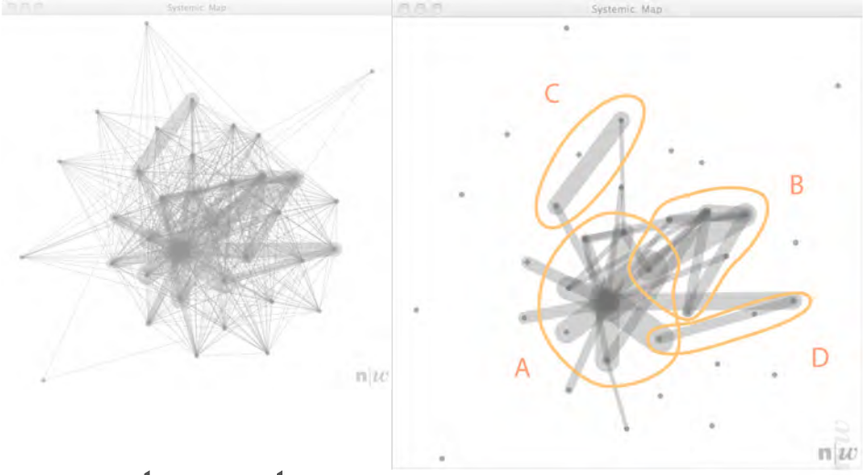
- Querying and visualizing electronic health records
  - Innocheque project (completed)
- Predicting, preventing and rehabilitating ‘POCD’ (post-operative cognitive dysfunction)
  - Innosuisse project (active), Partners: Altoida AG., Hirslanden Clinic
    - Additional funding: Seed Money Latin America & Switzerland collaboration
- Chronic care, digital humans as virtual assistants / companions
  - Innocheque project (active)
- Virtual trainer
  - MSc project (active), Innocheque/Innosuisse project planned
- Visual health (incoming)
  - Adaptive display based on eye movements, eye movement analysis


Thank
you

5 – Medical Decision Support Systems, FHNW
Dominique Brodbeck

Fachhochschule Nordwestschweiz

available ≠ **usable**



Make data usable through **highly-interactive**, **data-rich**, and **visual** applications

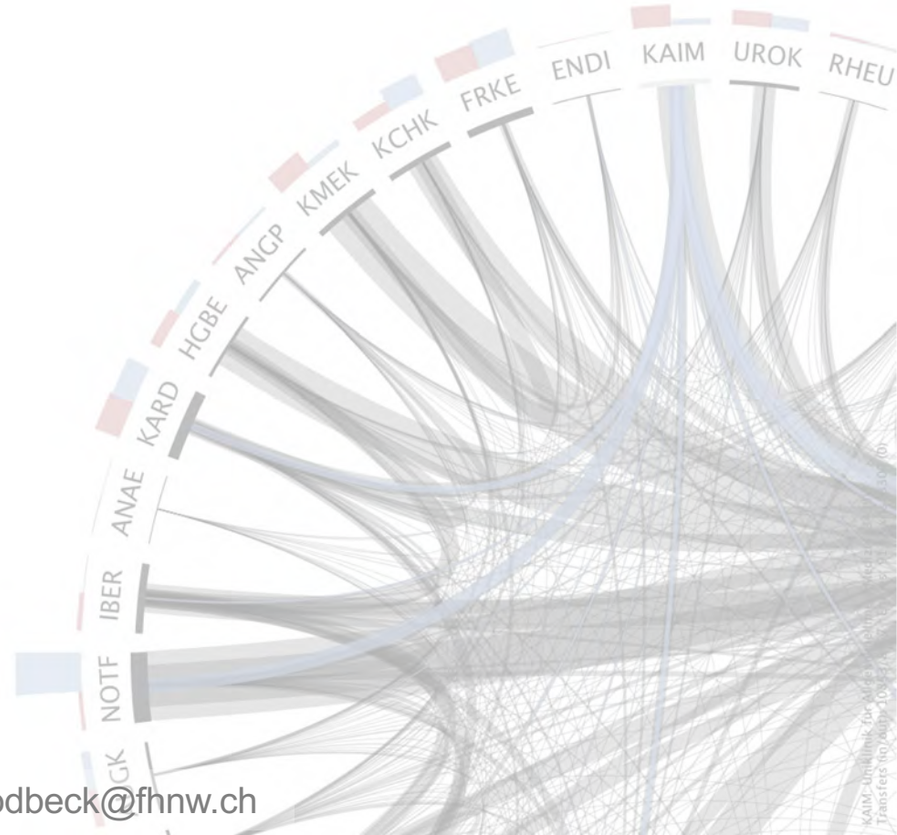
Design and implementation of medical decision support systems

Skills:

Visual analytics, information architecture, data wrangling, software engineering

Team:

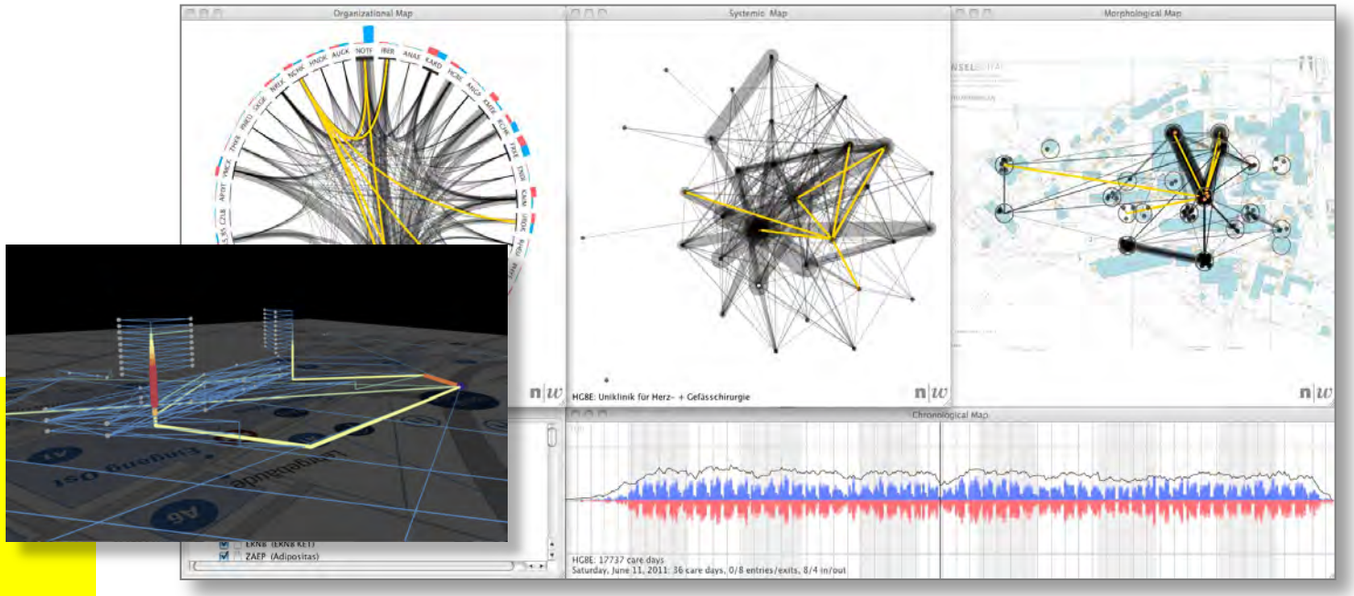
Experienced **visualization specialists** and **software developers**, who have a track record of successfully completed software projects in the realm of **medical informatics**



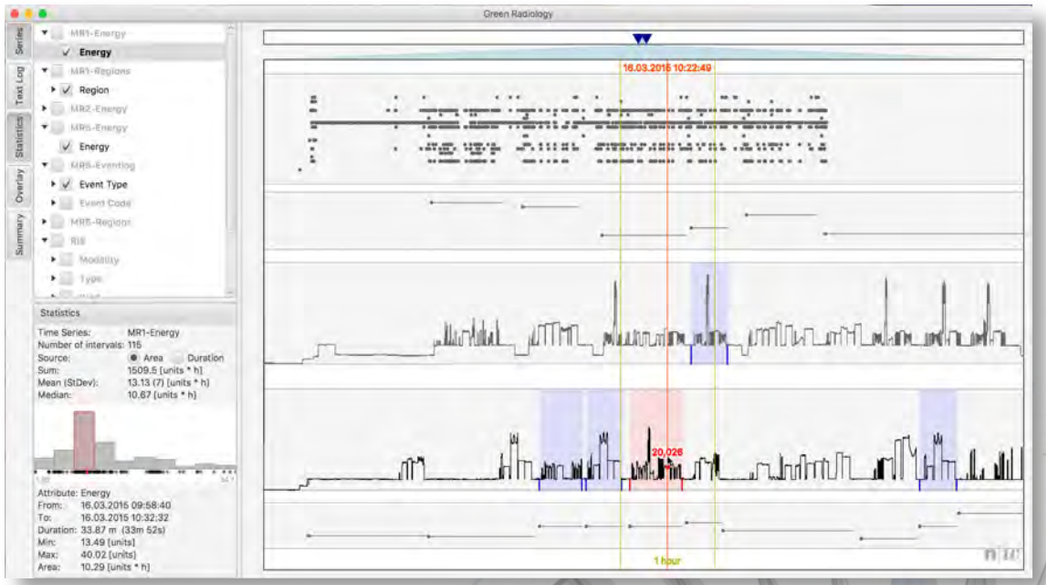
School of Life Sciences, Institute for Medical Technology and Medical informatics, Contact: dominique.brodbeck@fhnw.ch

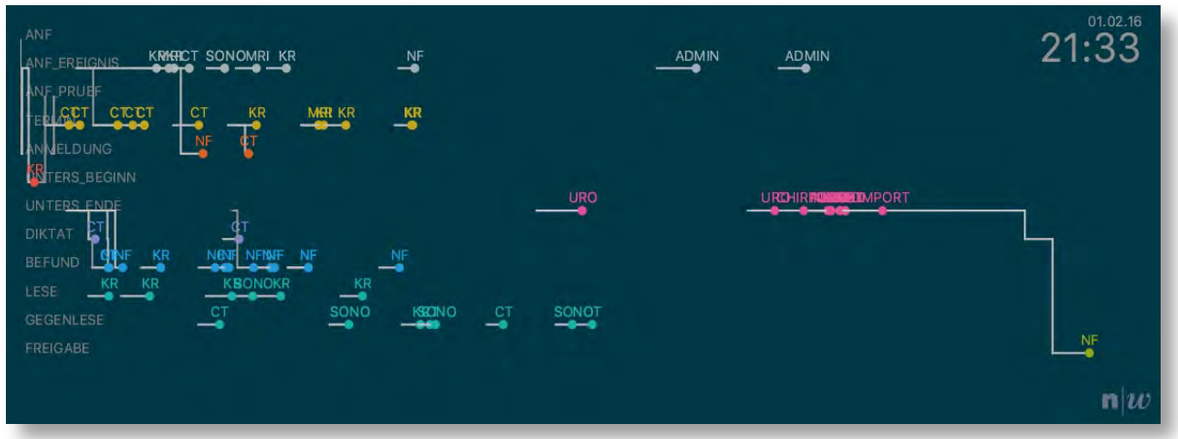
Fachhochschule
Nordwestschweiz

Visual analysis of patient flows on a hospital campus



Interactive visualization tool for large-scale heterogeneous time series





Animated time-lines for workflow optimization in radiology operations

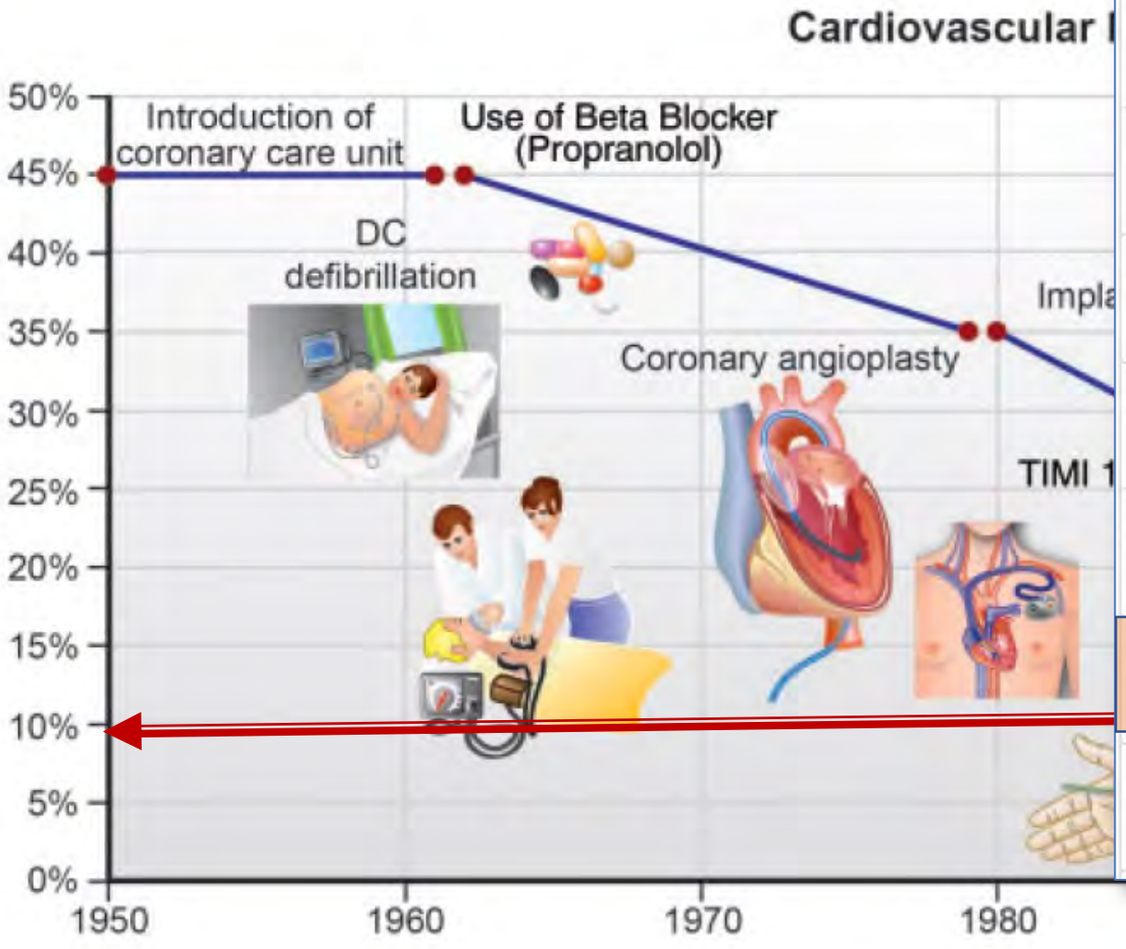
User interface to access live data streams in the ICU

School of Life Sciences, Institute for Medical Technology and Medical informatics, Contact: dominique.brodbeck@fhnw.ch

6 – AMIS Plus, University of Zürich
Thomas Lüscher

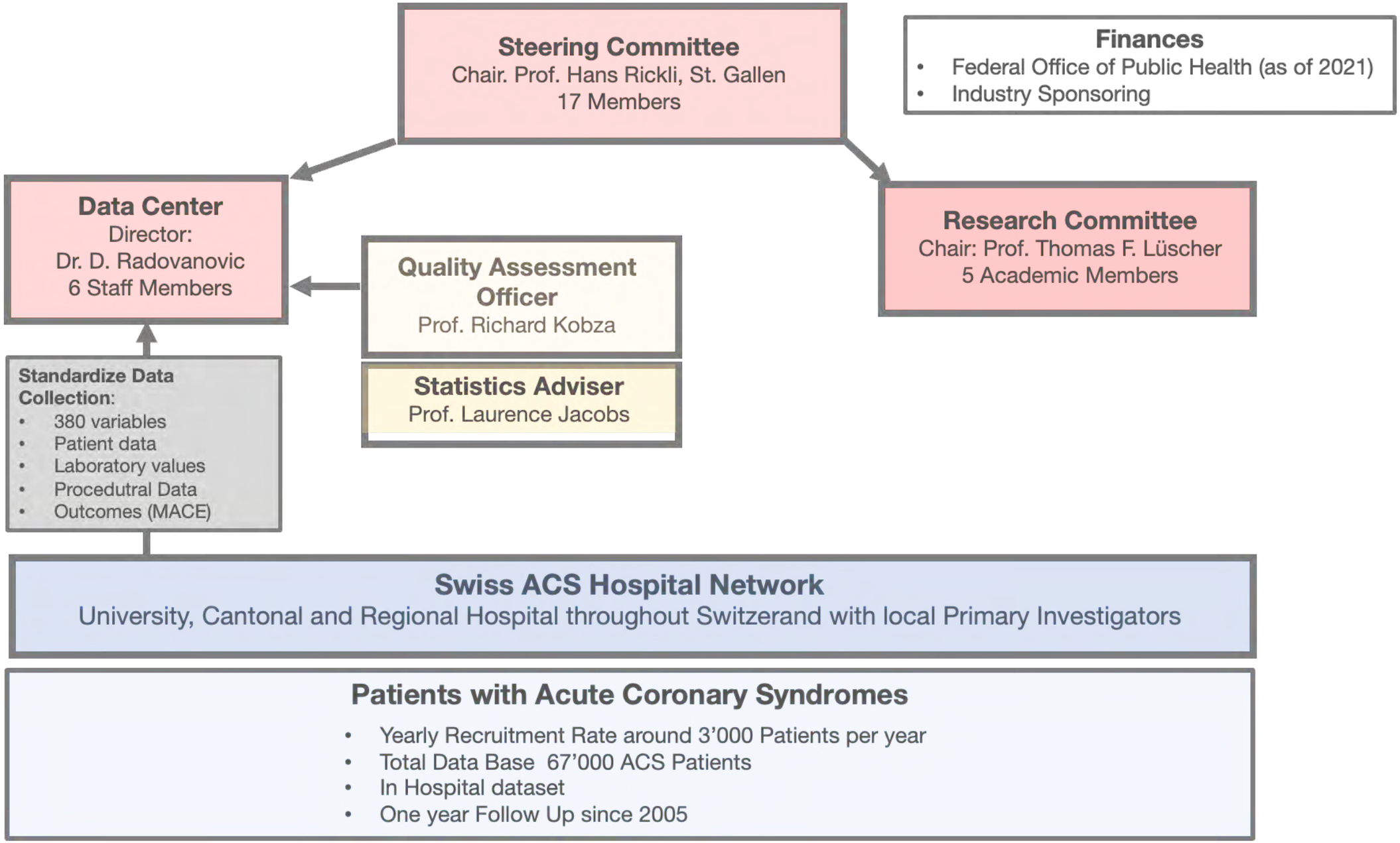
AMIS Plus – Swiiss Myocardial Infarction Newtwork

- Acute myocardial infarction (AMI) has, untre
- The management of AMI has made impress
- However, there remainns a 10% mortality a

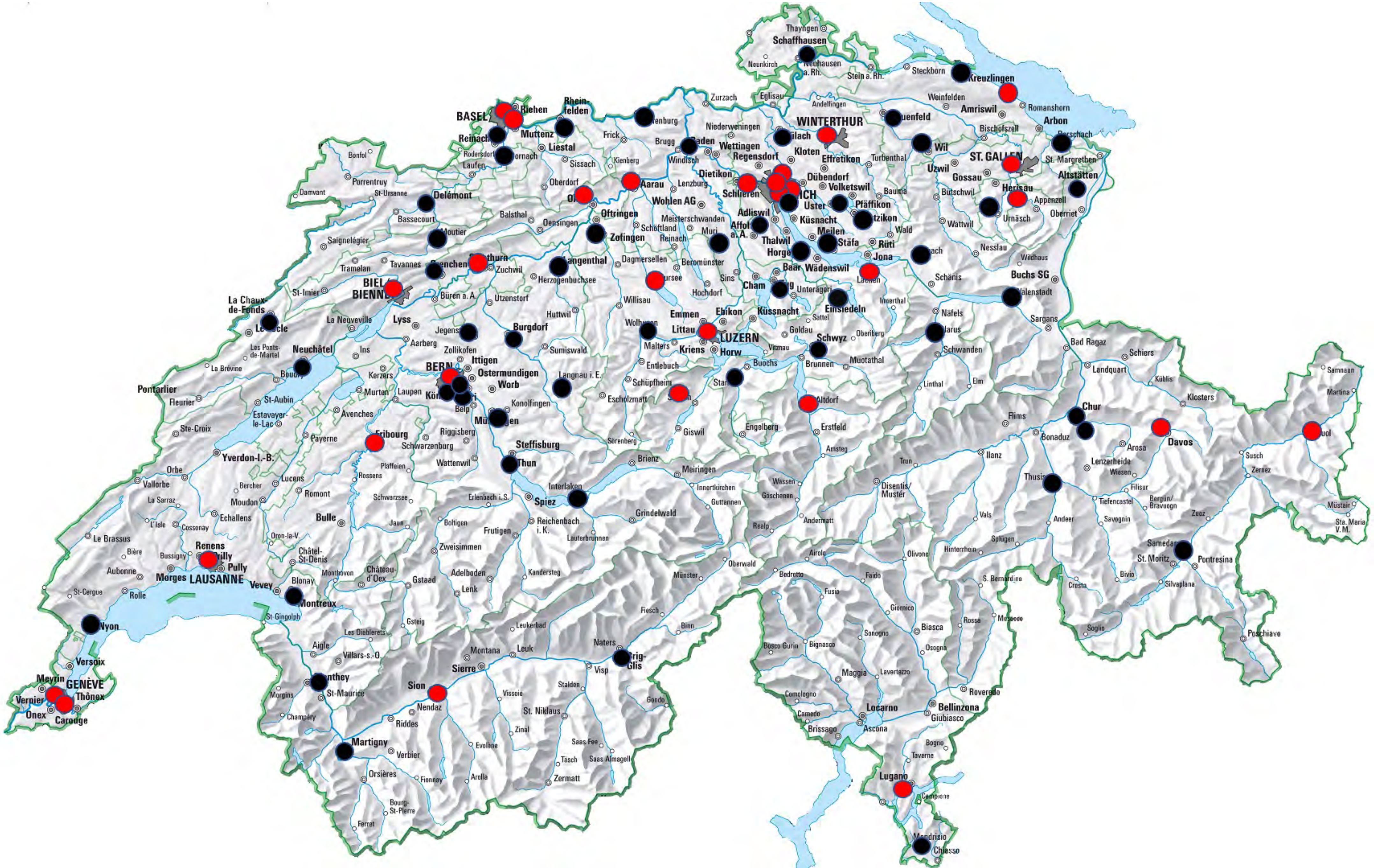


2018	Sterbefälle		Sterberate[1]	
	Männer	Frauen	Männer	Frauen
Alle Todesursachen	32 398	34 690	492,1	344,4
Infektiöse Krankheiten	374	432	5,6	4,0
› Krebserkrankungen insgesamt	9 545	7 815	149,1	101,1
Diabetes mellitus	574	578	8,3	5,1
Demenz	2 004	4 450	26,3	33,5
› Herz-Kreislauf-Erkrankungen	9 418	11 178	134,6	91,4
Atemwegserkrankungen insgesamt	2 395	2 228	33,8	21,1

AMIS Plus – Swiss Myocardial Infarction Newtwork



AMIS Plus – Swiss Myocardial Infarction Newtwork



Steering Committee
Chairman
17 members
Safety Officer

Data Center
Director
6 Staff

Partners
6 Univerversity Hospital
78 Regional Hospital

Patients
3’000 patients per year
65’000 patients total

Data sets
380 variables
In hospital outcome
1 year outcome

Strategic Focus Area
Personalized Health and Related Technologies

Swiss Personalized Health Network

7 – Clinical Proteotype Analysis Center, ETH PHRT

Patrick Pedrioli

Strategic Focus Area
Personalized Health and Related Technologies

ETH PHRT Swiss Multi-Omics Center

PHRT Swiss Multi-Omics Center

PHRT Clinical Omics Centers

Genomics
CGAC
Clinical Genomic Analysis Center

Proteotyping
CPAC
Clinical Proteotype Analysis Center

Metabolomics & Lipidomics
CMAC
Clinical Metabolomics Analysis Center

Measure

Single entry point for digitizing your clinical cohorts at the level of DNA, RNA, Proteins, Metabolites and Lipids

Integrate

Integrated FAST track and DEEP track analysis of multi-omics data

Analyze

Delivering molecular insights supporting publications and clinical decision making

Share

FAIR sharing of primary and derivative data based on ethical consent

GETTING THE MOST OF YOUR CLINICAL SAMPLES

Single entry point for integrated multiomic analysis.

MOLECULAR INSIGHTS INTO CLINICAL COHORTS

Standardised and automated processing of large clinical cohorts.

SAFE DATA STORAGE AND EXCHANGE

Handling of sensitive clinical data according to established SPHN/BioMedIT guidelines.

CONSULTANCY

We will find together the right strategy for digitizing and analizing you clinical samples.

FEASIBILITY STUDY

Small scale studies for optimizing clinical cohort experimental design and generating proof of concept data.

SUPPORT WITH GRANT AND PAPER WRITING

We will provide relevant text snippets supporting grants and publications.

One entry point, three centers with expertise across the value chain. Scalable production and analytics.

Strategic Focus Area
Personalized Health and Related Technologies

Fit for National Data Streams

Clinical Grade

Clinical research is all we do

Clinical grade sequencing (ISO 151189 accredited)

At scale

Designed to handle large the sample cohorts required for clinical research

Secure

Built on a secure foundation to keep sensitive clinical data safe, secure, and private

Interoperable

Our data and pipelines are standardized, harmonized and re-usable

We work with SPHN/BioMedIT to ensure technical alignment

Sharing ready

Onboarded into SPHN/BioMedIT secure IT infrastructure for controlled FAIR sharing, secondary and tertiary data analyses

Eligible

We are ETH domain infrastructure and eligible for PHRT/SPHN funds

SMOC is your partner for molecular profiling of clinical biospecimens on the DNA|RNA|Protein|Metabolite|Lipid multi-omic level

http://smoc.ethz.ch

smoc@ethz.ch