



InfraVis

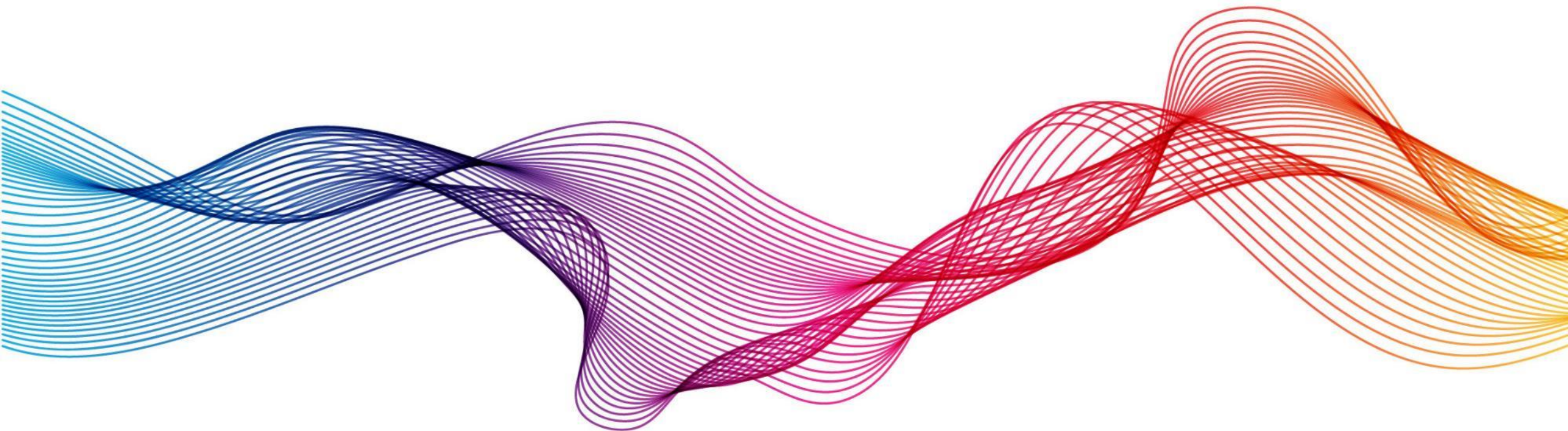
National Research Infrastructure for Data Visualization

SND Presentation – Webinar
2023-10-27





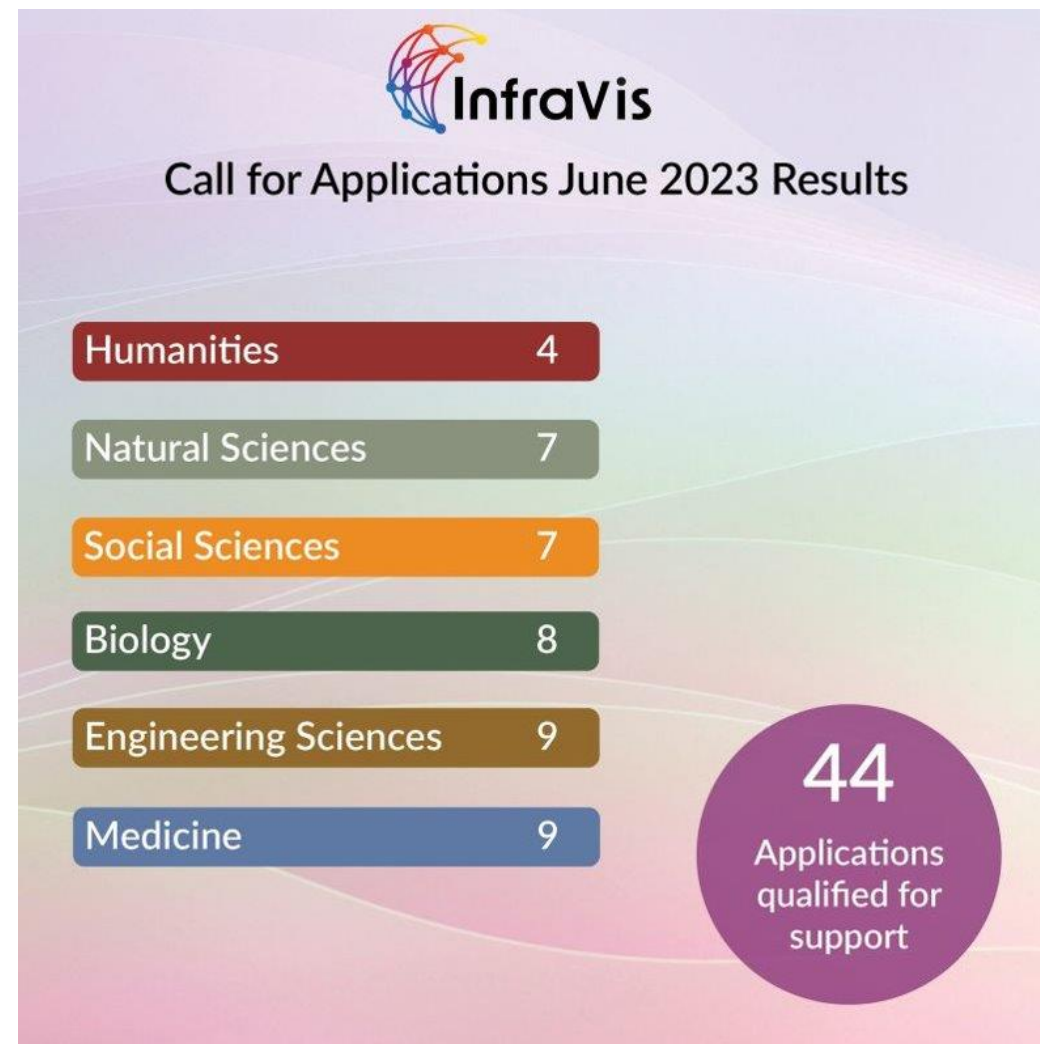
Scientific Discovery Through Visualization Support



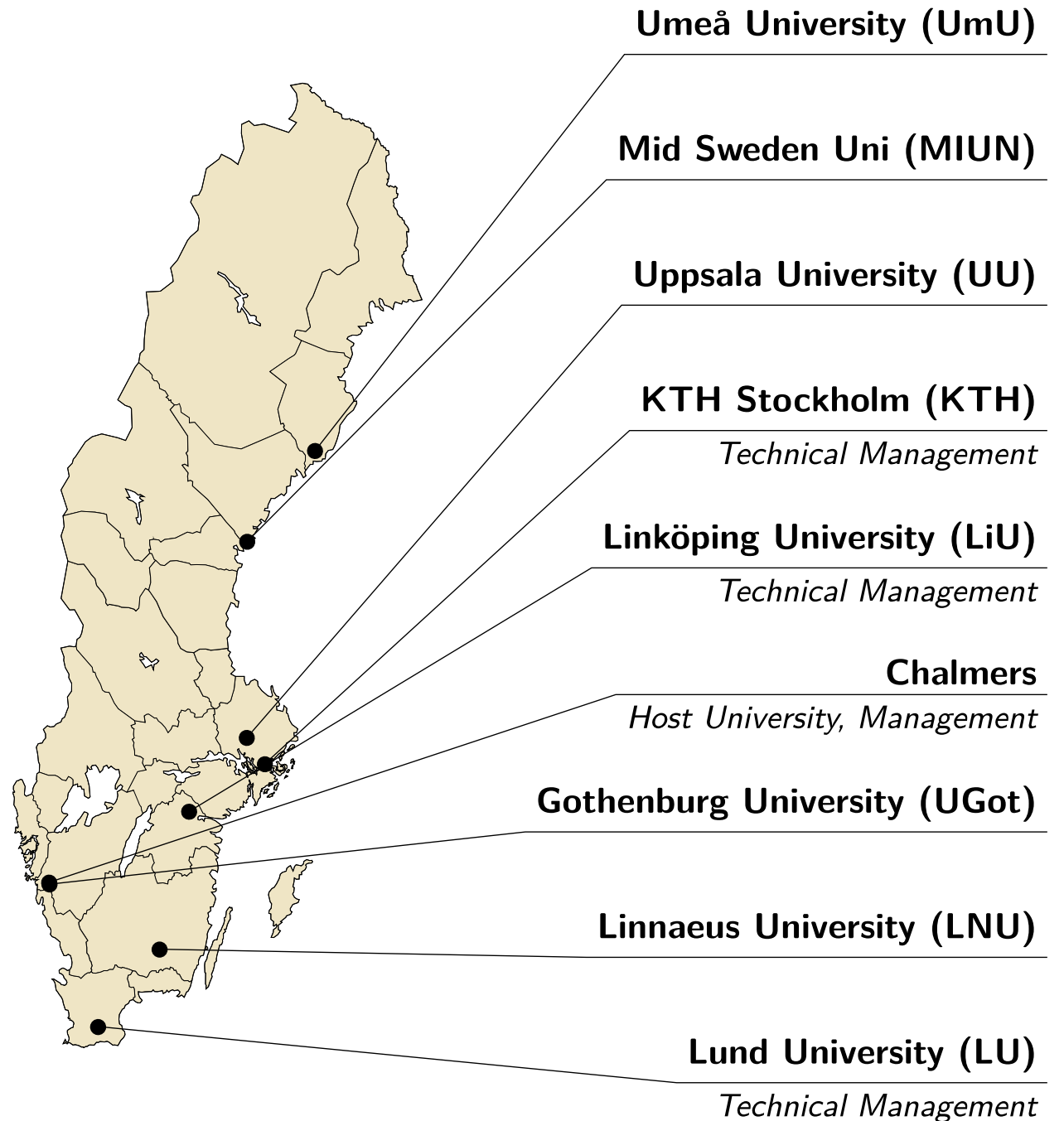
National Research
Infrastructure
for Data Visualization



June 2023 CALL FOR PARTICIPATION OUTCOME

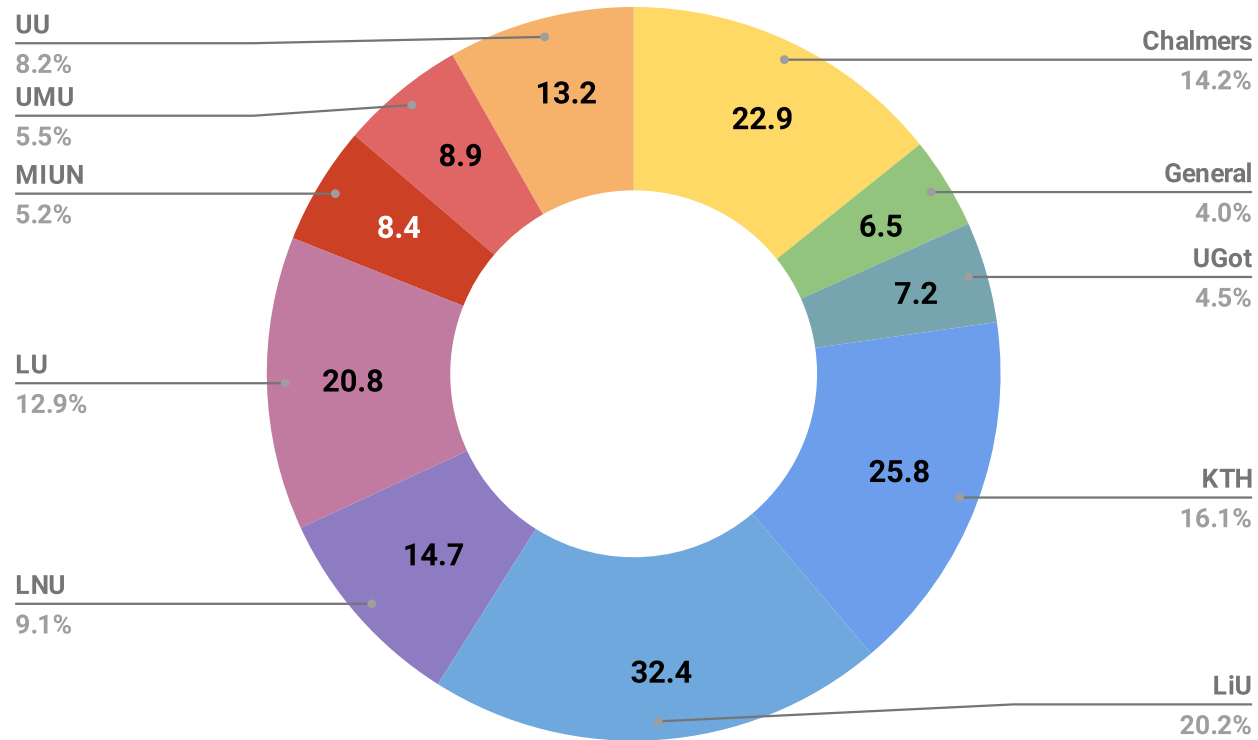


Funded by
Vetenskapsrådet
150 MSEK over 5 years
50% Co-Funding
9 Partner Universities
started 2022

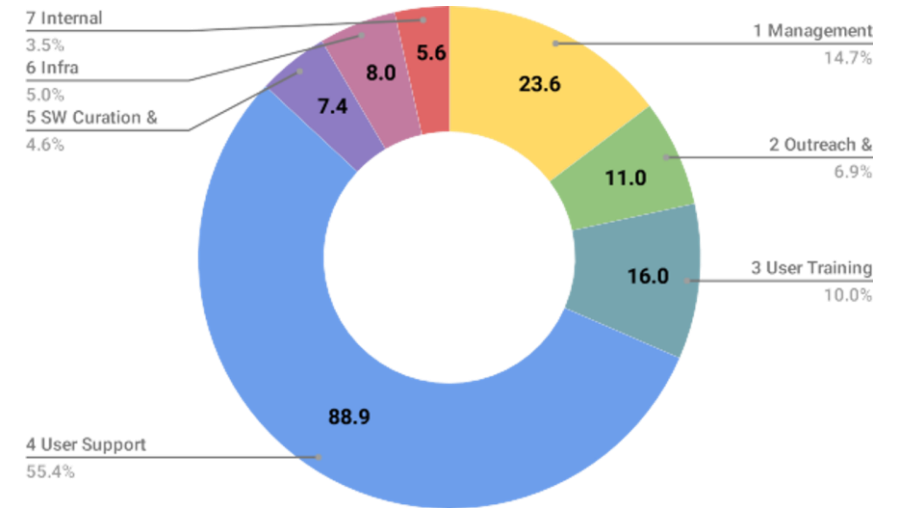


Funding

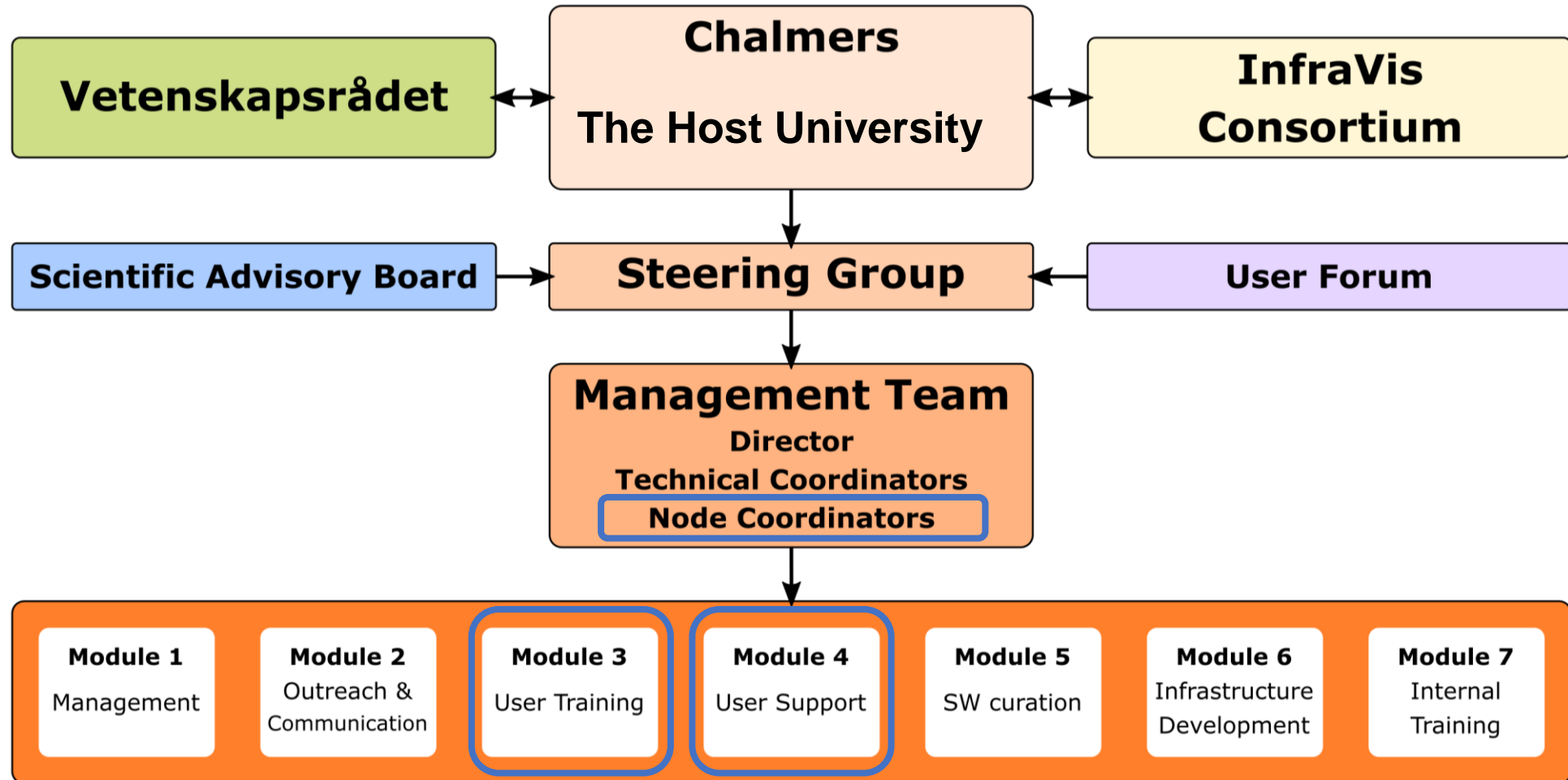
Universities



Activities

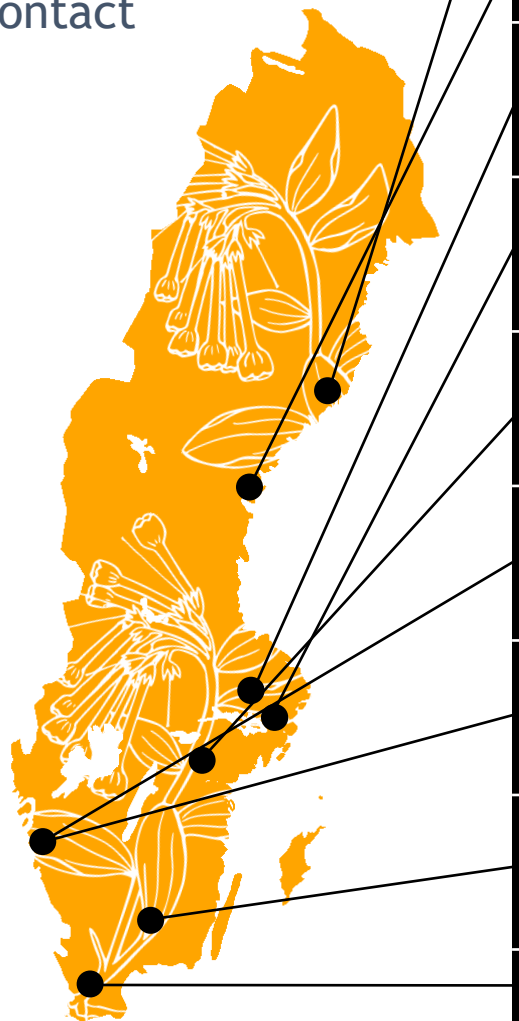


Organizational Structure



Node Coordinators

- Regional Points of Contact
- Project Owners

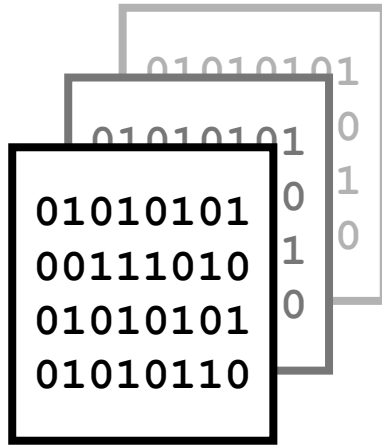


 Umeå University
 Mid Sweden University
 Uppsala University
 KTH Royal Institute of Technology
 Linköping University
 Chalmers University of Technology
 University of Gothenburg
 Linnaeus University
 Lund University



Evelina Lilliequist
Mårten Sjöström
Ingela Nyström
Mario Romero
Lonni Besançon
Jonathan Westin
Andreas Kerren
Emanuel Larsson

Data



*Engineering, Physics,
Medicine, Biology,
Chemistry, Linguistics,
Social Sciences, ...*

Analysis

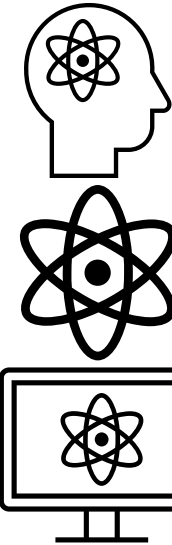
*Large data sets,
multi-run simulations,
parameter space,
noise, missing data,
uncertainty*



InfraVis

Expertise in data analysis and visualization
infrastructure of people

Benefit

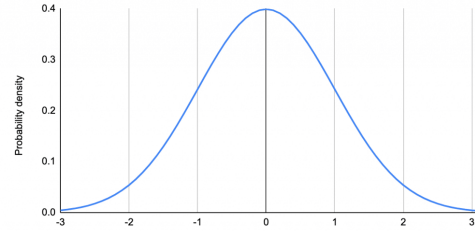
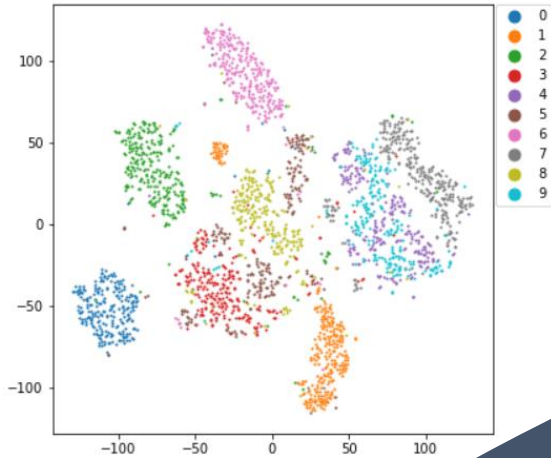


*Hypothesis
generation*

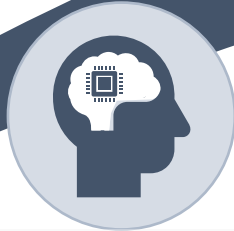
*Hypothesis
verification
falsification*

Presentation

Expertise over the Visualization Process



Data Collection and Curation



Machine learning (ML) and Artificial Intelligence (AI)



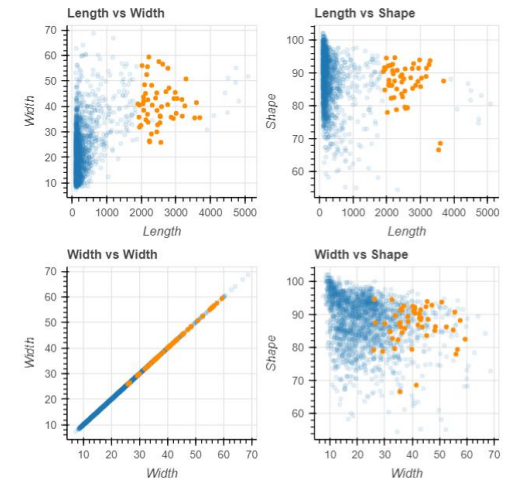
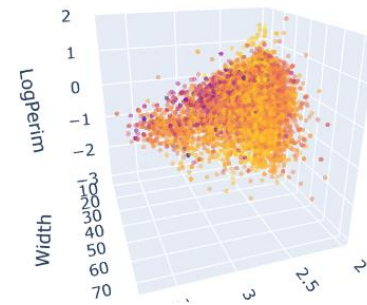
Statistical Data Analysis



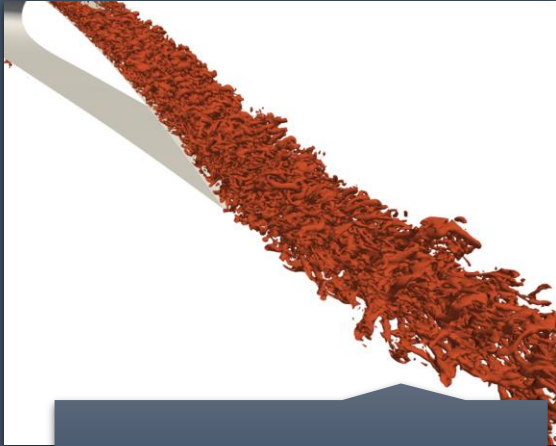
Data Visualization



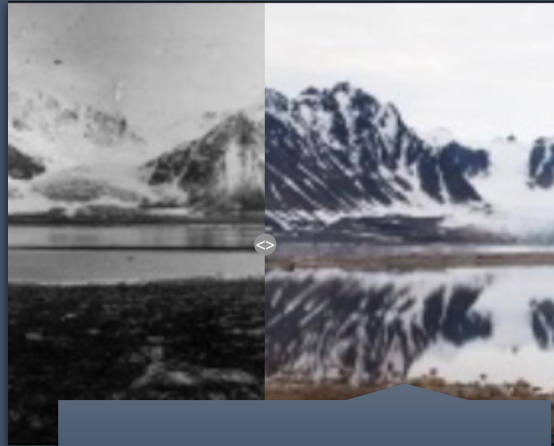
Interactive and Collaborative Visual Analysis



Select Projects



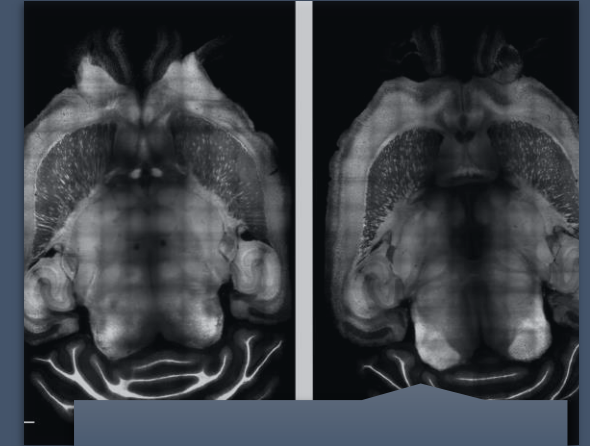
Wing Flow



Climate Change



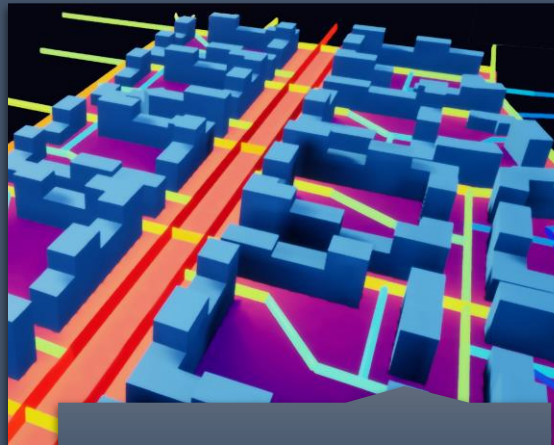
VR in the Cloud



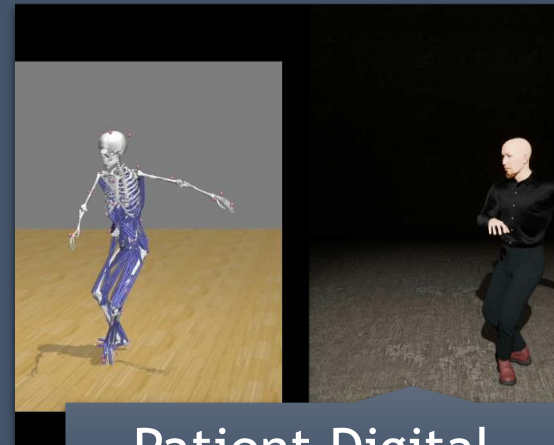
Epileptic Brain



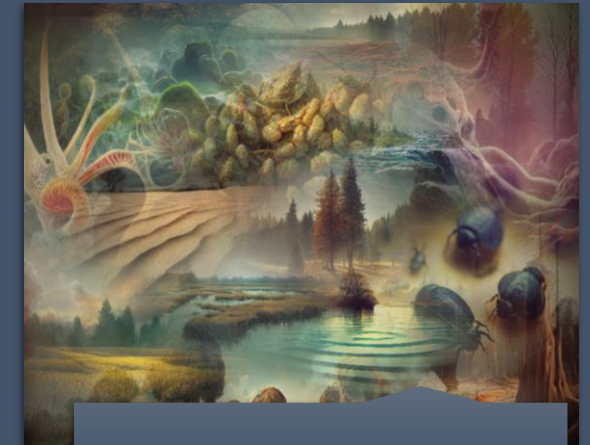
Online Activism



Urban Noise

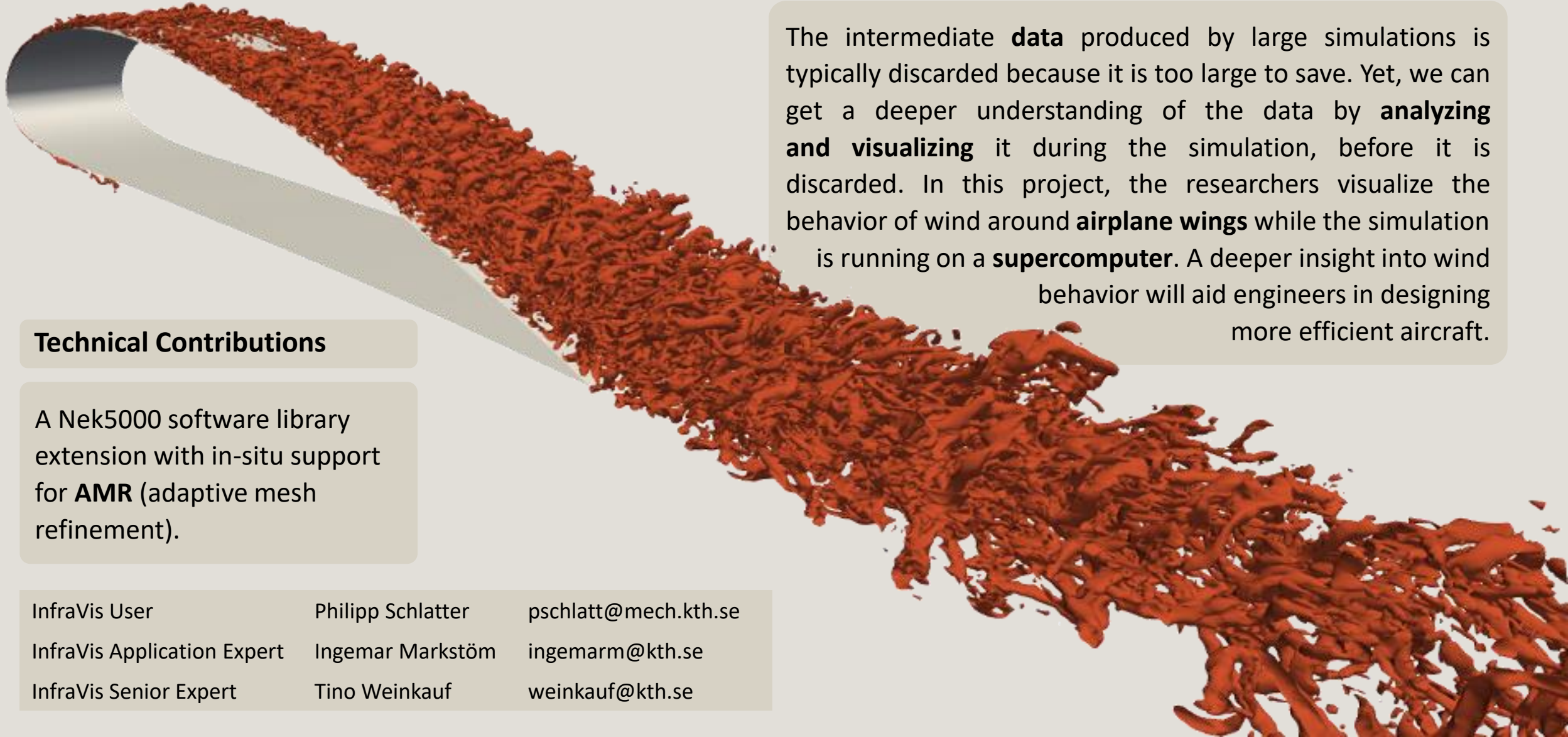


Patient Digital
Twins



Paleobiology

In-situ Visualization Support for AMR meshes in Nek5000



Technical Contributions

A Nek5000 software library extension with in-situ support for **AMR** (adaptive mesh refinement).

The intermediate **data** produced by large simulations is typically discarded because it is too large to save. Yet, we can get a deeper understanding of the data by **analyzing and visualizing** it during the simulation, before it is discarded. In this project, the researchers visualize the behavior of wind around **airplane wings** while the simulation is running on a **supercomputer**. A deeper insight into wind behavior will aid engineers in designing more efficient aircraft.

InfraVis User

Philipp Schlatter

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InfraVis Application Expert

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InfraVis Senior Expert

Tino Weinkauff

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Extended Rephotography

We develop interactive spatio-temporal views of arctic areas affected by climate change, where the researchers can register their data and compare the material to trace the changes of the landscape over time.

The visualization will allow researchers and public alike to follow the human presence through documentation of the Magdalenefjord (Svalbard) over 400 years, while also seeing the effects of climate change on this environment.

Contact

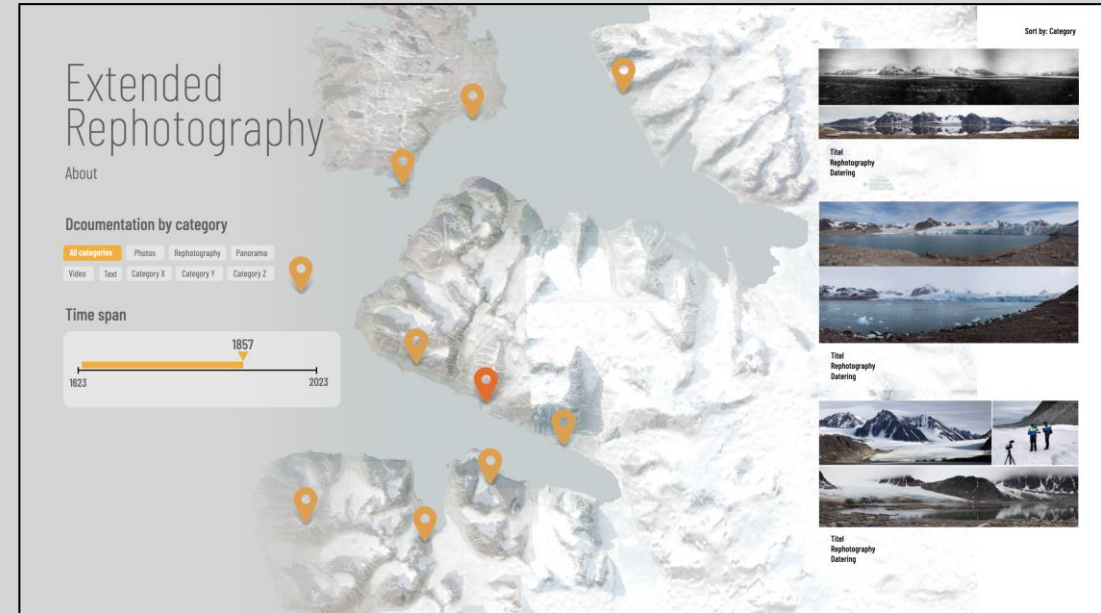
InfraVis User:

Tyrone Martinsson

(tyrone.martinsson@akademivaland.gu.se)

Infravis Expert:

Jonathan Westin (jonathan.westin@lir.gu.se)



Interactive map which lets the user explore the documentation sites and see the changes in the natural environment over time.



Module for comparing historical photographs with modern photographs.

Virtual Reality applications in the cloud

The project aims at designing an infrastructure that supports VR applications in the cloud using 5G/6G

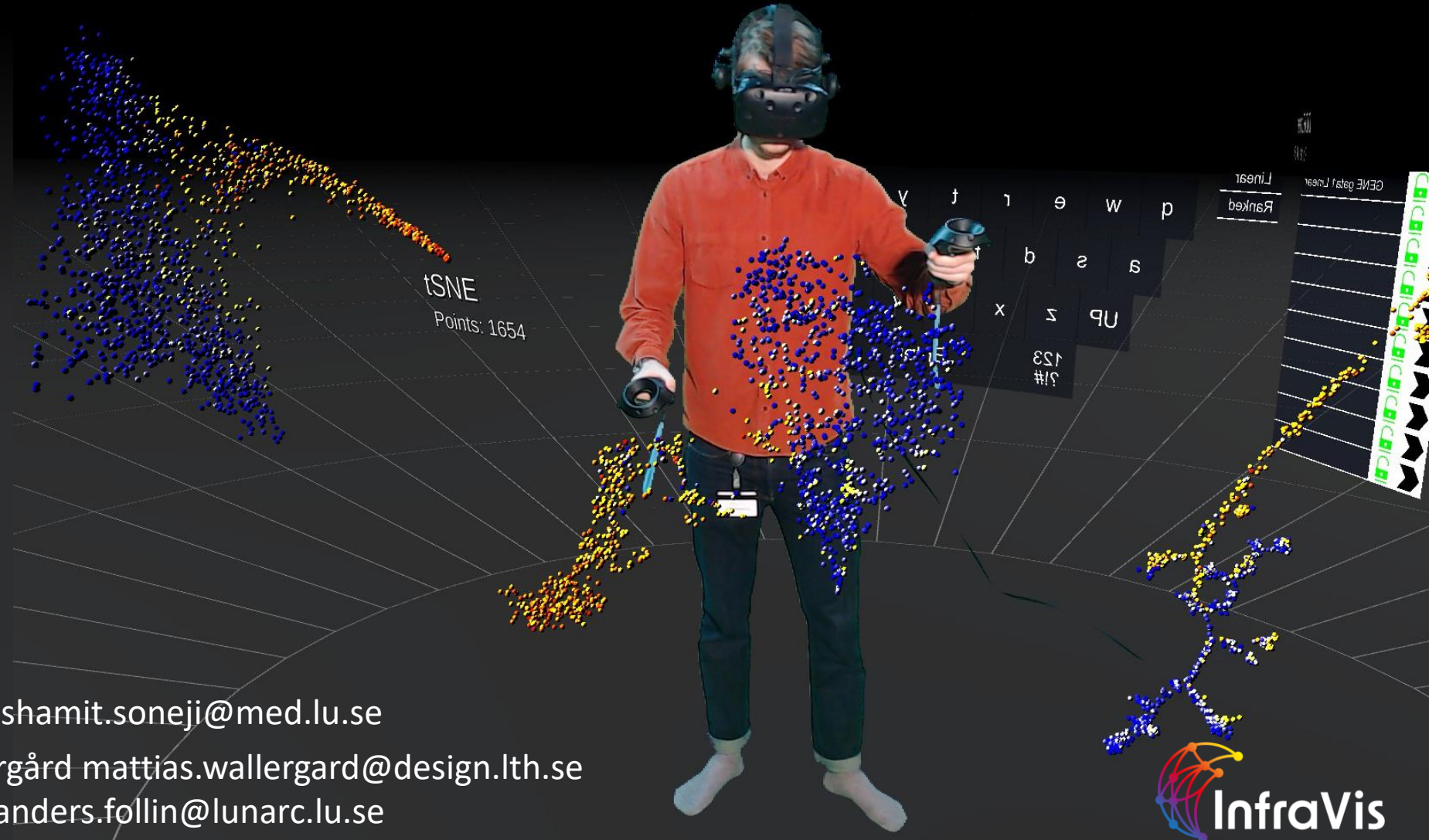
Outcomes

- (a) Reduced requirements for expensive and immobile hardware setups to deliver access to complex applications such as CellexaVR.
- (b) Visualization and manipulation of large datasets through VR.

InfraVis User: Shamit Soneji shamit.soneji@med.lu.se

InfraVis experts: Mattias Wallergård mattias.wallergard@design.lth.se

Anders Follin anders.follin@lunarc.lu.se





Visualization of pedestrian noise exposure

We develop an interactive map where the impact of noise is dynamically visualized through heatmaps over the course of a day as a synthesis of pedestrian traffic and noise level at a certain place and time.

The visualization can lead to a discussion about the regulations for sound environments, and to the initiation of new research questions about health effects.

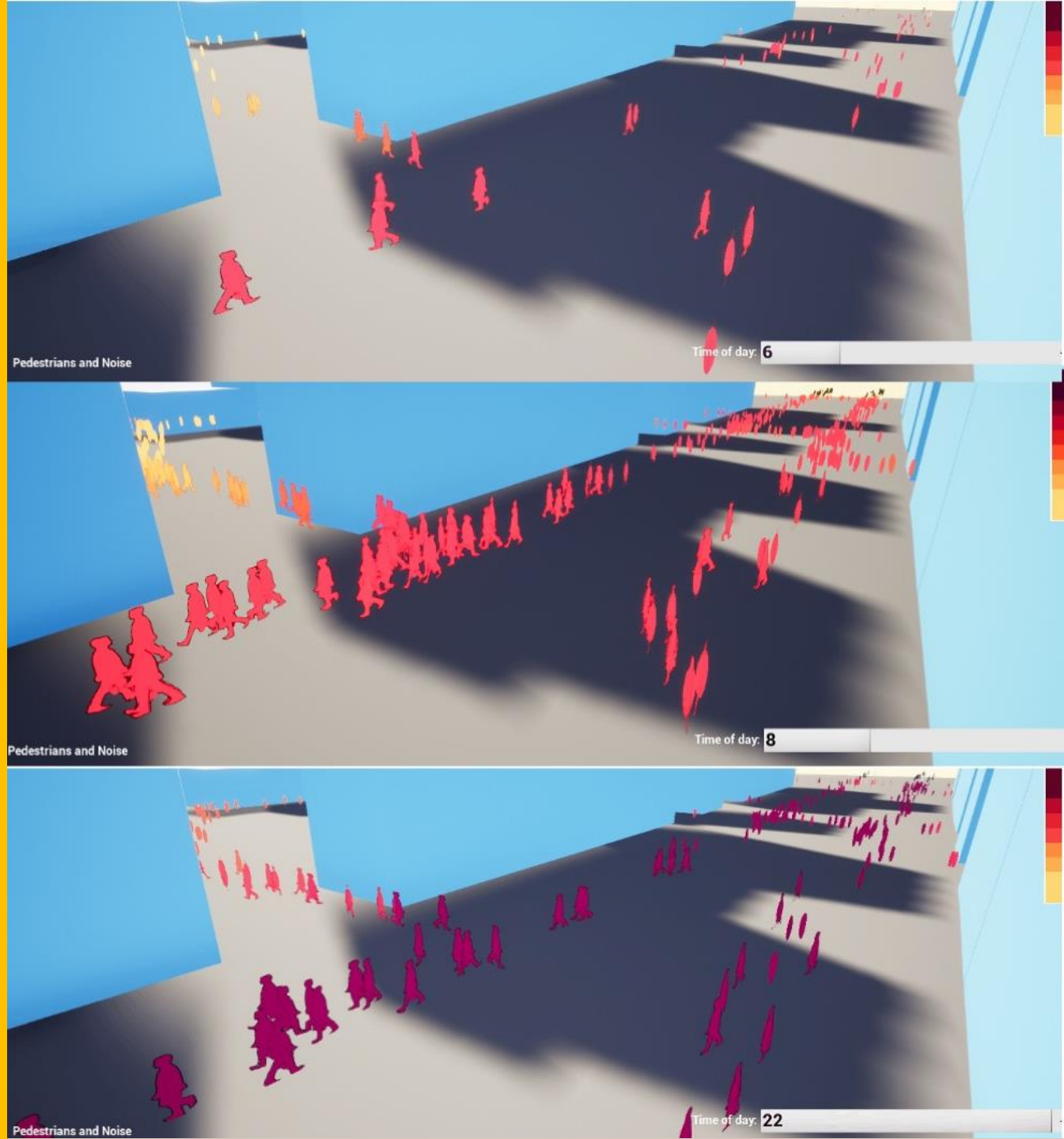
Contact

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MEDICAL DIGITAL TWIN – LINKÖPING UNIVERSITY

In the future, a digital copy of your own body – a digital twin – may be used to help you understand how to live a healthy life. At Linköping University (LiU), mathematical models are being developed as tools for better health communication. This is the result of collaboration between engineering biologists, psychologists, software developers, behavioral scientists and doctors.

InfraVis helps bring the data to life with Motion Capture animations and realistic 3D models of patients to help communicate medical information in a more personalized way.

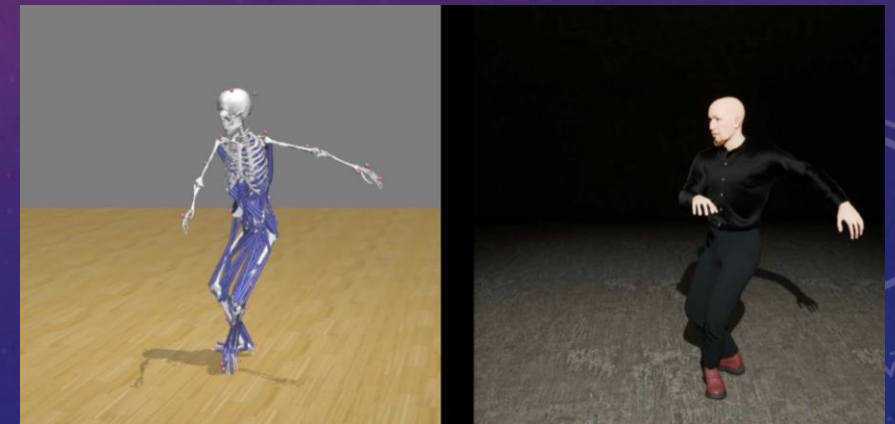
- Combining realistic 3D models with physiology and biochemistry models
- Creating realistic digital twins with Metahuman Creator
- Animating the models in Unreal Engine using motion capture data
- Movies and interactive elements

Domain expert: Gunnar Cedersund gunnar.cedersund@liu.se

InfraVis Expert: Gustav Eriksson gustav.eriksson@liu.se



3D model made with Metahuman



Simulation and Metahuman animation using the same motion capture data

SEAD Conservation Paleobiology

How have people and climate change affected Earth's past biodiversity?

This project will demonstrate the availability of a long-term record of biodiversity data which could be used to understand the biodiversity implications of the current climate and extinction crisis.

The project will create an **online GIS app** using a **space-time** pattern mining methodology for an **interactive visualization** of changes in insect biodiversity, and its environmental implications, over space and time.

Contact

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InfraVis Experts:	Cenk Demiroglu	cenk.demiroglu@umu.se
	Kajsa Palm	kajsa.palm@umu.se



8 Selected Projects (of 45)

- *Storytelling through Visualization* - UmU - Evelina
- *Art of Melt* - GU - Jonathan
- *Simulated Neural Network Toolbox* - KTH - Mario
- *Retrospective Visions* - LU - Emanuel
- *Map Visualizations* - LiU - Lonni
- *Visualizing the Dissemination of Linguistic Innovations in Online Communities* - LNU - Andreas
- *Information flow within and between interacting intracellular biochemical signaling pathways* - MiUn - Mårten
- *Improving Breathing during Sleep* - UU - Ingela

Storytelling Through Visualization

Challenging Modern
Ways of Viewing by
Reading Text and
Archaeology Together



Principal Investigator Dr. Michael Lindblom

PI Main University Uppsala University

Project Owner UmU, Evelina Liliequist

Project Manager Carl-Erik Engqvist

IAEs Carl-Erik Engqvist, Mattis Lindmark,
Kajsa Palm (+ Amilcar Soares (LiU))

Skills required Environmental storytelling, game design, 3D modeling, VR design, and UX design.

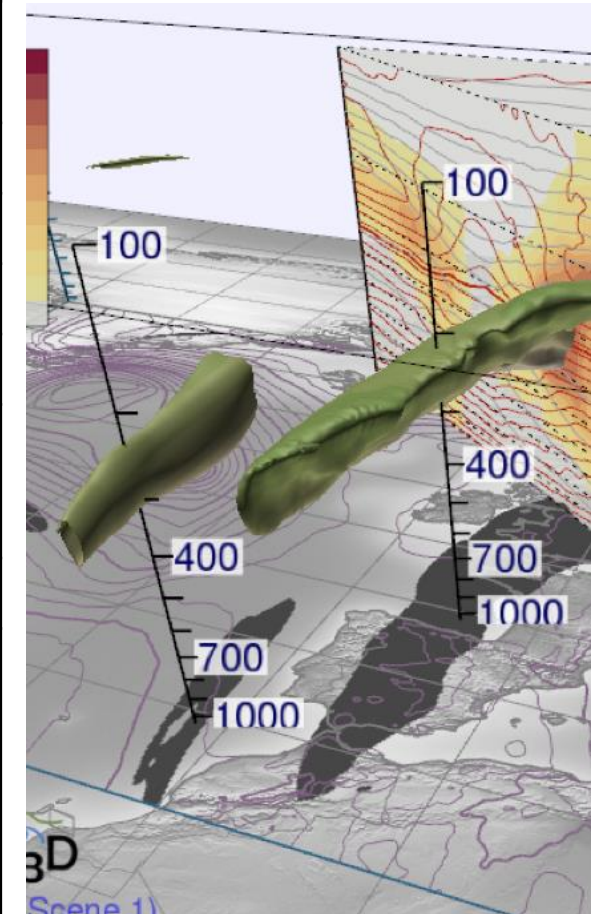
Skills missing Linked open data.

Short Description Visualizing the 2nd century CE narrative account of Pausanias (*Periegesis Hellados*) complemented with archeological data with a focus on interactive storytelling.

ARTofMELT

Visualizing behaviour of cyclons

Principal Investigator	Gunilla Svensson
PI Main University	Stockholm University
Project Owner	Gothenburg University, Jonathan Westin
Project Manager	
IAEs	
Skills required	Met.3D, data science, Convert data set from German system to the one preferred, skill in working with app modification and compilation. Norrköping has experience working with the researcher's data.
Skills missing	Met.3D, Meteorology?
Short Description	Climate science has been built on mean fields and studied as a thermodynamic problem. However, the small-scale processes and the interaction with the fluid dynamics i.e. needs more attention. The goal is to visualise cyclones behaviour on oceans and on land; how do you deal with the topography of Greenland and its surface pressure field wave?

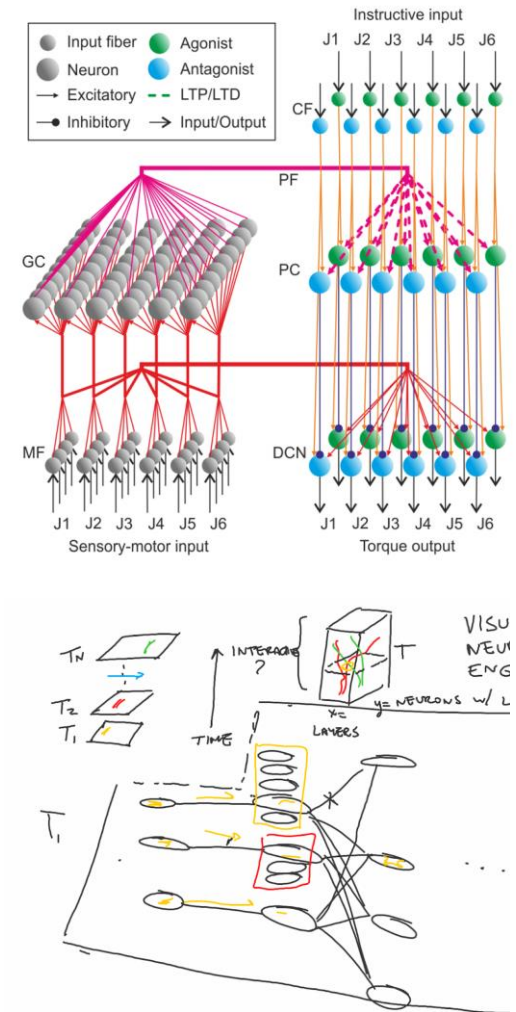




Simulated Neural Network Toolbox

space-time analysis of training stimulus & response

Principal Investigator	Jörg Conradt
PI Main University	KTH
Project Owner	KTH, Mario Romero
Project Manager	Filip Berendt
IAEs	Filip Berendt Ingemar Markström
Skills required	InViwo, Neural network analysis (Nikita?), spatiotemporal analysis, space-time cube
Skills missing	InViwo, Neural network analysis
Short Description	Goal: provide researchers and students with a visual analysis interactive tool to support understanding of neural network activation patterns in neural space during training time though image-based stimuli and response.



Retrospective Visions: Tracing the Past to Understand the Future of Marine Environments

Principal Investigator	Helena Filipsson
PI Main University	Lund University
Project Owner	Emanuel Larsson
Project Manager	To be decided, but most likely Emanuel Larsson
IAEs	Alexandros Sopasakis, Jonas Ahlstedt, Günter Alce, Henrik Garde
Skills required	TBC on Monday 2nd of October , but potentially, machine learning-based segmentation, batch-based 3D renderings in e.g., a Python-based renderings software e.g., 3D slicer, Paraview, DragonFly. Potentially image registration needed prior to rendering. Quantitative morphological analysis will be given to the users.
Skills missing	TBC on Monday 2nd of October , but hopefully none
Short Description	Our project aims to understand their severity and consequences of response to global change during times of rapid warming and decreasing levels of oxygen and pH, by creating 4D (3D + time) series of marine microorganisms'. We need help to further develop pipelines for visualizing and quantifying morphological changes based on Synchrotron X-ray microtomography data sets of microfossil. We have > 500 synchrotron-based 3D μ CT scans of Baltic microfossils (foraminifera).



Beamline BL 47XU, SPring-8 synchrotron facility (Japan)

http://www.spring8.or.jp/wkg/BL47XU/instrument/lang-en/INS-0000001375/instrument_summary_view

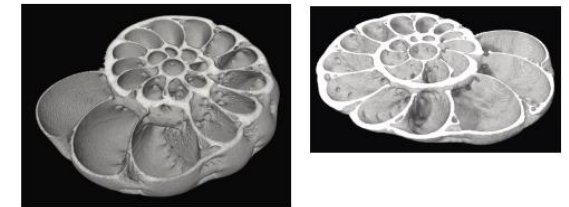
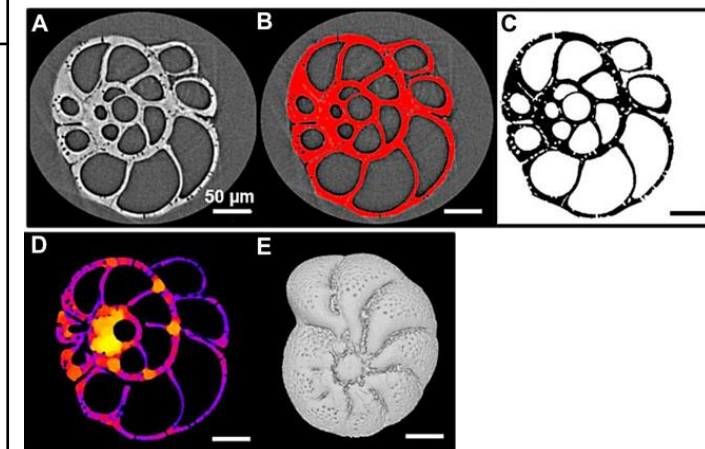


Fig.1 3D modell of the bottom-dwelling foraminifera *Elphidium williamsoni*, scanned at the ANATOMIX beamline, Soleil, Fr. Size ~300 μ m across.

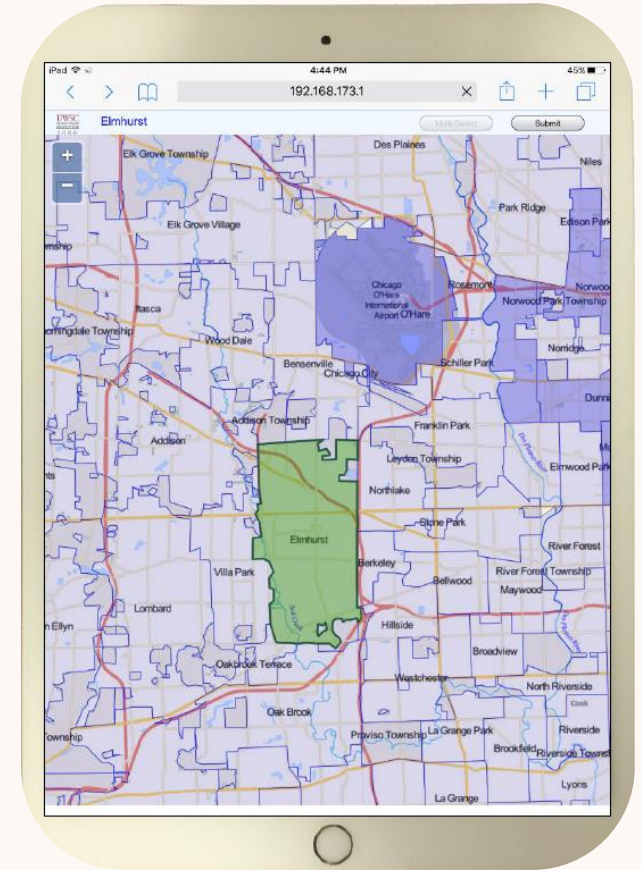


<https://www.frontiersin.org/articles/10.3389/feart.2023.1120170/full>

Map visualization

Implementation of a Tablet Map as Input Device for Respondents in a Collaborative Approach to CAPI Interviewing

Principal Investigator	Benjamin Jarvis
PI Main University	Linköping University
Project Owner	Lonni Besançon
Project Manager	Lonni Besançon
IAEs	Måns Gezelius
Skills required	Full stack and map-programming
Skills missing	
Short Description	The novelty is mainly the scale of the predictions that we now can model accurately. To the best of our knowledge, a dynamic visualization of this does not exist. Boundary layer with underlying map tiles

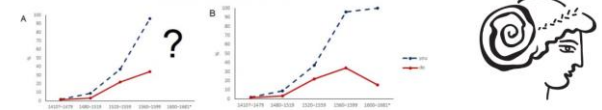


Visualizing the Dissemination of Linguistic Innovations in Online Communities



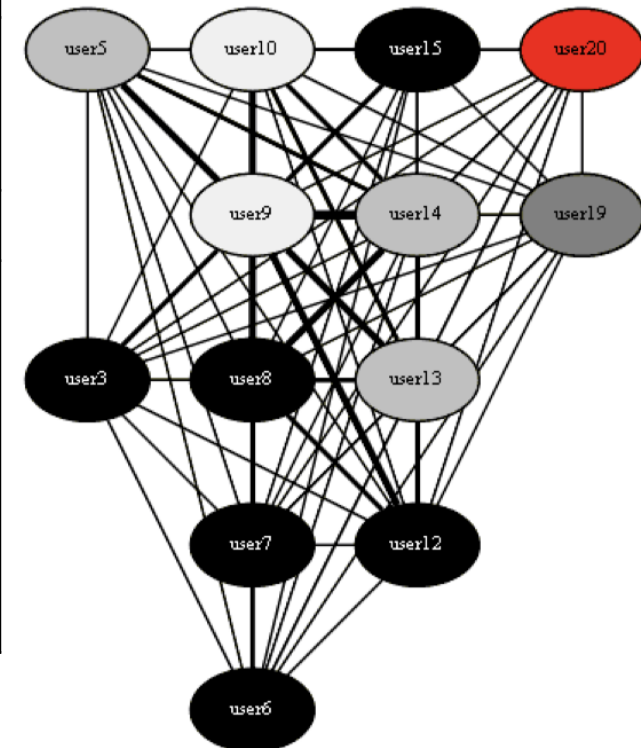
SPRÅKBANKENTEXT

Cassandra: Explaining and predicting short-term language change in Contemporary Swedish



<https://spraakbanken.gu.se/projekt/cassandra>

Principal Investigator	Aleksandrs (Sasha) Berdicevskis
PI Main University	Språkbanken Text, University of Gothenburg
Project Owner	Andreas Kerren, LNU
Project Manager	Rafael M. Martins, LNU
IAEs	Rafael M. Martins
Skills required	(Dynamic, large) network visualization, multivariate networks, minor knowledge in lexical & syntactical linguistic features
Skills missing	None
Short Description	Network data sets derived from annotated Swedish social media texts over a time span of 20 years (provided by PI). Fokus on lexical and syntactical features (usage of new words or specific use of grammar) that change over time. Task is to visually analyze how changes spread through the (dynamic, time-dependent) networks. Visualization tool should support exploratory research.



Improving Breathing during Sleep

The Role of Jaw Advancement Surgery

Principal Investigator	Andreas Thor, Dental MD
PI Main University	UU
Project Owner	Ingela Nyström, UU
Project Manager	Emanuel Larsson, LU
IAEs	Nikita Singh, UU, ...
Skills required	Volume rendering, Image segmentation, (possibly) AI
Skills missing	
Short Description	<p>The overall aim of this project is to perform surgery planning of the jaw to allow for best clinical outcome, where the surgical procedure will restore a normal airway-flow and breathing pattern.</p> <p>We have access to pre- and post-operative CT data from (at least) 20 patients.</p> <p>Standard DICOM format with Hounsfield Units, but how to visualize air volume, that is, the upper airway and nasal cavity?</p>

