2023 Cisco Higher Education Study Tour to Norway and Denmark

Presentations from Site Visits

Please note these presentations are intended solely for delegates on the 2023 Cisco Higher Education Study Tour. They are not intended for circulation.

Accelerating Progress Towards Net Zero

NIIN National Industry Innovation Network

LA TROBE UNIVERSITY

Transforming La Trobe

Using digital to get to Net Zero ready faster

Challenge

La Trobe University (LTU) needed to deliver on many priorities such as improving the digital student engagement, priority business functionality, security and improved sustainability. The question for La Trobe was whether it could use the same underlaying digital platform to improve its sustainability / reduce emissions

Approach

Cisco and LTU partnered to transform the aged on-campus infrastructure.

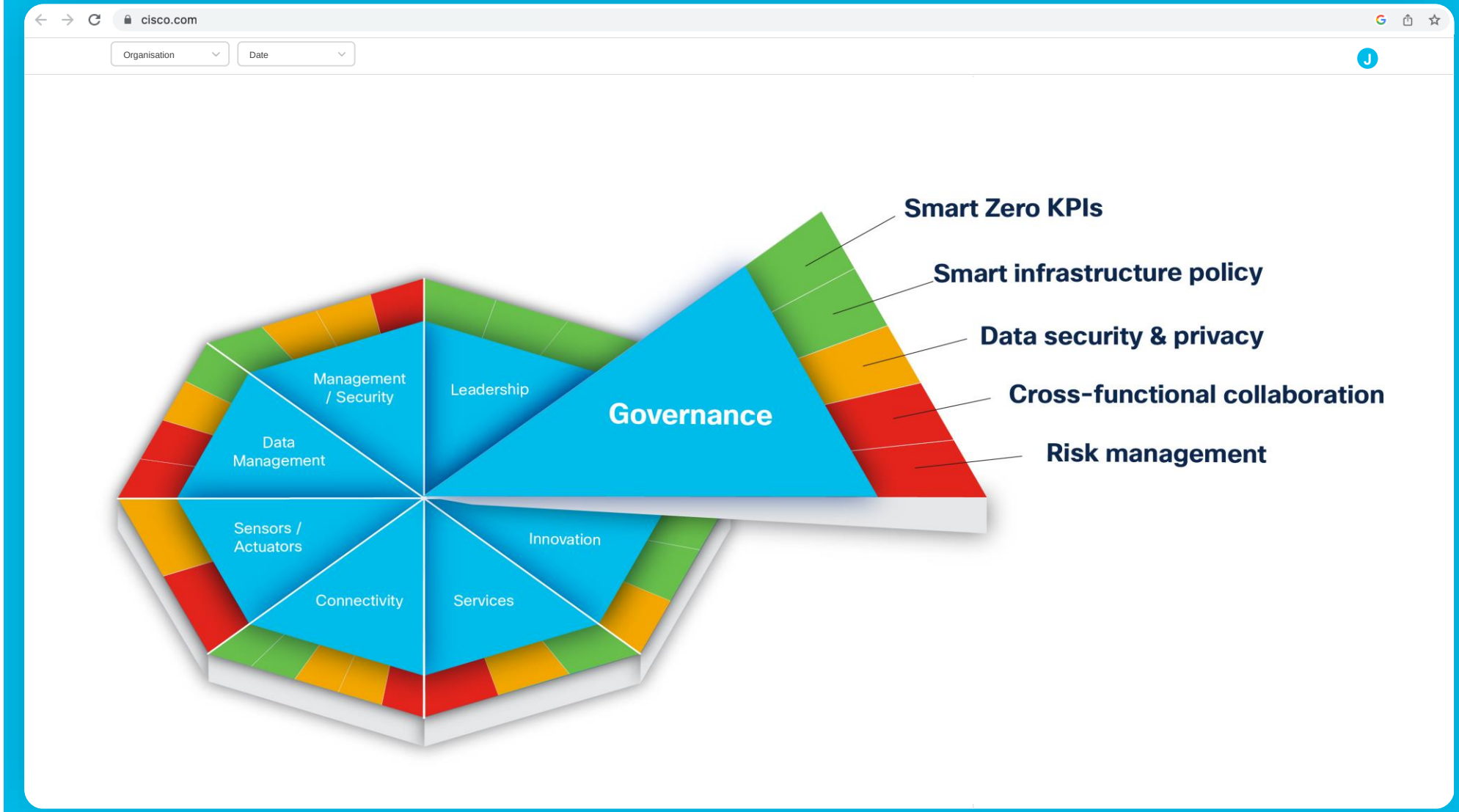
The La Trobe-Cisco Research Chair in AI and IoT took the lead on a project to take learnings from the Smart Zero Research Report - led by Cisco, Curtin and La Trobe and outlining how digital could help accelerate the path to Net Zero – and using it to create a practical tool to identify a university's readiness for embracing Smart Zero.

Outcome

A working prototype is currently being developed and tested with planned pilot rollout of the tool likely by mid-year.

Smart Zero dashboard

An interactive dashboard will be developed to visualise organisations' smart zero readiness and, over time, enable tracking changes and benchmarking.

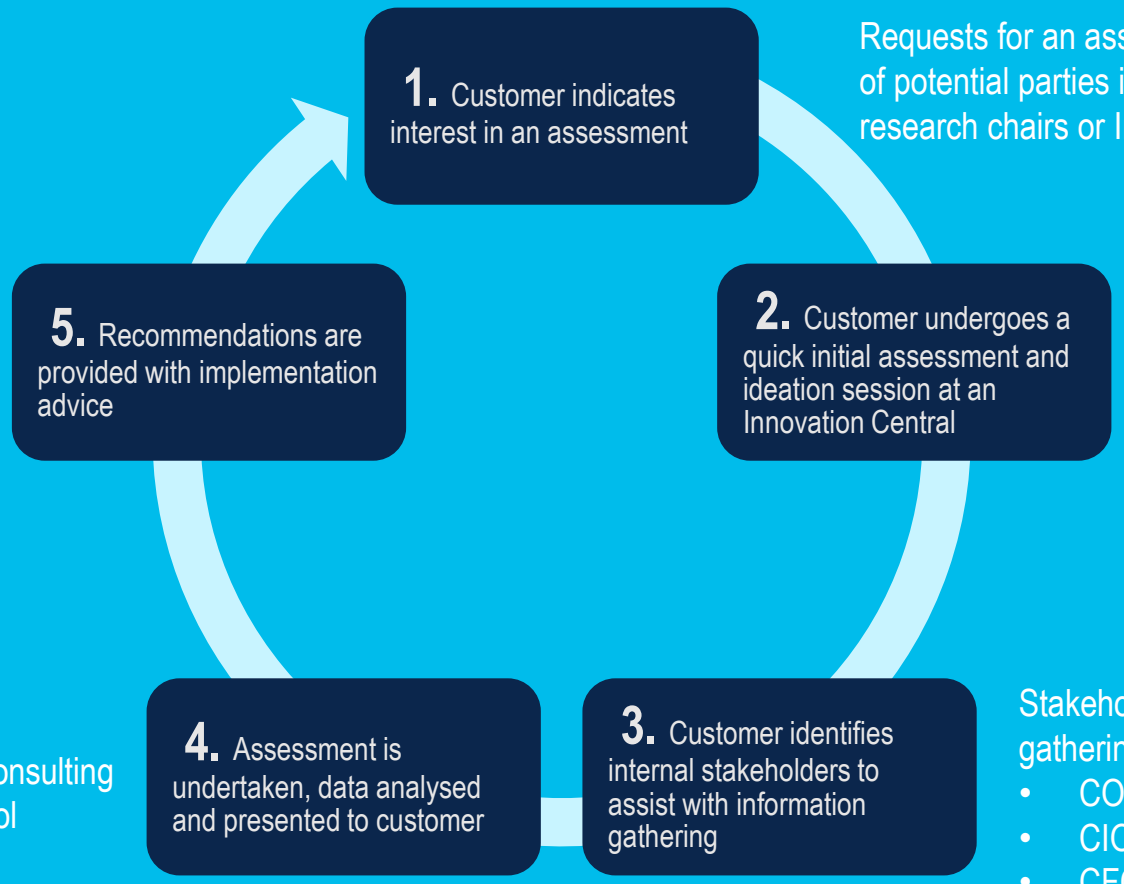


Smart Zero data capture tool

Emission measurement services	Automated collection and reporting of CO2 emissions	Largely manual collection of data related to major sources of emissions (e.g. reviewing utility bills, log book records) and manual reporting (ERP)	Automated collection of primary emissions data (energy usage, transport emissions) and mix of automated and manual reporting	Automated collection of data for major sources of emissions and automated reporting / visualisation
	Automated calculation of Scope 1 travel emissions for staff (land, sea and air)	No or limited collection of data related to staff travel (flights, use of fleet cars)	Manual extraction of travel records from ERP/travel systems and other sources to calculate emissions from staff travel	Full automation of process to calculate travel (including mode of transport, size of vehicle/passengers, distance travelled) using scripts/software to extract and validate data and calculate emissions
	Automated calculation of Scope 3 transport emissions including staff and students travelling to and from the campus and travelling between campuses	No capacity to calculate Scope 3 transport emissions including including number and lengh of trips, mode of transport, emissions generated by trip and in aggregate	Incomplete calculation of Scope 3 transport emissions based on student and staff records (e.g. home address), campus occupancy and data sourced from surveys about modes of transport / frequency of travel to campus.	Automated calculation of Scope 3 transport emissions using public mobile data to track trips to and from the campus
	Automated calculation of Scope 3 waste emissions including total waste created, its form and how disposed	No calculation of emissions arising from waste produced by the university as part of its operations	Manual extraction of waste data by reviewing waste invoices, separating types of waste, estimating the emissions created by disposal of waste (including fuel costs from campus to waste facilities)	Automated process that extracts relevant data from ERP systems for purchases and waste, models emissions created by transport of waste including fuel burn and the emissions associated (by volume) for disposal of different types of waste
	Automated calculation of scope 3emissions from suppliers using a trusted model.	No capacity to calculate scope 3 emissions from suppliers	Manual processes in which suppliers submit their scope 3 emissions annually using reports.	Trust-based model with suppliers where they automatically provide scope 3 emissions to be included in the universities GHG emissions.
	Automated calculation of emissions associated with work from home arrangements	Limited capacity to identify carbon emission from staff working from home	Manual processes to calculate emissions based on manual entries into systems including time sheets to record location	Automated calculation of emissions from WFH staff by sampling multiple data sources (ERP system to determine is staff is on leave, device providing location data, campus WiFi/network detecting if on campus).

Assessment process

The process is rigorous from a data collection process but designed to be streamlined and based on a Web interface



Requests for an assessment will be initiated by range of potential parties including industry, universities, NIIN research chairs or Innovation Central

Qualifying the opportunity:

- Ideation session at Innovation Central
- Ensure org meets basic benchmarks: has a Net Zero intent and strategy
- Senior sponsorship

Stakeholders likely to play a role in data gathering (using tool) include:

- COO
- CIO
- CFO
- Sustainability Lead
- DVCA

In most cases will be undertaken by Vector Consulting which architected the tool

The aim of the tool is to create progress: it's not about full transformation (yet)

Where to next

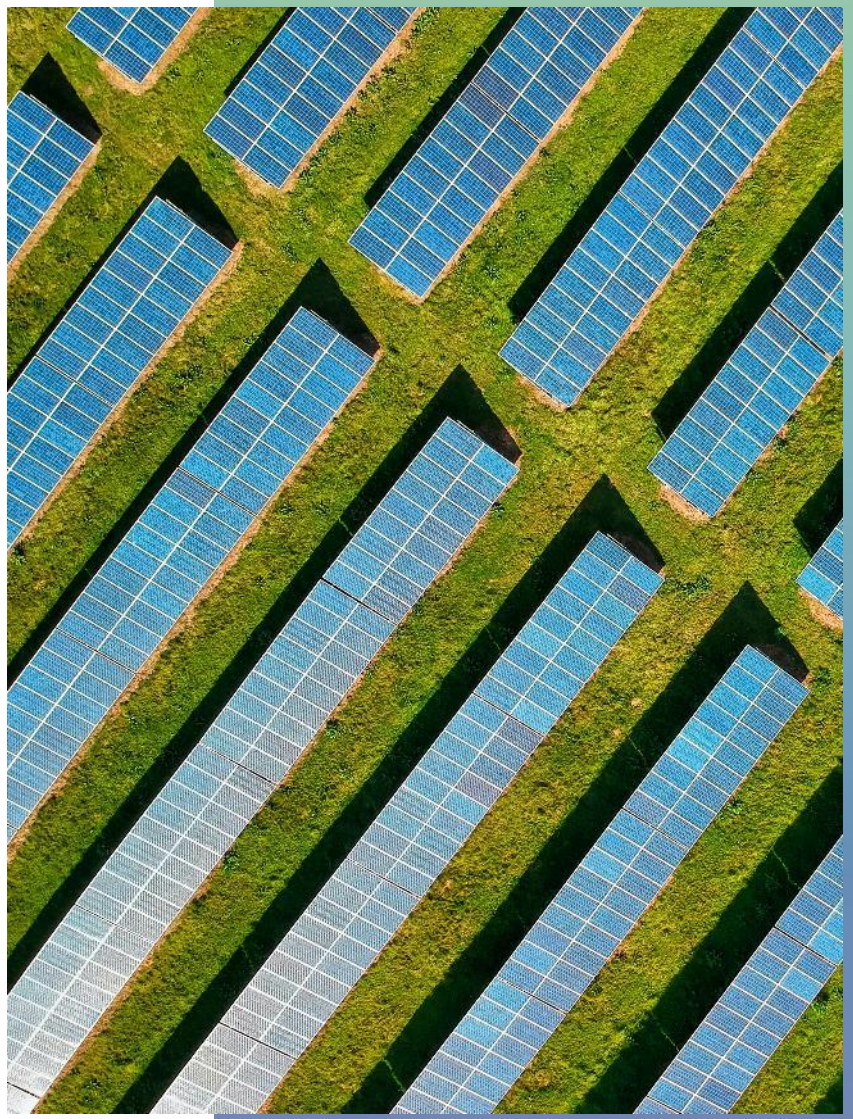
- Final testing of the assessment tool and process
- Proof of concept at La Trobe to iron out challenges in real world setting
- Roll out to universities first then other industry sectors (via Innovation Centres within the NIIN)

How to get involved:

1. Nominate interest in undertaking an assessment
2. Run an ideation session in your State with Innovation Central
3. Be one of the pilot assessments in Australia

UNIVERSITY OF OSLO

Energy, climate and environment
– from top-level strategy to action



Vebjørn Bakken
Director UiO:Energy

The University of Oslo

- Founded in 1811
- 25 000 students/7000 staff
- Classical university with broad range of disciplines
- 8 faculties; 2 museums
- 3 interdisciplinary, strategic initiatives
  – combined all the SDGs are covered

- **Climate ambitions:**
  - **Comprehensive climate and environmental strategy**
  - **Cutting emissions (incl. scope 3) >50% by 2030**

UiO:Energy and Environment

UiO:Life science

UiO:Democracy

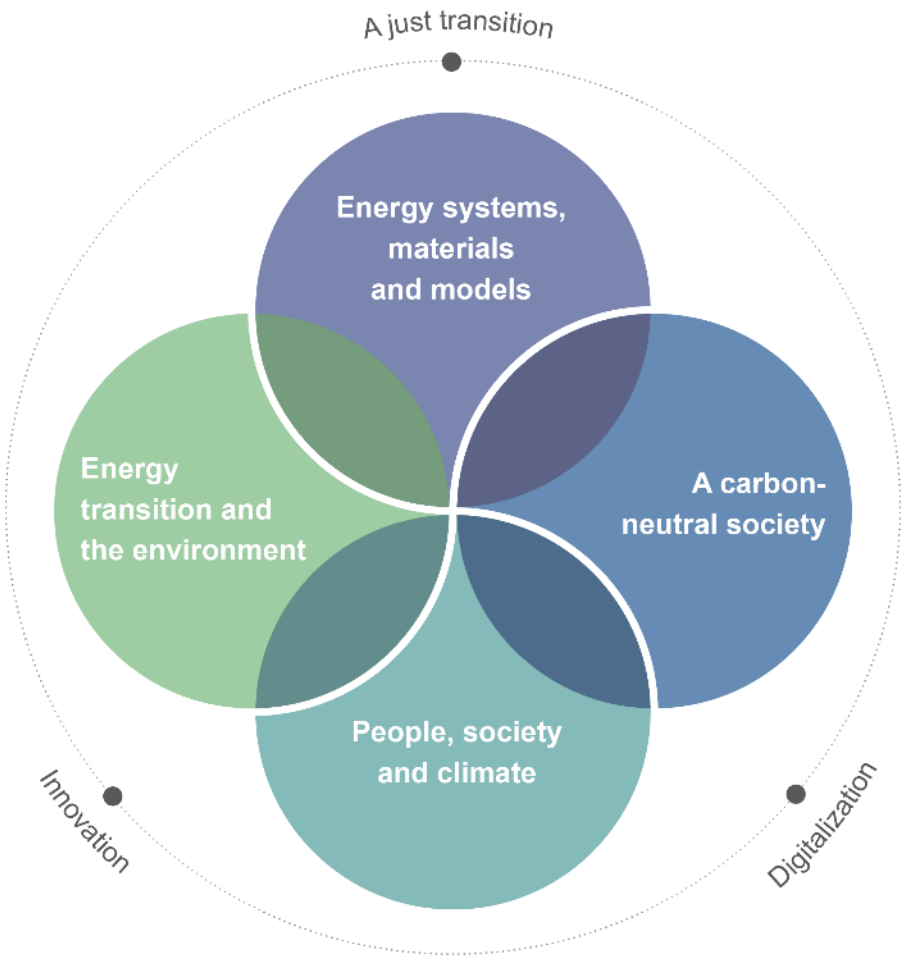
UiO:Energy and Environment
– Energy, climate and environment

Four main research areas:

- Energy transition and the environment
- People, society and climate
- Energy systems, materials and models
- A carbon-neutral society

… and three cross-cutting topics:

- A just transition
- Digitalization
- Innovation



Encouraging interdisciplinarity through internal projects
- Thematic Research Group (TRG)

Awarded 2020

- **Circular energy** (informatics & law)
  the role of digital product design, maintenance, and repair in energy conservation
- **Oil in Transition** (history & political science)
  discourses on the Green Shift and Climate Change in Norway and the Gulf
- **SPATUS** (mathematics & technology systems)
  studying the uncertain production from wind and PV installations

Awarded 2022

- **Wind for future** (psychology & technology systems)
  envisioning swift and inclusive energy transitions with young people across Norway
- **RESULTS** (social geography, development studies & culture studies)
  what key insights are missing from current approaches to the energy transitions?
- **CCNS** (geosciences & law)
  exploring the southern North Sea as a strategic area for future European CCS-activities
- **DENT** (physics & chemistry (materials science))
  discovery and exploration of novel materials for tandem solar cells

UiO:Energy and Environment – **Convergence environments**

PriTEM: Privacy-preserving Transactive Energy Management

- Safe and secure decentralized energy trade (P2P)
- 5 PhDs + 1 postdoc
- Involving:
  - Informatics, Technology systems, Psychology, Law

PriTEM will development new knowledge at the intersection of Energy technology, Energy Informatics, Psychology, and Data and Energy Law through collaboration and highly cross-disciplinary research synergy for privacy preserving and secure data sharing based transactive energy management.

Centres for Environment-friendly Energy Research (FME)

- Funded by: Research Council of Norway (50%), industry (25%), research institutions (25%)
- Long-term: 8 year duration (w/midterm evaluation)
- Typically gathers all major national players – «national teams»
- Young researchers are exposed to:
  - Industry, both large companies and SMEs (but also public sector)
  - Complete value chains
  - Interdisciplinarity

FME evaluation 2021:

…possibly the most important longer-term impact of the scheme will be the […] people trained through the centres in Masters, PhD and postdoc programs who will contribute significantly to the transforming energy industry.

Centres for Environment-friendly Energy Research (FME)

Materials for Energy

SUSOLTECH
The Norwegian Research Centre for Sustainable Solar Cell Technology

MOZEES
Mobility Zero Emission Energy Systems

HYDROGENi

Energy Systems

NORTH WIND

Carbon Capture and Storage

NCCS

Energy Transition and Sustainable Societies

Include
A research centre for socially inclusive energy transitions

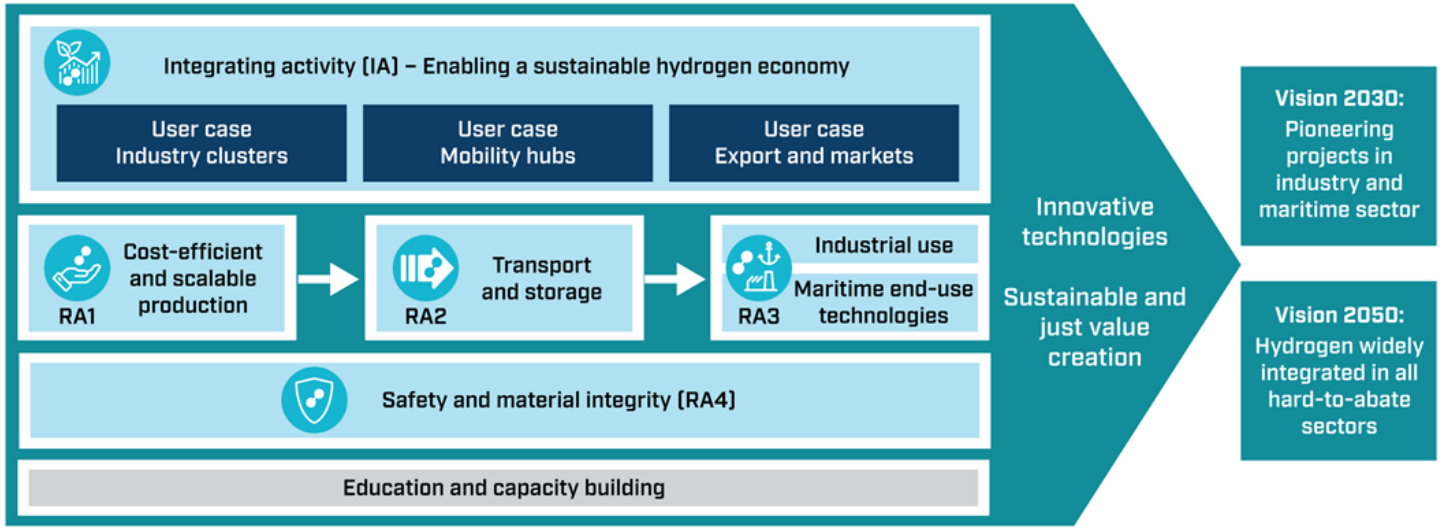
NTRANS
Norwegian Centre for Energy Transition Strategies

HYDROGENi

Norwegian research and innovation centre for hydrogen and ammonia

Aims to accelerate a hydrogen-based energy and technology export industry for Norway, reducing emissions while boosting industry competence and creating new green jobs.

- Total budget > $50M;
- Will train ~35 PhDs and postdocs; >100 master students



FME HYDROGENi – strong partnership

The Research Council of Norway

ABB
Air Liquide
AKER CARBON CAPTURE
AkerSolutions
altera INFRASTRUCTURE
Bergen Tankers as
BOSCH
CASALE
CoorsTek
Corvus Energy
DNV
ENERGI I NORD
equinor
Ferrolegeringsindustriens Forskningsforening
TiZir
GASNOR
GASSCO
GEXCON
Green Industry Cluster NORWAY
Hydro
HAV hydrogen
H2
HYEX SAFETY
HYDROGEN Mem-Tech AS
Clean hydrogen and carbon capture
HYON
hystar
ICT
IFE Institutt for energiteknikk
JOTUN
KONGSBERG
maritime cleantech
Mo Industripark as
nel
NORDKRAFT
Norwegian Hydrogen
NTNU
Panametrics a Baker Hughes business
PERMASCAND
REINERTSEN NEW ENERGY
SAFETEC
SICK Sensor Intelligence.
SIEMENS
SINTEF
Statkraft
TechnipFMC
TECO 2030
Troms Kraft
TrønderEnergi
UiO : University of Oslo
UiT The Arctic University of Norway
USN University of South-Eastern Norway
vallourec
vår energi
Wilhelmsen
wintershall dea
YARA
ZEG Power

Supporting partners: inovyn An INEOS company, Statnett, SUSTAINABLE ENERGY, NORWEGIAN CATAPULT CENTRE

The City – Oslo

Capital of Norway

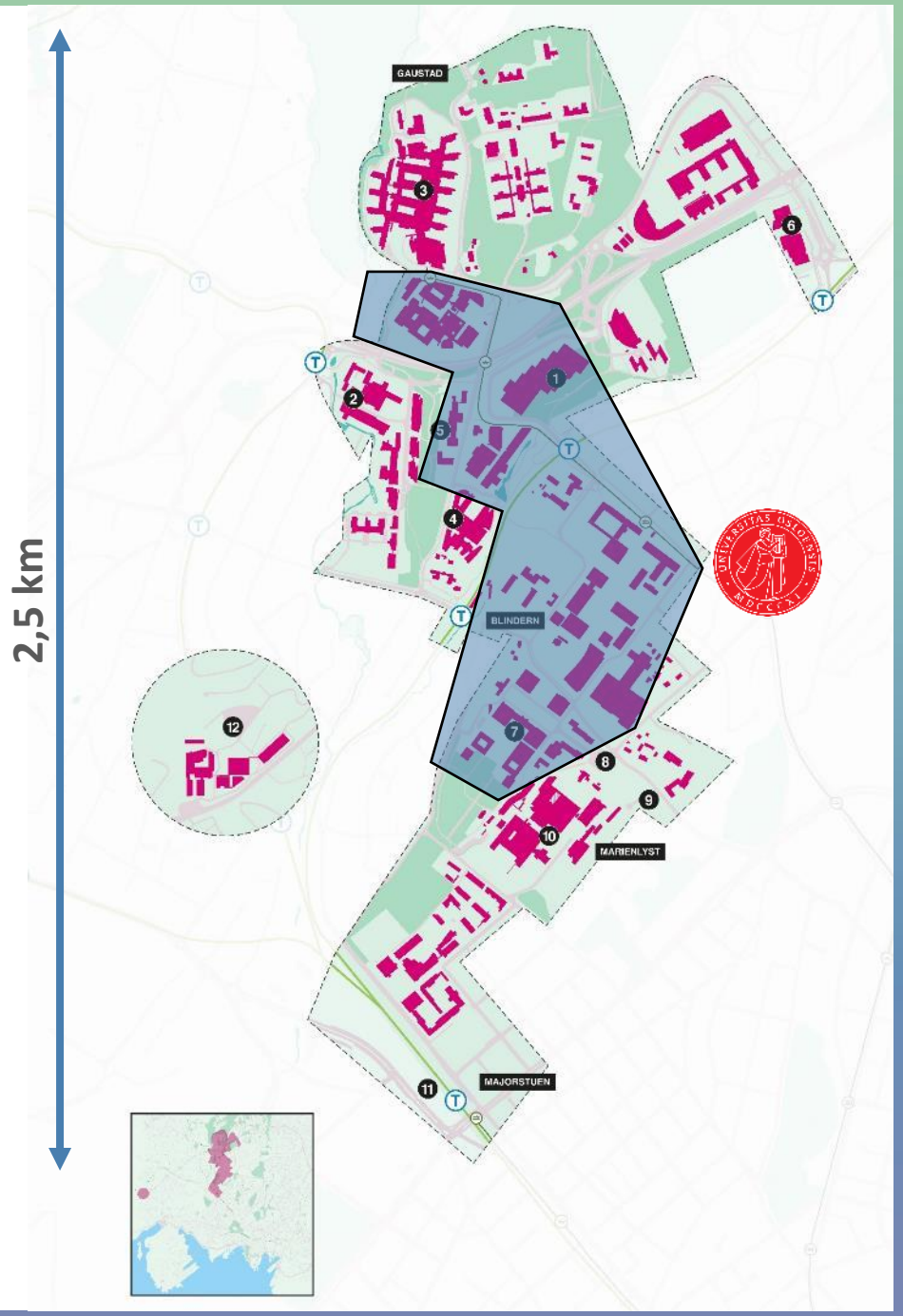
- Founded in 1048
- 700 000 inhabitants
- Between forest and fjord

- Ambitious climate targets:
  - Close to climate neutral in 2030 (95% reduction comp. to 2009)
- European Green Capital 2019
- Member of C40 Cities
- One of the 100 climate-neutral cities

Oslo Science City

An *innovation district*

Geographical urban area where knowledge institutions and knowledge-intensive companies gather and collaborate with entrepreneurs, incubators, investors and government to promote innovation, creativity and commercialization of ideas, knowledge and research.



oslo science city

Prioritized topics - *initially*

- Climate adaption
- Climate neutral cities
- Carbon capture and storage
- Hydrogen
- Battery technology
- Energy systems (and electrification)
- Circular economy
- Nature and biological diversity

Digitalization and computational science

Climate, energy and environment

Health and life science

Democracy and inclusion

UiO:Energy and Environment – **Education**

NorRen summer school

- 2023 – Tenth edition(!) – Theme: Green industrialization
- 2022 – Theme: Sustainable transport
- 2021 – Theme: Energy production and consumption
- Lectures from a range of disciplines, industry and government
- Interdisciplinary project work

"I would highly recommend this course to anyone doing a PhD in the energy field."

"The multidisciplinary approach with a diverse group of participants from across the globe was an amazing experience for me. Lectures combined with site-visits, group work, presentations and social interaction made it not only an enjoyable learning week but also reinforced the understanding of the subjects learnt besides exposing me to the wider viewpoints brought out by other participants."

UiO:Energy and Environment – **Summer research projects**

2023 – 30 students working on 18 projects, three examples:

- *Improving the computational foundation of an electricity system model*
  Take part in the development of an open-source electricity system model for Europe (highRES), used to research challenges and opportunities in the current large-scale transformation of the energy system
- *Surveying subsea cables and pipelines with non-ideal sonar*
  The tasks involve numerical simulation and processing of sonar data using Matlab, and in collaboration with leading industry and government actors
- *High resolution EV load curves for electricity system modelling*
  Investigating the effect of EV charging on electricity systems incorporating high shares of variable renewable energy - including exploring possibilities for flexibility.

UiO – **Student-led Green Office**

UNIVERSITETET I OSLO

dScience

dScience

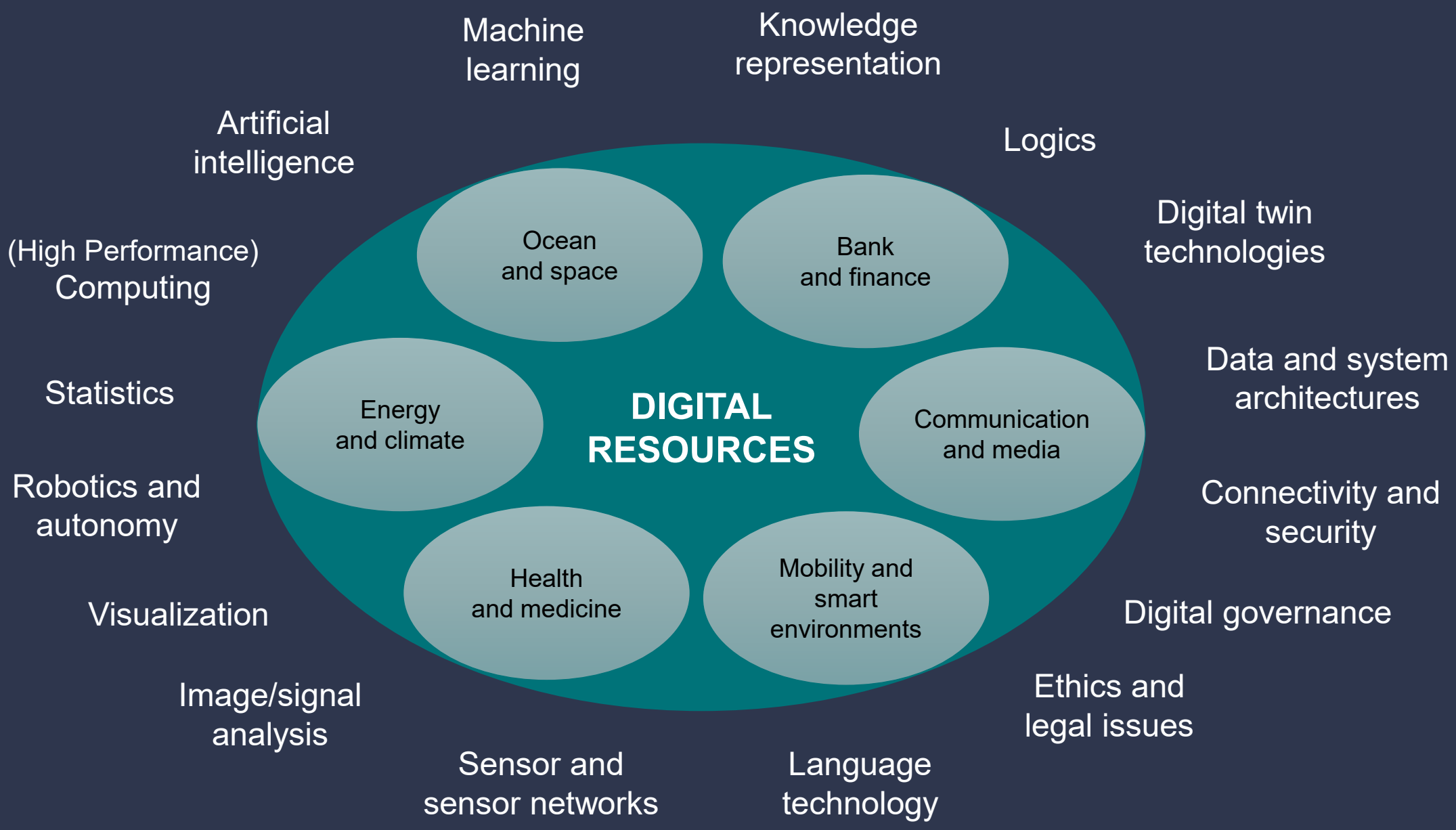
Centre for Computational and Data Science

May 2023

The role of dScience is to.....

- build an **internationally leading research community** in **computational and data science** at the University of Oslo
- deliver important (digital) contributions to the **green transition** of society and a sustainable future for all
- be a frontrunner in developing and maintaining **collaboration** between academia, industry and the public sector, including being a key player in the development of **Oslo Science City**

The landscape of dScience!



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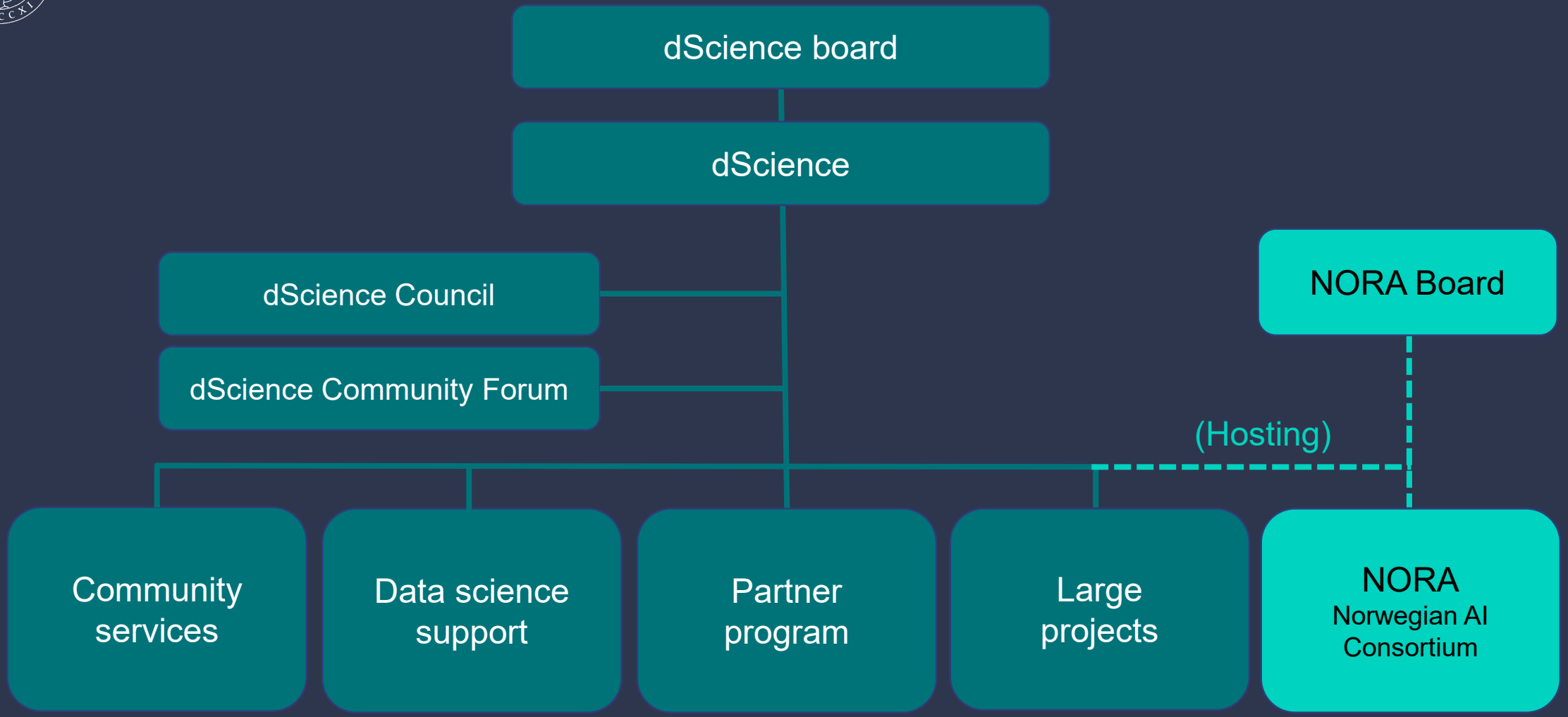
dScience



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dScience

Integreat – Norwegian Centre for Knowledge-driven Machine Learning
(CoE funded 2023-2033)

DSTrain - Data Science Training
(Marie Curie COFUND (EU) proposal 2024-2028)

Norwegian AI Cloud
(National infrastructure funded 2023-2027)

Portfolio of existing projects
(100+ projects)

- 40+ research groups with 320 (80) PhD-students
- 36 events with 1600 participant in 2022
- Data and compute services
  (TSD, Educloud, Fox, Sigma2, Lumi, EOSC...)

UNIVERSITETET I OSLO

dScience

Partner Program

Main purpose and goals

Create (more) value from digital resources

Provide strong contributions to the green transition

Contribute to the creation of profitable jobs

Take/develop international positions on selected topics/domain

UNIVERSITETET I OSLO

dScience

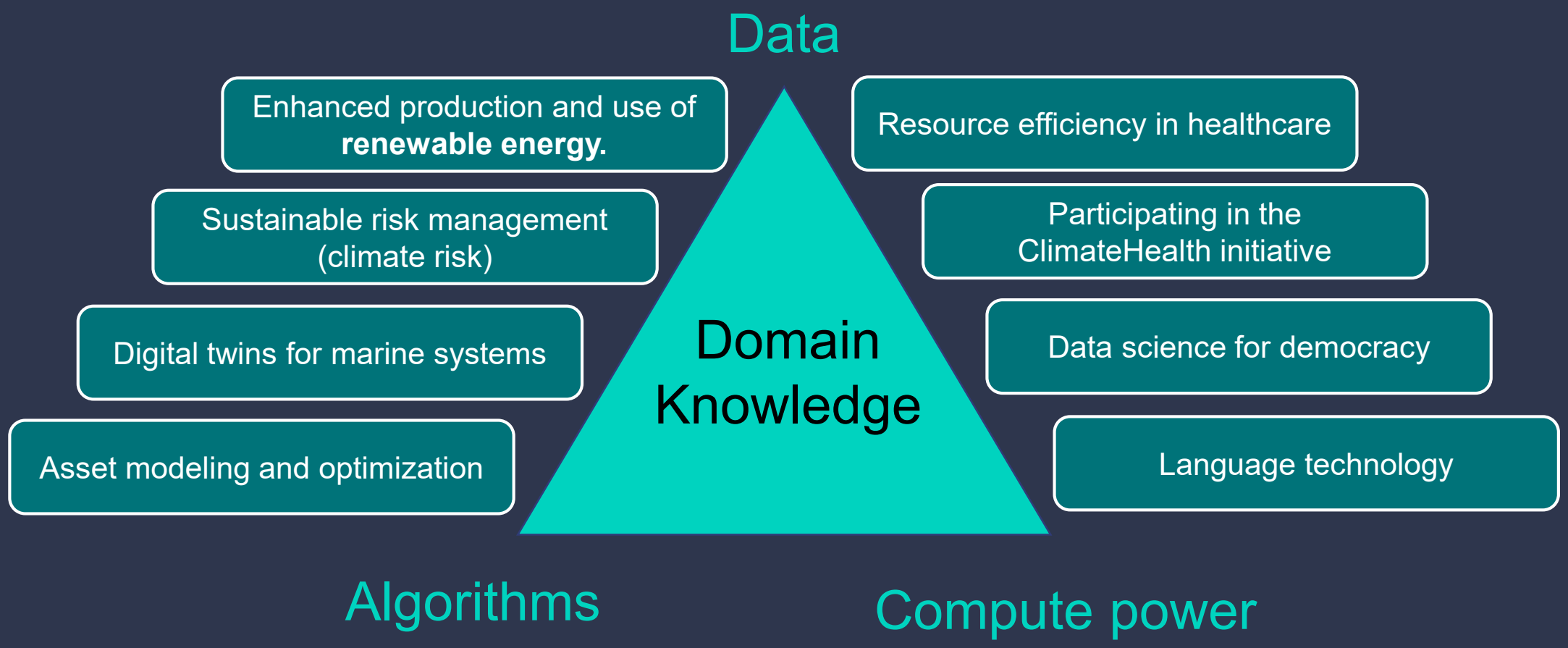
Partner Program

Projects	People	Capacity building
Access to projects (and researchers)	Recruitment (access to student at all levels)	Understand important (technology) trends
Joint applications for funding (NFR, EU, etc.)	Mentoring and supervision (both ways)	
Advanced impact studies (6-12 months)	Industrial-/public PhD-program (NFR)	Cultivate long term knowledge development (within selected fields)
	Life long learning (courses)	
	Access to (international) networks	

Meeting places (Conferences, seminars, webinars, thematic working groups,…..)

*Inspired by MIT, DARPA, Alan Turing Institute, Swedish eScience Research Centre (SeRC), WASP (Wallenberg), SIRIUS, BigInsight,...

Some Initiatives




equinor


DNV


KONGSBERG


DNB


NORGES BANK
INVESTMENT MANAGEMENT

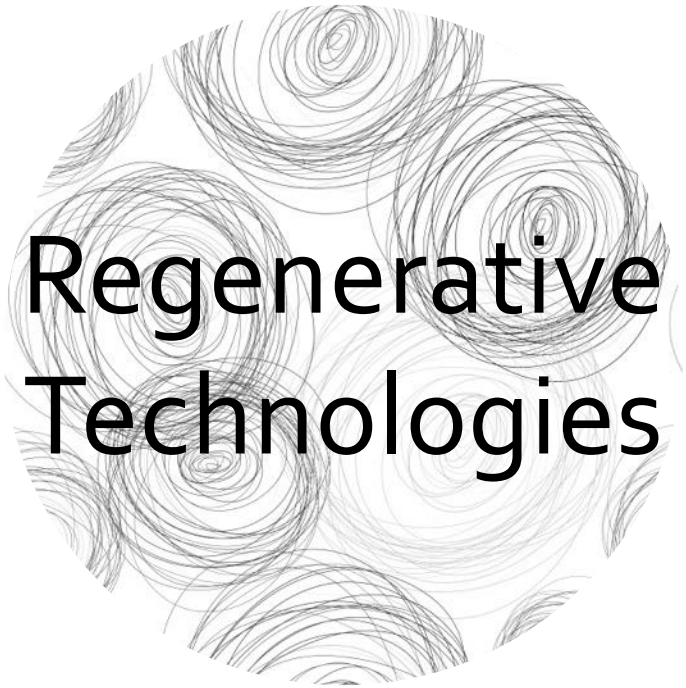

HELSE
SØR-ØST

SUSTAINABILITY LAB

&

SUSTAINABLE DIGITALISATION

Andrea Gasparini | 30.05.2023



Regenerative Technologies

The Regenerative Technologies research group aims to contribute to redirecting human modes of planetary habitation towards sustainment. We ask: what are technologies that repair, restore, and regenerate rather than harm people and degenerate our planet? Our focus is on digital artefacts and digitalisation processes, and the practices that they shape.

Prof. Maja van der Velden

Dr. Andrea Gasparini

Dr. Tigist Fetene Adane

Dr. Kari-Anne Lyng

Dr. Arian Mahzouni

PhD candidate Ines Junge

PhD candidate Svein Kjøde

PhD candidate Siv Årsand

Futuring Sustainable Nordics Business Models

A project investigating the transition to sustainable business models with different stakeholders in the Nordics.

Circular Energy for a Sustainable Circular Economy

circular energy

A project investigating the role of design, maintenance, and repair in energy conservation in digitalisation technologies.

Empower: Sustainable Batteries in Mobility

A project investigating the role of electric vehicle (EV) batteries in enabling a sustainable net-zero energy transition in Norway.

Materials Library for Sustainable Digitalisation

A project establishing a library of materials used in digital technologies as a provocation towards unsustainable digitalisation technologies and practices

- **We are a Lab with a vison and a mission**

  Our vision is a world in which people and planet thrive while achieving their full potentials. Our mission is to investigate digital artefacts, their ecosystems, and the practices that they shape, and how design can make these more sustainable.

- **Provide an inspiring lab environment to students**

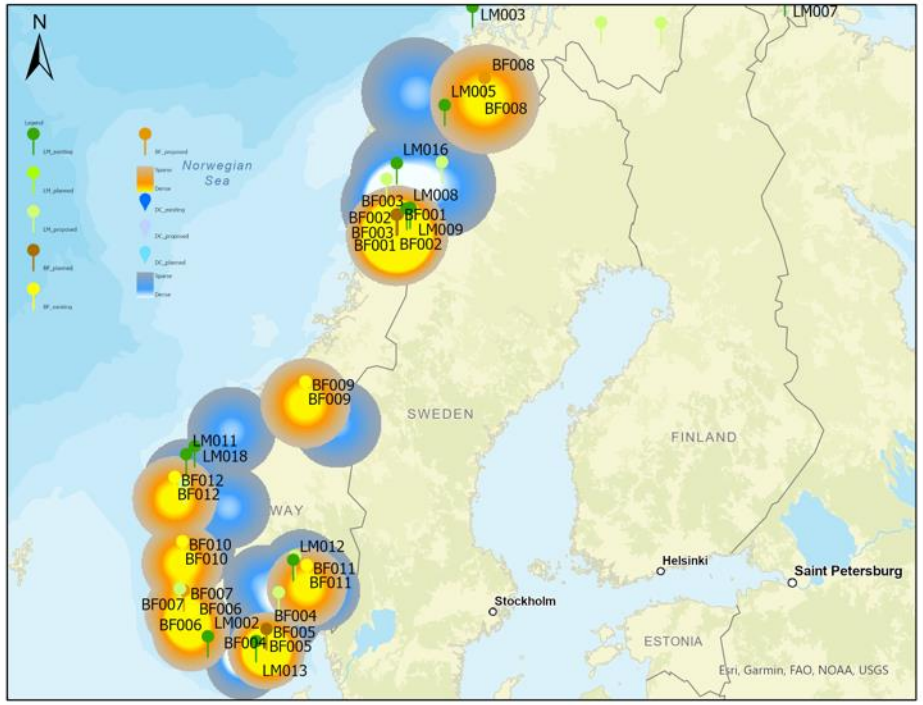
- **Critical inquiry into existing knowledges and practices**

- **Adapt and develop methodologies and methods**

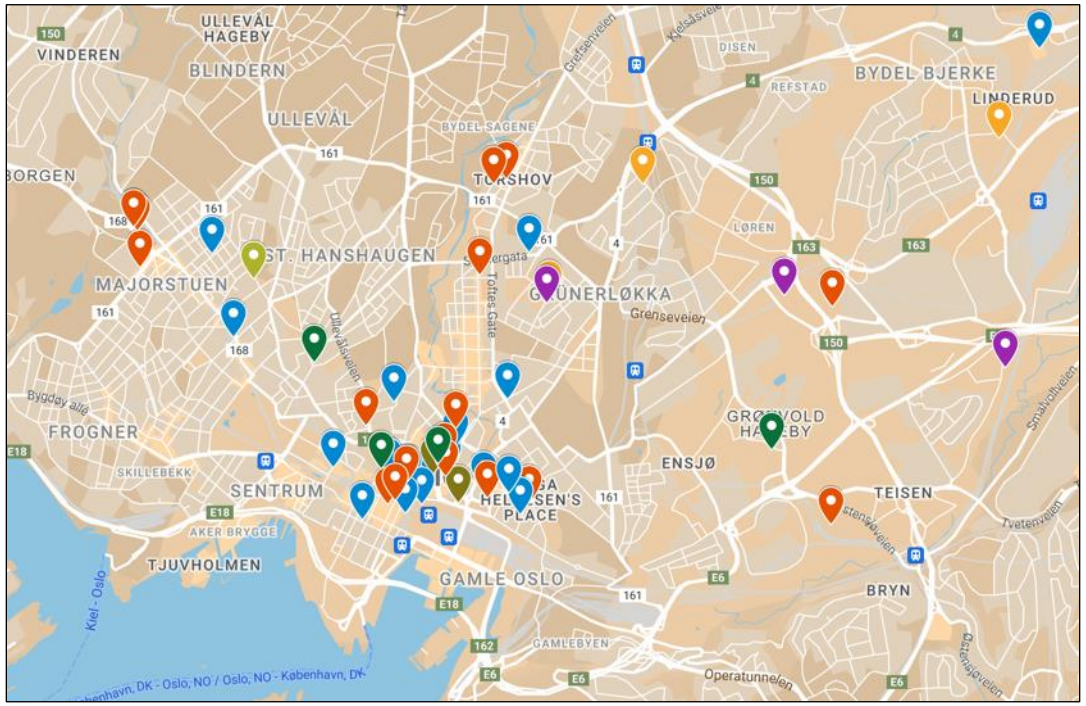
- **Collaborate across disciplines and projects**

- **Organise workshops and seminars**

Provide an inspiring lab environment to students



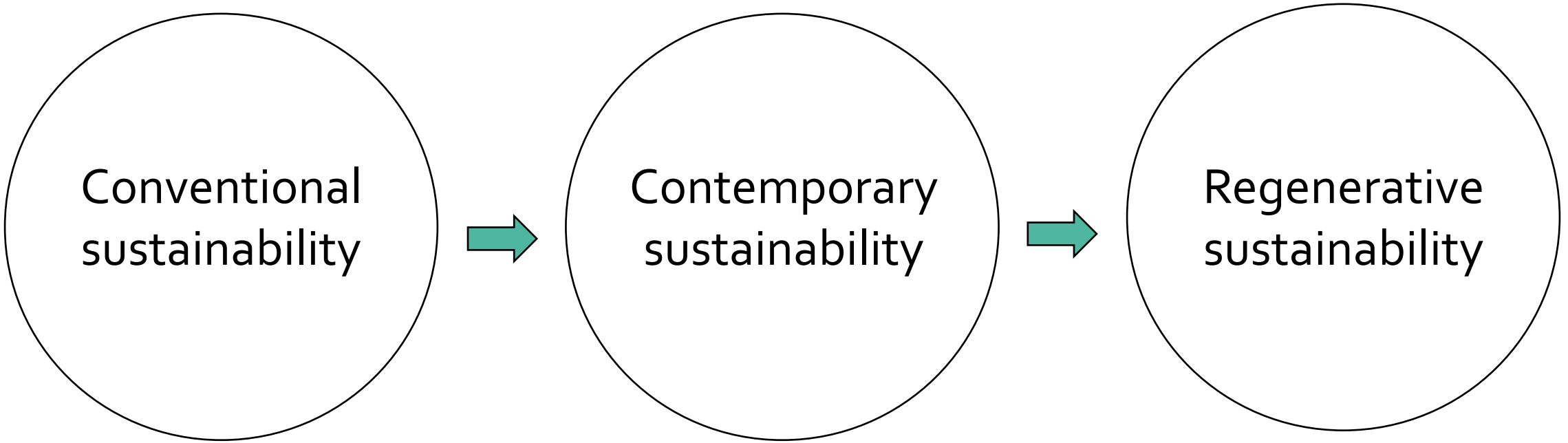
Mapping the Twin Transition was a project implemented during the summer of 2022. Three master students received a stipend to develop an interactive map visualising planned and existing electrification and digitalisation projects in Norway.



Repair & Conserve was a project implemented during the summer of 2021. Three master students received a stipend to map and interview independent repair shops in Oslo.

Provide an inspiring lab environment to summer students

Critical inquiry into existing knowledges and practices



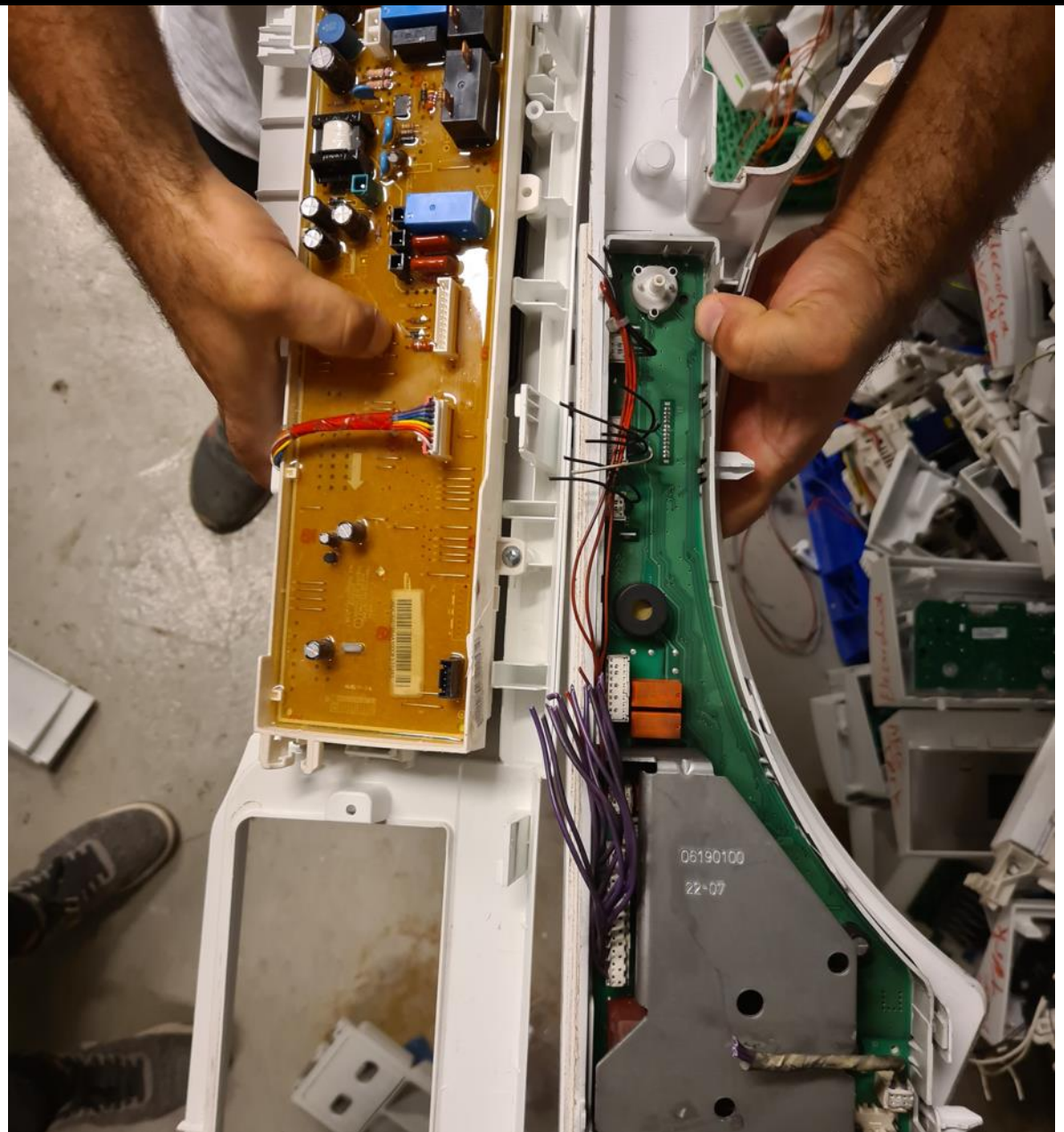
Anthropocentric worldview

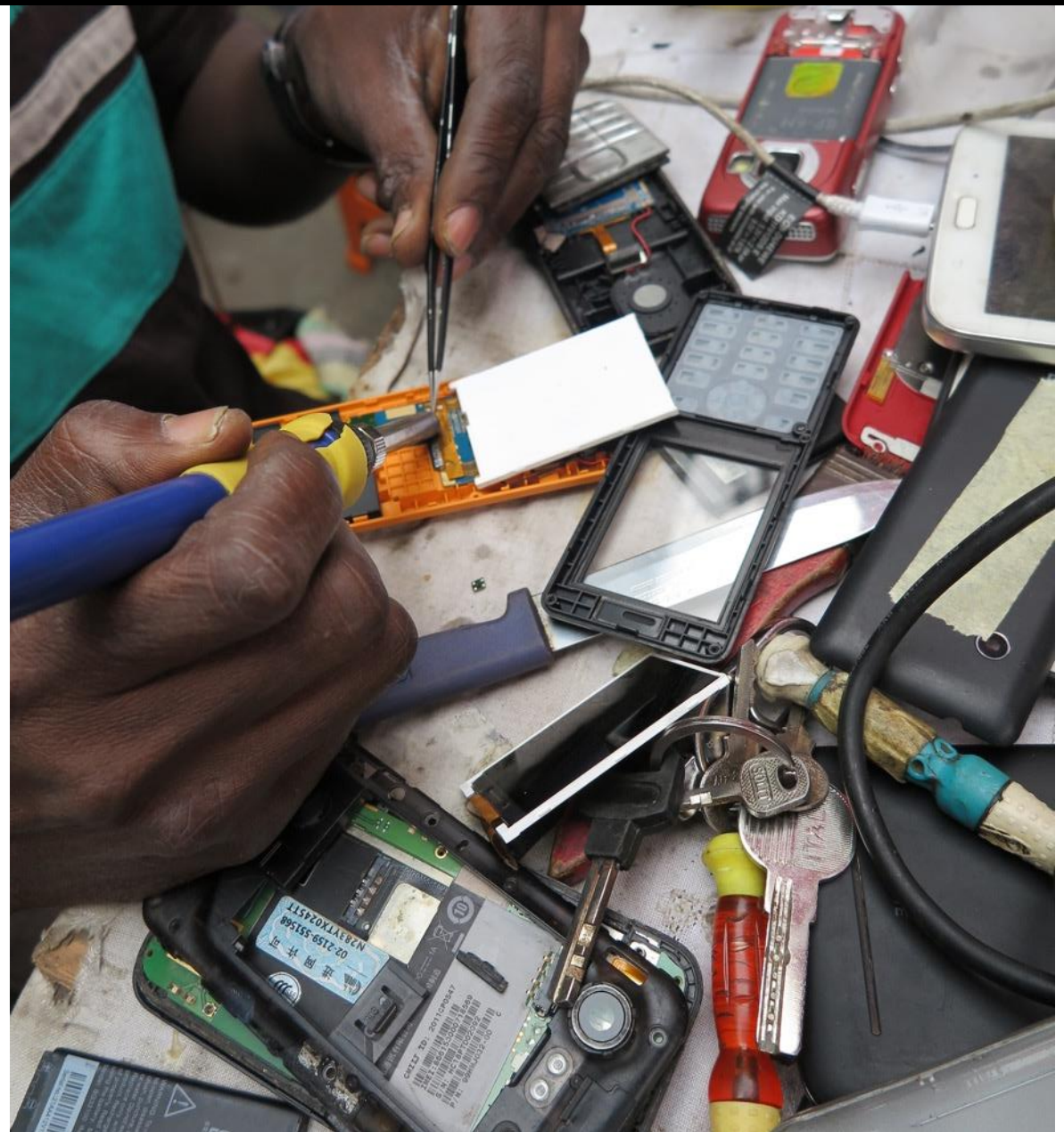
Socio-ecological-technical systems

Thriving whole living system

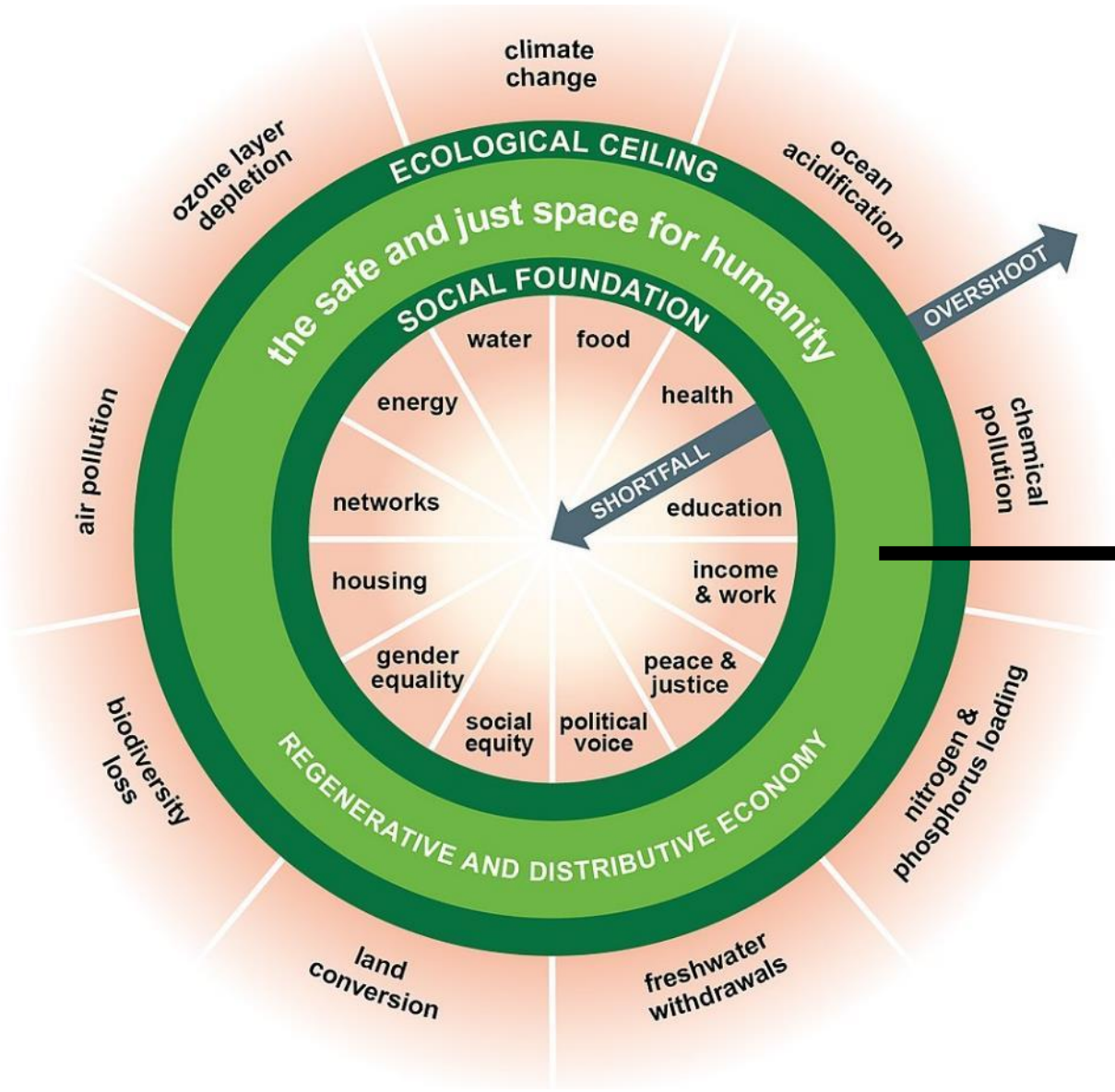
Critical inquiry into existing knowledges and practices

Critical inquiry into existing knowledges and practices





Adapt and develop methodologies and methods



Location for digitalisation processes and design of digitalisation technologies.

https://www.kateraworth.com/doughnut/

Method: A materials library for sustainable digitalisation

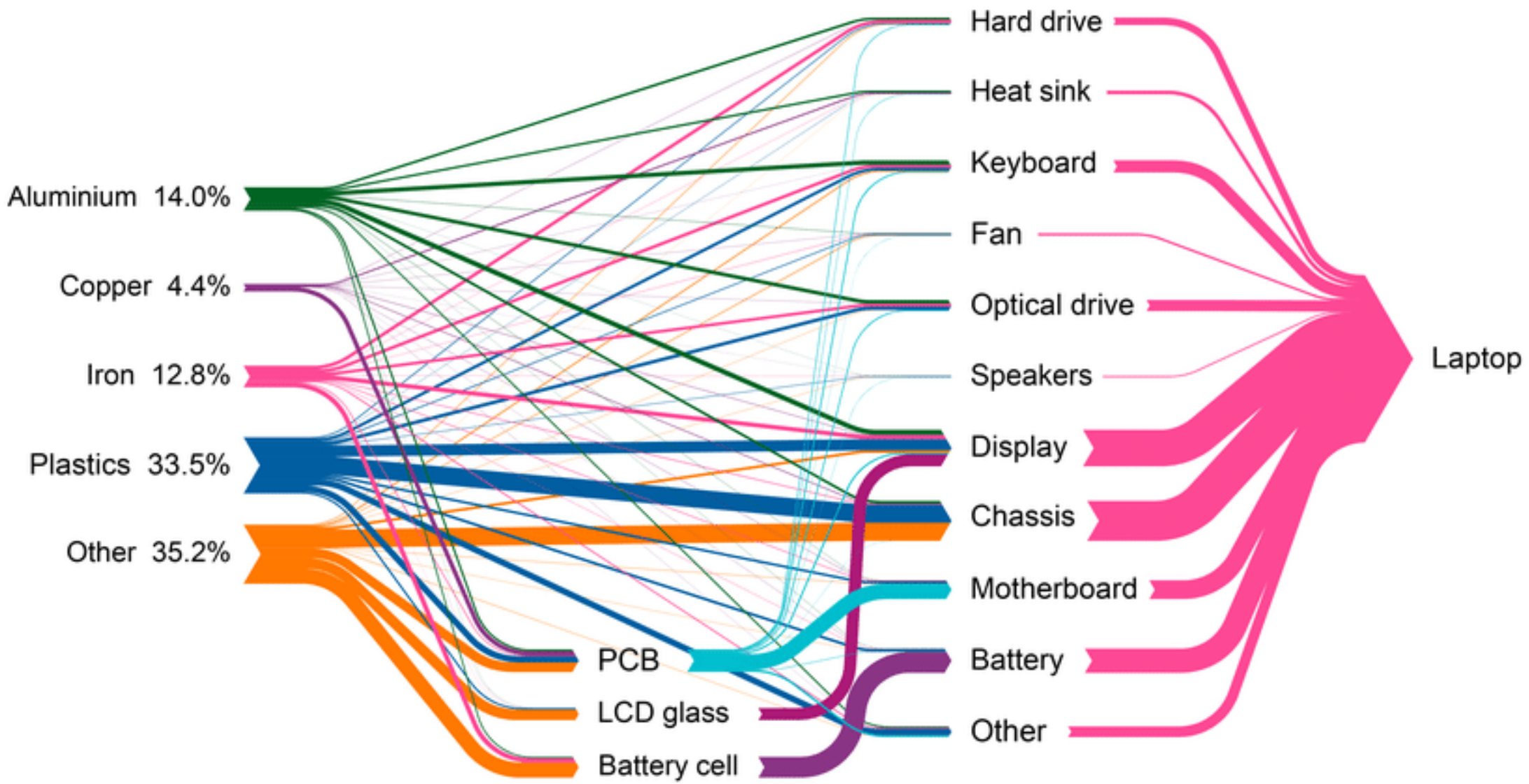


Image: Moraga et al., 2022

SUSTAINABLE AI

a mini-seminar on the challenges with artificial intelligence

Programme
13:00 – 13:15: Welcome and opening of the Programmed Inequality poster exhibition
13:15 - 13:35: Michael Puntschuh (AI Ethics Impact Group) on the AI Ethics label
13:40 - 14:00: Henrik Skaug Sætra (Østfold University College) on AI for the Sustainable Development Goals
14:00 - 14:15: Break with coffee/tea/drinks and snacks
14:15 - 14:35: Christopher Wilson (UiO) on a sustainable AI model for the public sector
14:40 - 15:00: Cathrine Bui (ex-IFI) on gender equality and AI
15:00 - 15:30: Questions and discussion

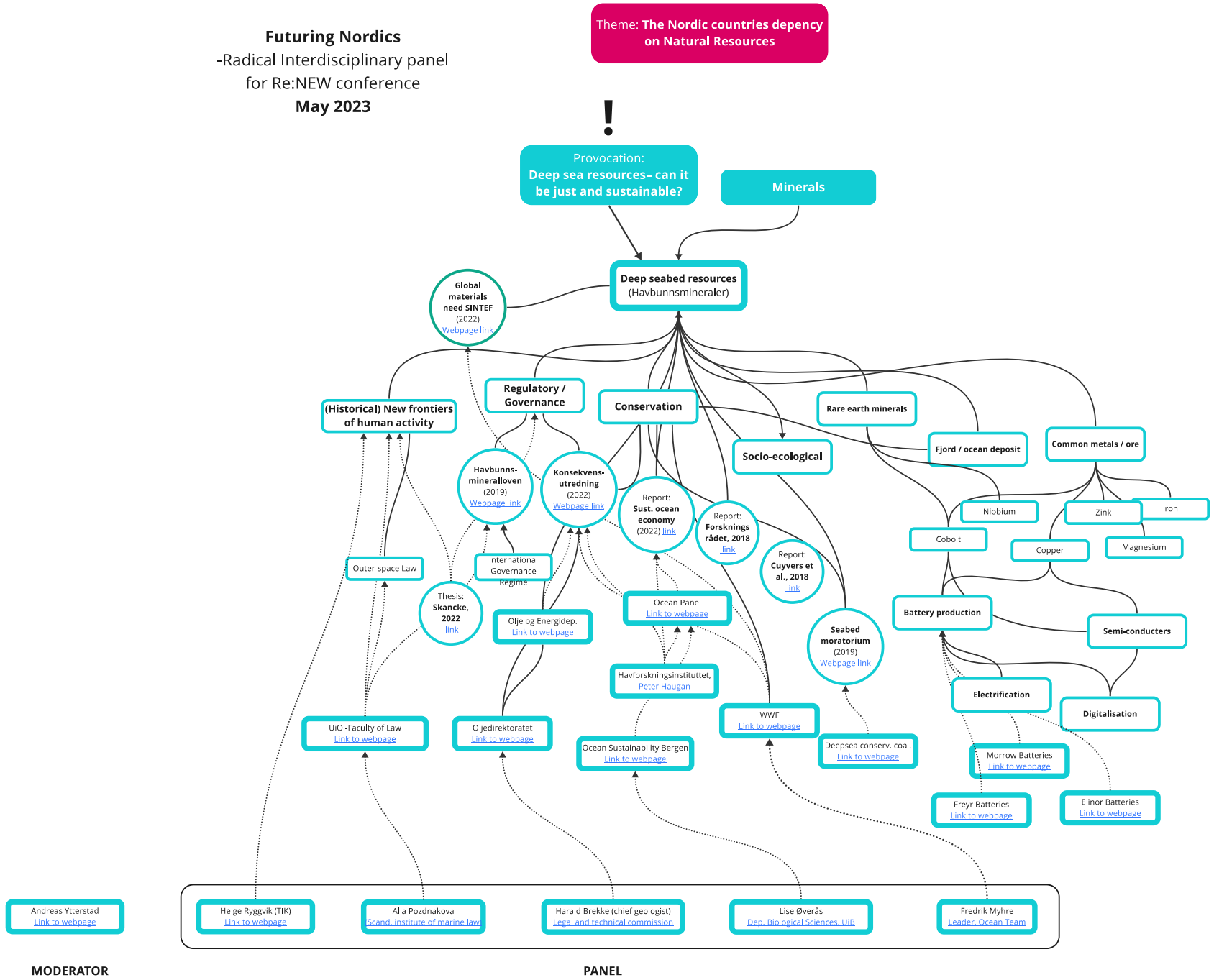
Date:
March 10

Time:
13:00 – 15:30

Venue:
IFI Library

Organisation:
Sustainability Lab

Futuring Nordics
-Radical Interdisciplinary panel
for Re:NEW conference
May 2023



A panel on the deep sea mining of minerals for the twin transition


Department of
Informatics, UiO
18th & 19th
November 2021
Nordic perspectives
on product repair
Fixing for future
Designed by
Janna Opheim

Organise workshops and seminars … and more

A photo exhibition on repair practices in Accra, Amsterdam, and Oslo


Bibliotek
CD
AUTOMATING INEQUALITY
YOUR COMPUTER IS ON FIRE
Data Feminism
DATA FEMINISM
WEAPONS OF MATH DESTRUCTION
CATHY O'NEIL
WEAPONS OF MATH DESTRUCTION
RUHA BENJAMIN
RACE AFTER TECHNOLOGY
RACE AFTER TECHNOLOGY

Our *precious plastic* machine

Futuring Nordics

Circular Energy

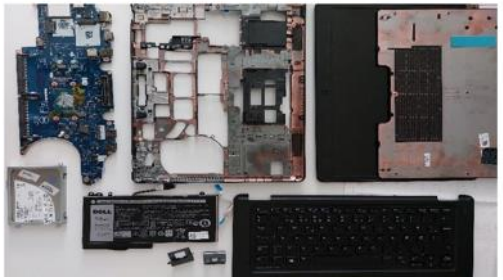
circular energy

Empower

Precious Plastic

From Designed Obsolescence to Sustainable Technology Design

Maintenance and Repair as Energy Conservation



Designerly Approaches to Sustainability Oriented Innovation

Materials Library for Sustainable Digitalisation

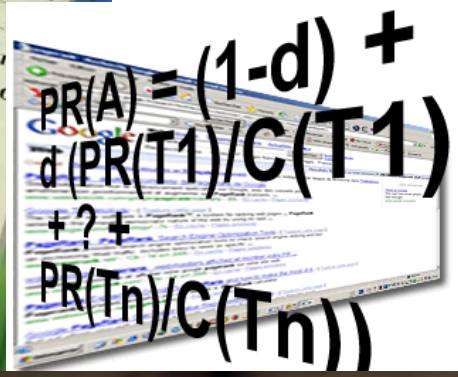
A big thank you to **UiO: Energy and Environment**
for supporting several of our projects

SUSTAINABILITY LAB

AI opportunities and challenges

Anis Yazidi
Computer Science Department
OsloMet

AI and ML: part of our dailylife



AI part of our future

‘MIND-READING’ ALGORITHM DECODES THE PICTURES IN YOUR HEAD

Researchers from ATR Computational Neuroscience Laboratories and Kyoto University in Japan developed a deep learning-based algorithm that can generate images from brain activity.


StartupGRIND
powered by Google for Entrepreneurs
Global Conference 2018
AI is the New Electricity
Dr. Andrew Ng

Regulating the internet giants

The world's most valuable resource is no longer oil, but data

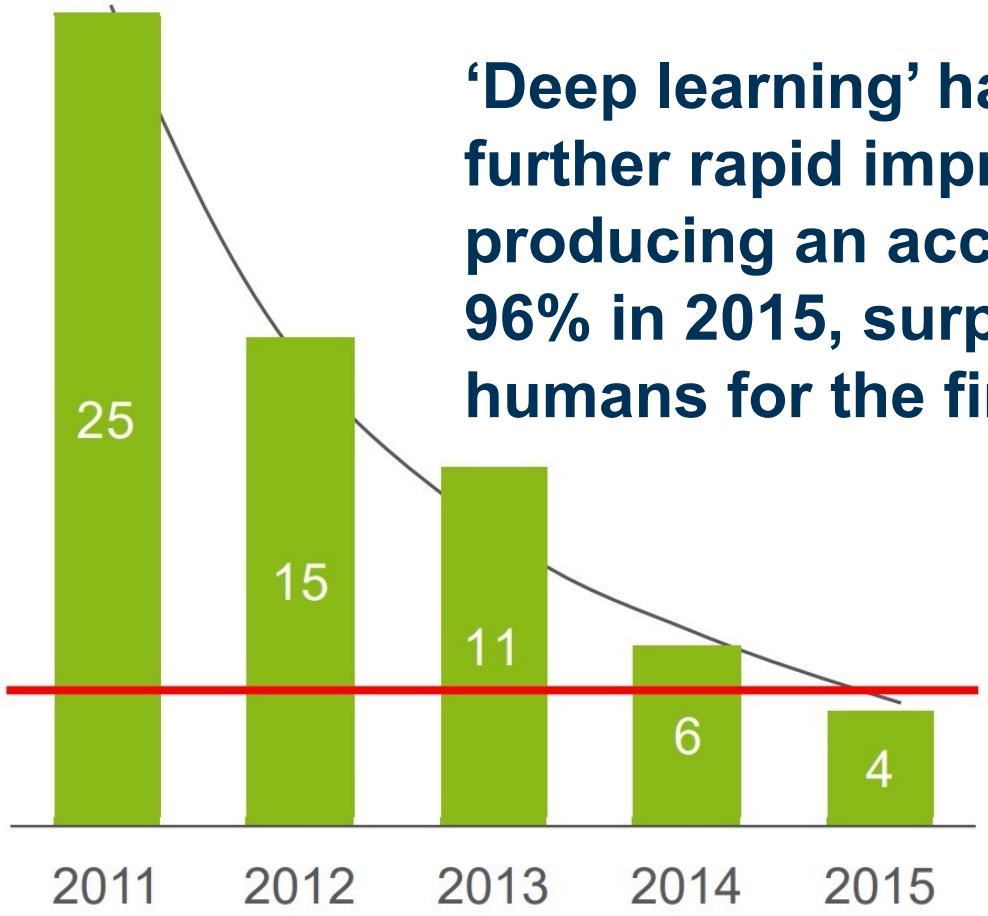
The data economy demands a new approach to antitrust rules

Print edition | Leaders ›

May 6th 2017

(Source: The Economist)

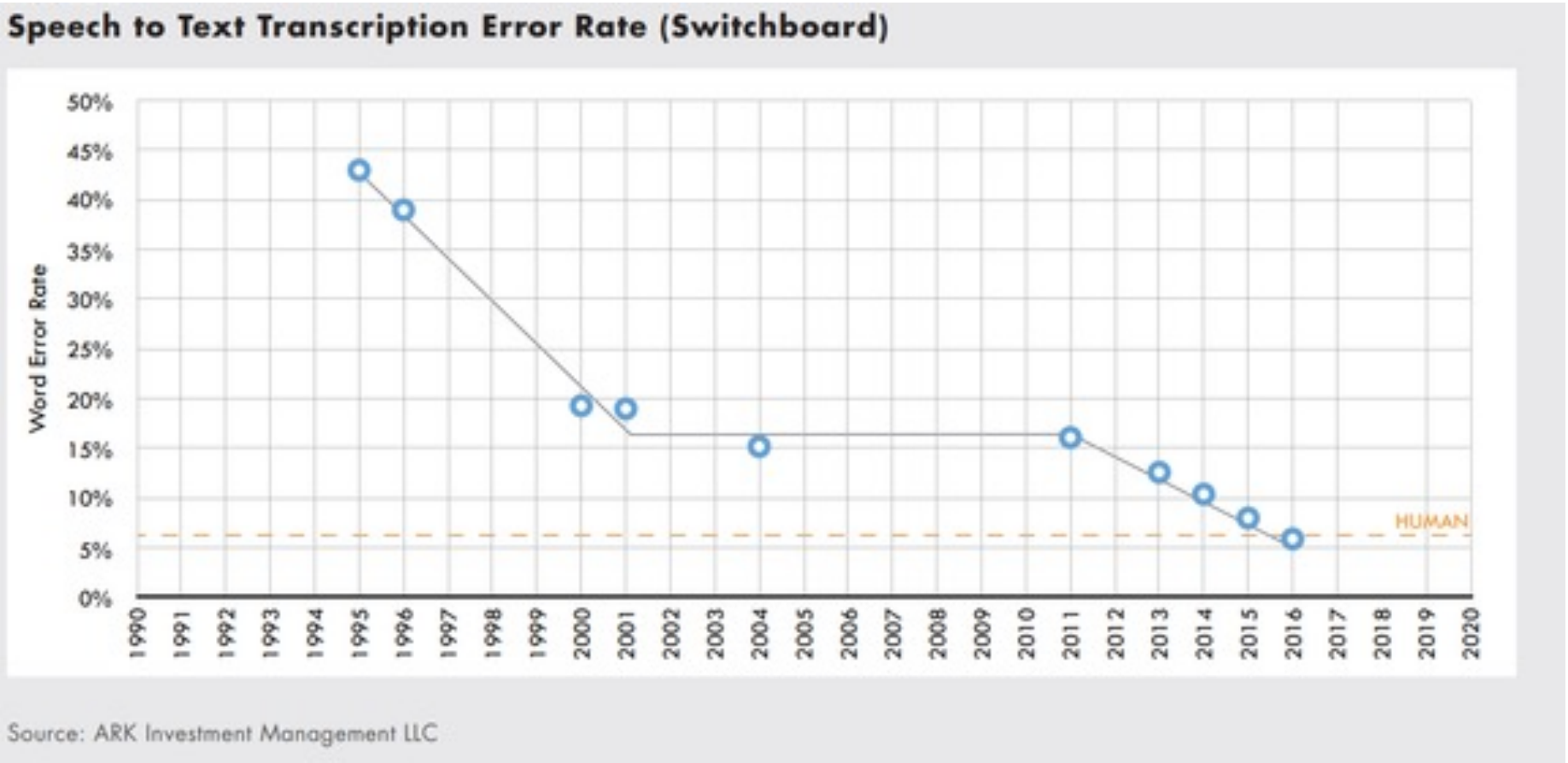
First Inflection Point



‘Deep learning’ has brought further rapid improvements, producing an accuracy of 96% in 2015, surpassing humans for the first time

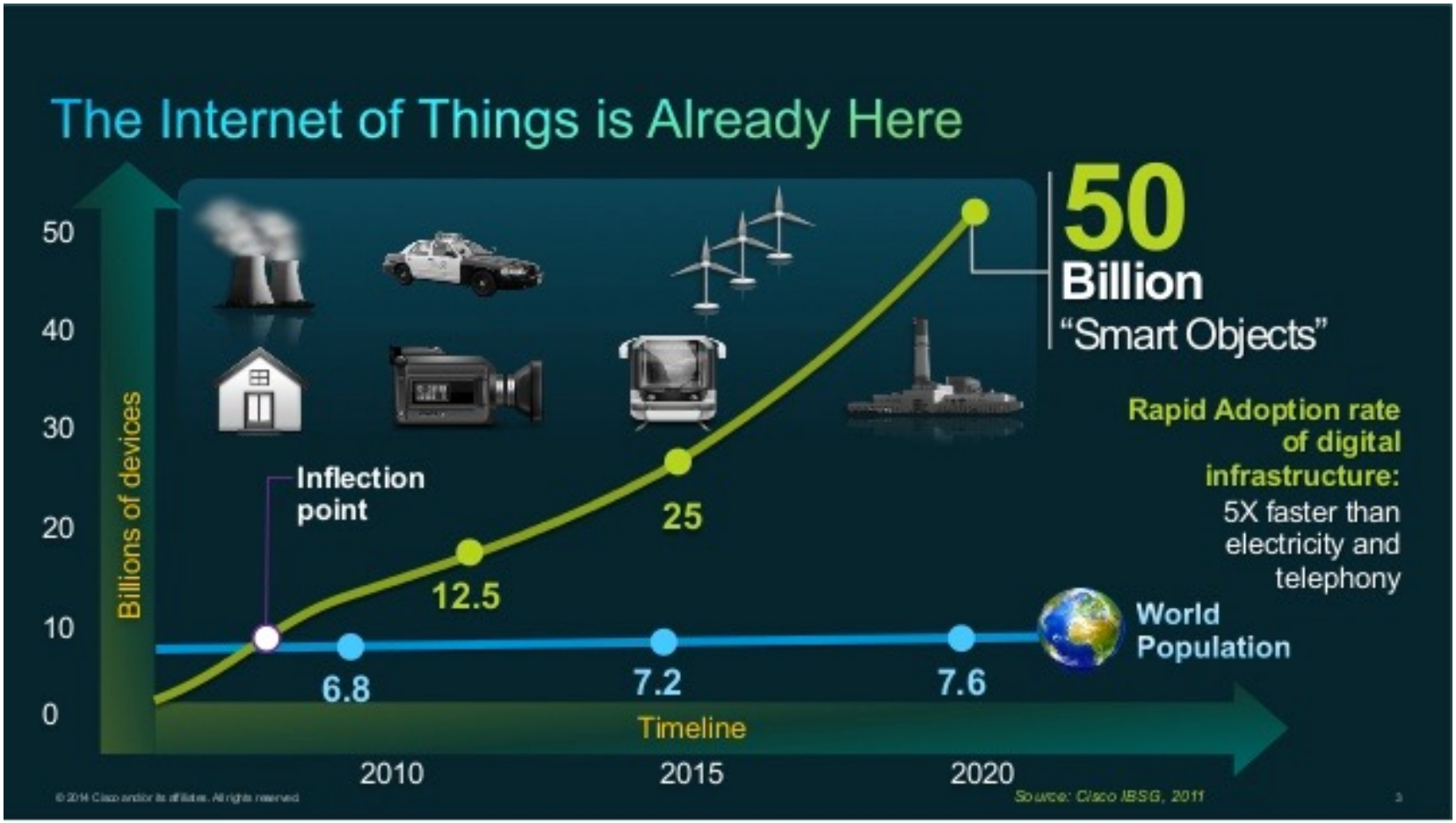
Error rates on ImageNet visual challenge, %

Second Inflection Point



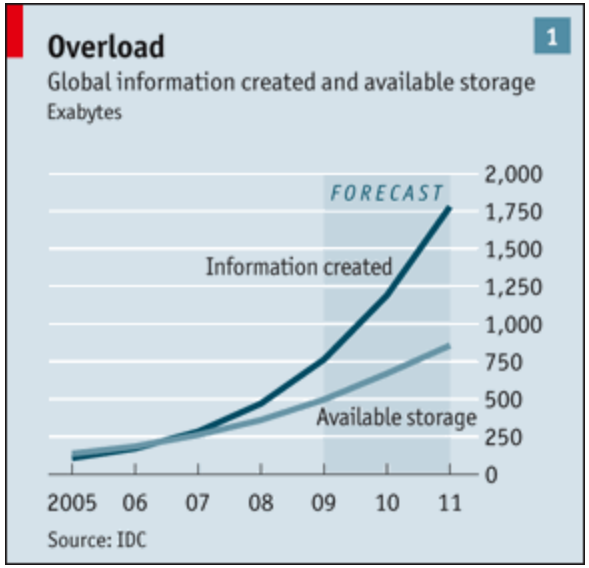
Third Inflection point: More IoT data:

- Cisco predictions:



Fourth Inflection point

- We live in an era of “Big Data”:
  - Technology are producing increasingly large data streams every second.
- We can no longer afford to store all the data produced by devices



The economist

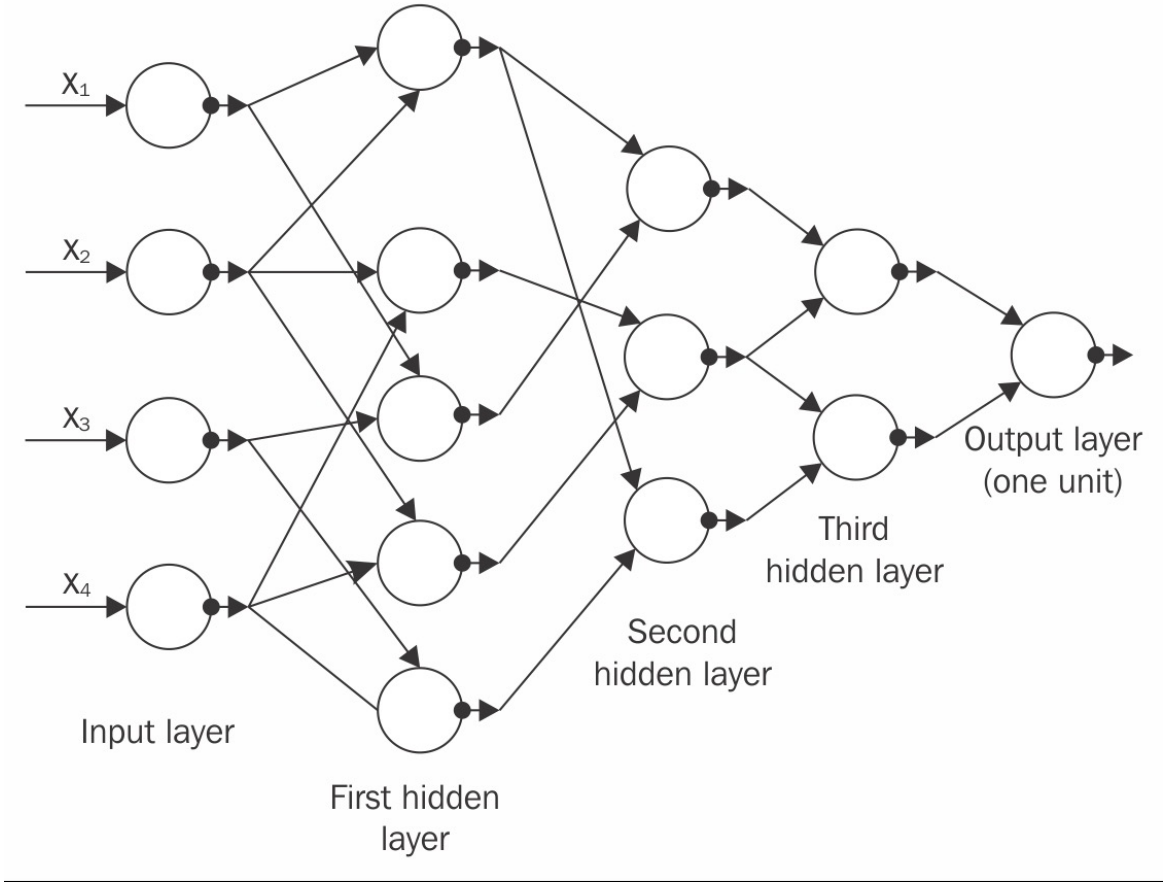
Why Machine Learning?

- It is very hard to write programs that solve problems like recognizing a face.
  - We don't know what program to write because we don't know how our brain does it.
- Instead of writing a program by hand, we collect lots of examples that specify the correct output for a given input.

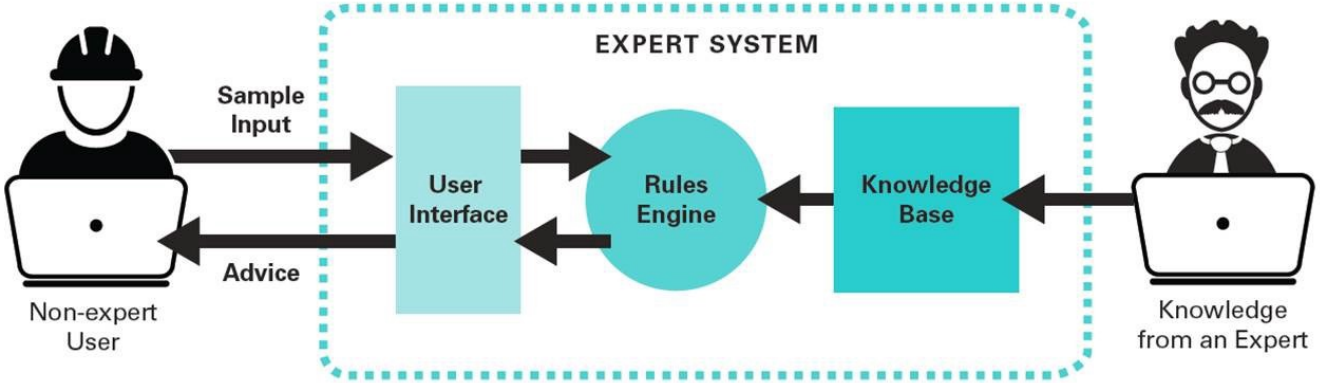
Some History of AI

1960s: Alexey G. Ivakhnenko and multilayered neural networks

О.Г. Івахненко (1967 р.)



1980s:
The age of expert systems



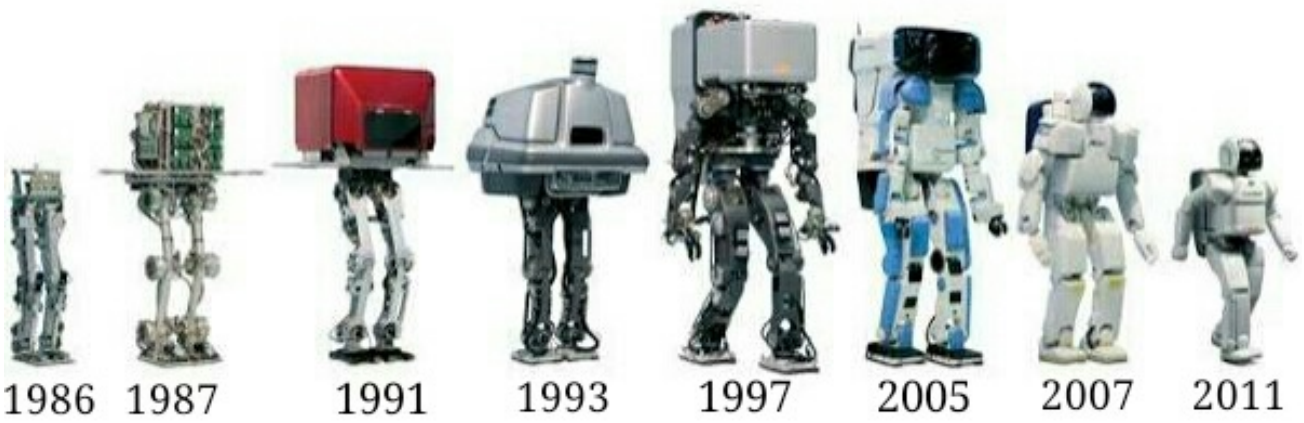
- 1980 Revival of the AI research with the narrow focus of managing knowledge

1997 Deep Blue beats Garry Kasparov in Chess

1999 Aibo and MIT Emotional AI Lab

New artificial intelligence technologies are learning and recognizing human emotions, and using that knowledge to improve everything from marketing campaigns to health care.

Honda P-series continues evolving



2002 First anti-spam

Paul Graham

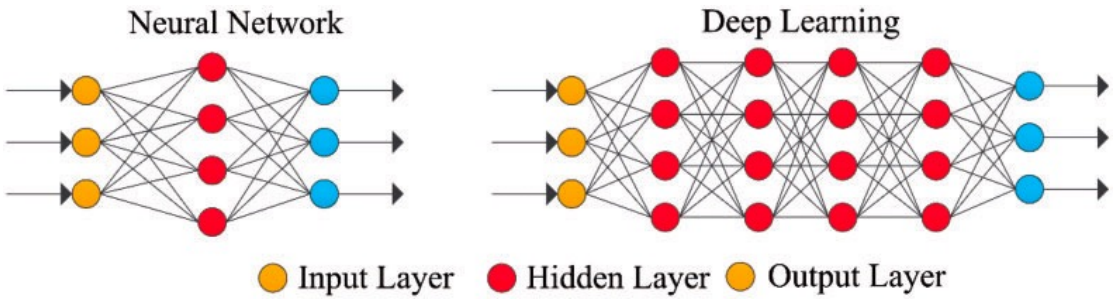
2004 Darpa Autonomous Vehicle Challenge

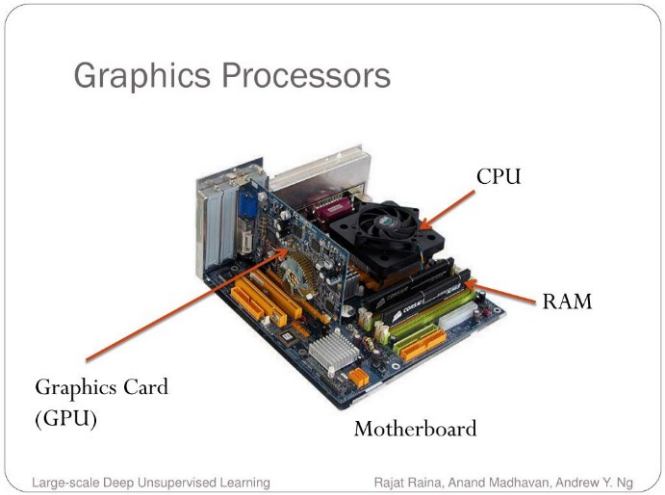
- The first competition of the DARPA Grand Challenge was held on March 13, 2004 in the Mojave Desert region of the United States, along a 150-mile (240 km).
- None of the robot vehicles finished the route. Carnegie Mellon University's Red Team traveled the farthest distance, completing 11.78 km (7.32 mi).

- Therefore, a second DARPA Grand Challenge event was scheduled for 2005.
- Just one year later 5 vehicles completed the course and almost all of the 23 competitors did better than the best entry of the 2004 competition.

2008 IBM Watson Jeopardy

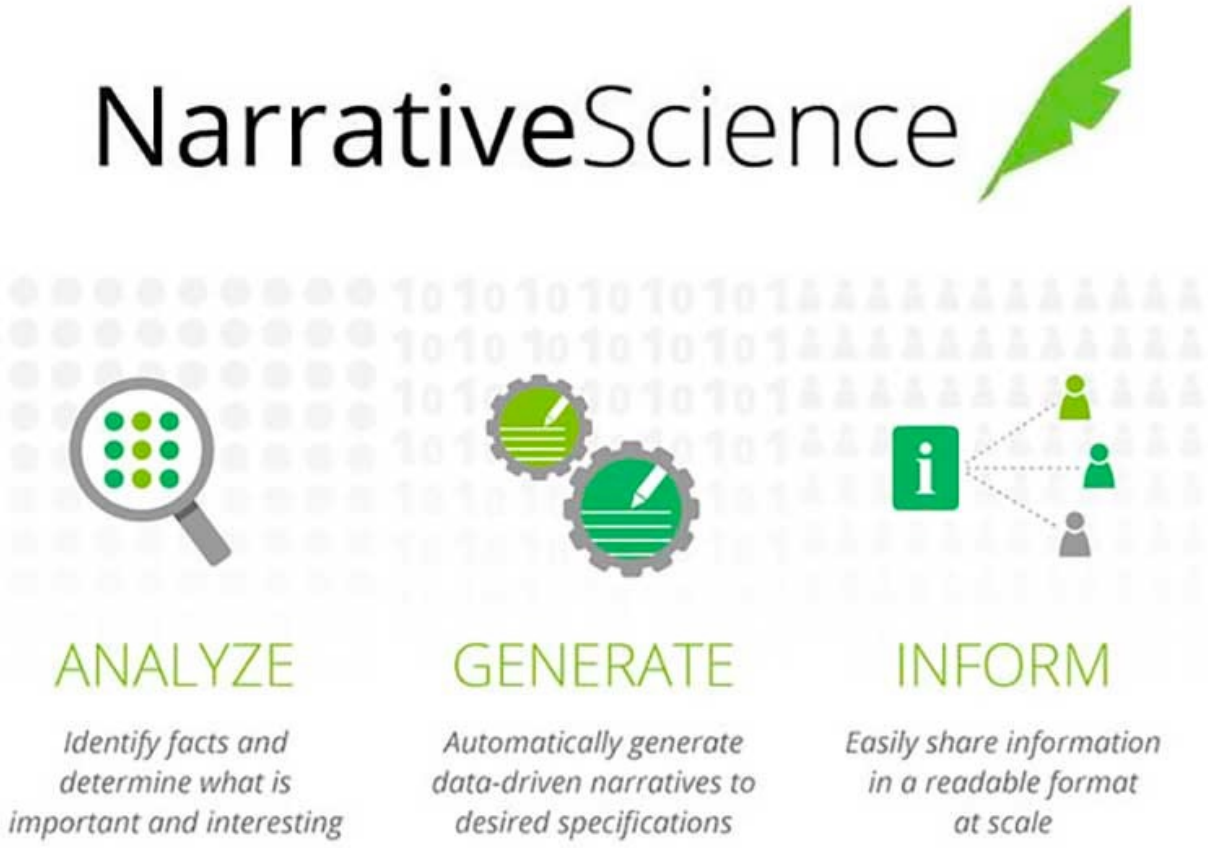
2009 Deep Learning revolution powered by GPUs





2009

2010 Natural Language Generation: Writing reports



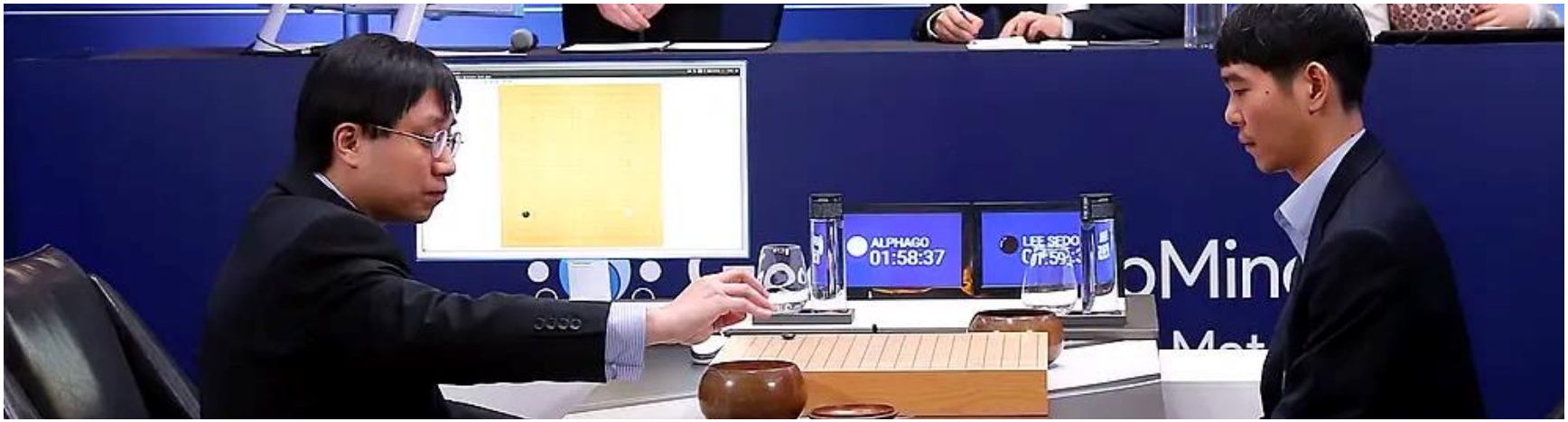
OpenAI

2015 Open source AI projects receive massive investment

2016 Google's Alpha Go defeats Lee Sedol in a game of Go

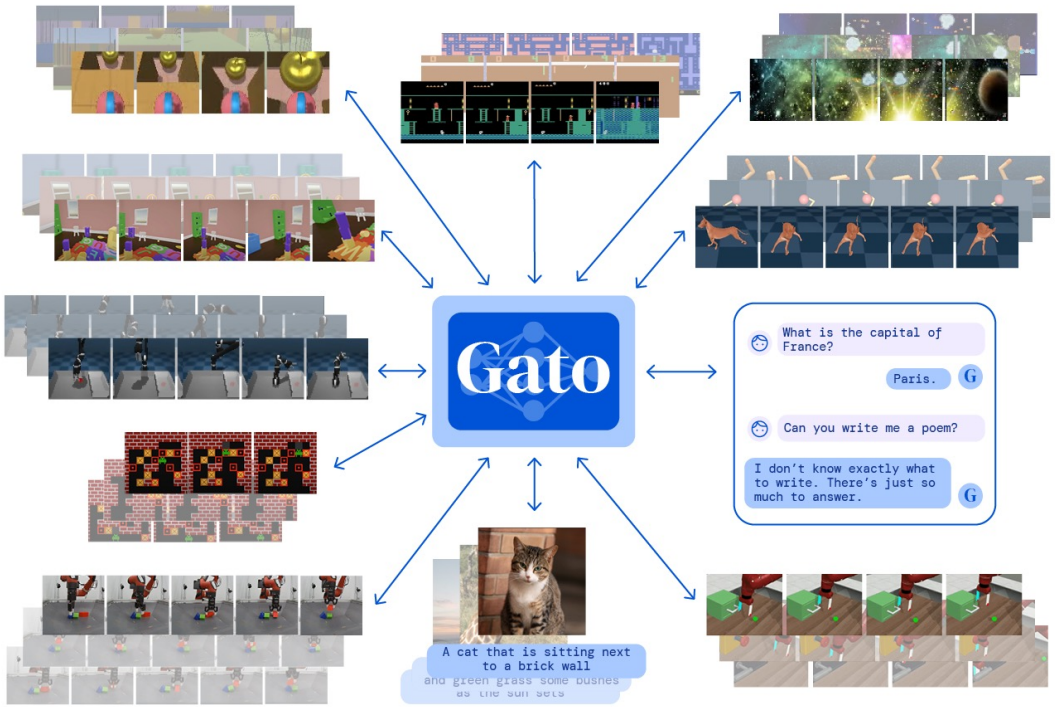
- *About an hour into the match, AlphaGo placed one of its stones in a nontraditional spot on the board that surprised those watching.*

- ***«This technology is going to cut through the global economy like a hot knife through butter. It learns fast and largely on its own. It's widely applicable. It doesn't only master what it has seen, it can innovate. For example: some of the unheard of moves made by AlphaGo were considered "beautiful" by the Grandmaster it beat.» John Robb***



Current state of the art models

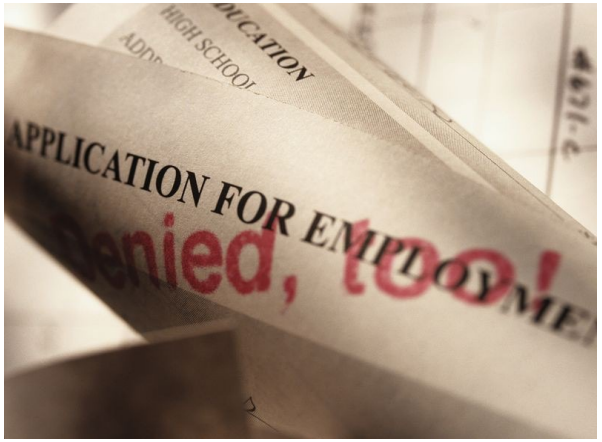
Generalist agents (Gato, GPT-3)



Digital artists (DALL-E 2, Imagen)

https://www.deepmind.com/publications/a-generalist-agent

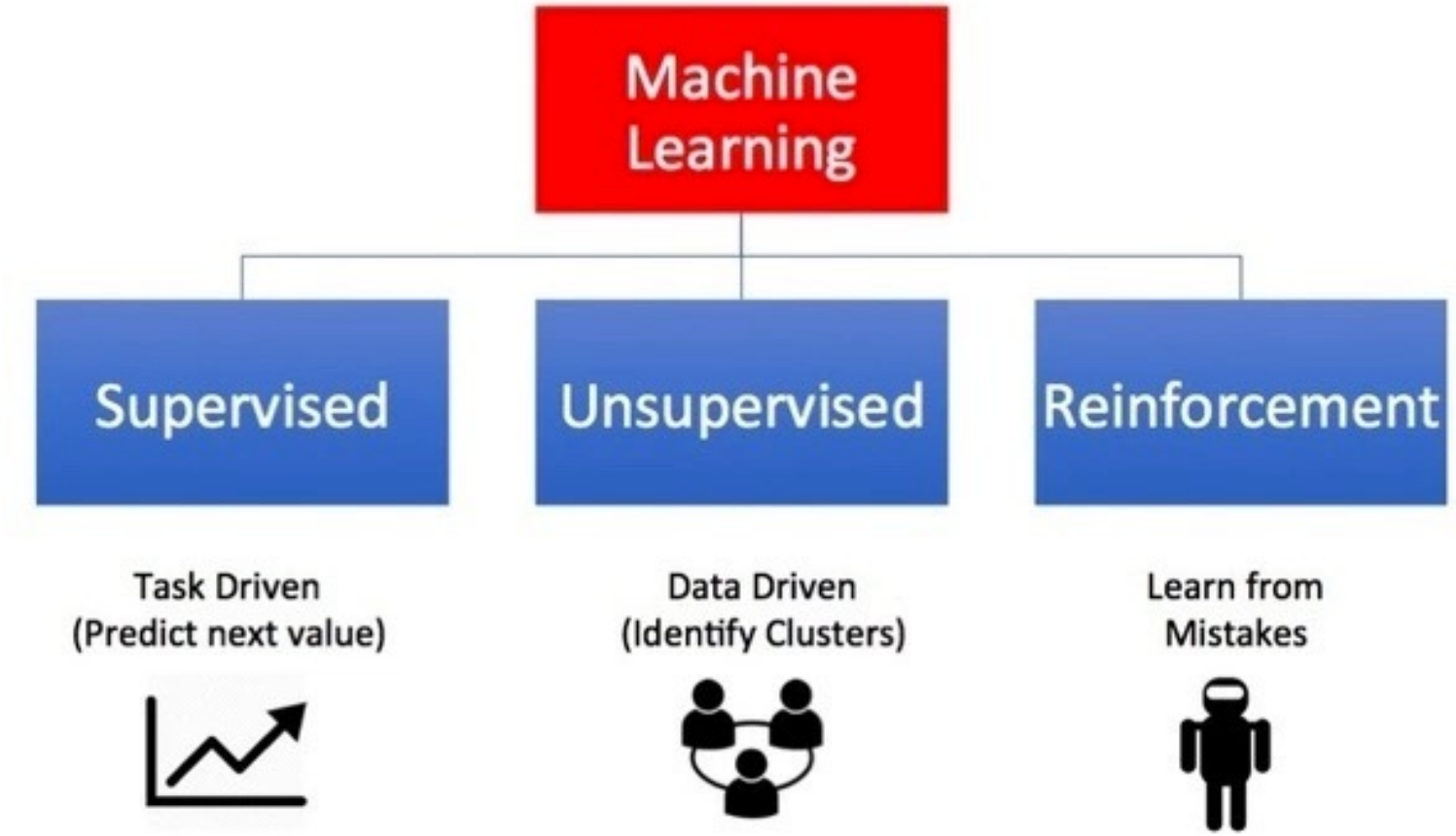
AI is increasingly used in many high-stakes tasks



AI BASICS TAILORMADE

WHAT SHOULD WE ALL KNOW TO BE ABLE TO HAVE AN INTERESTING AI TALK WITH YOUR COLLEAGES?

Types of Machine Learning

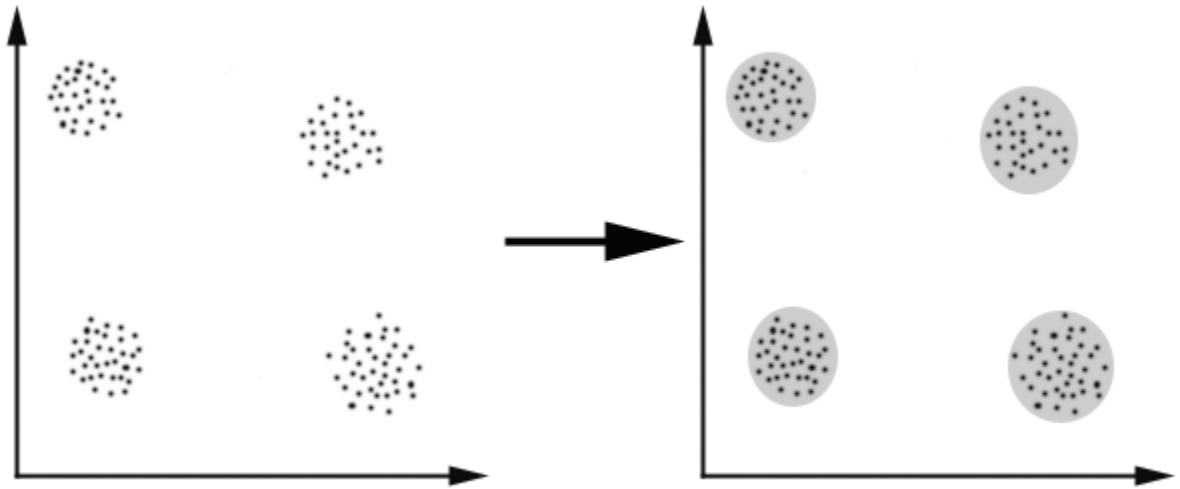


Reinforcement Learning

- **Familiar models of machine learning**
  - **–Learning from data.**
- **How did you learn to cycle?**
  - **–Not from Data!**
  - **–Trial and error!**
  - **–Falling down hurts!**
- **Walking, Talking, etc.**

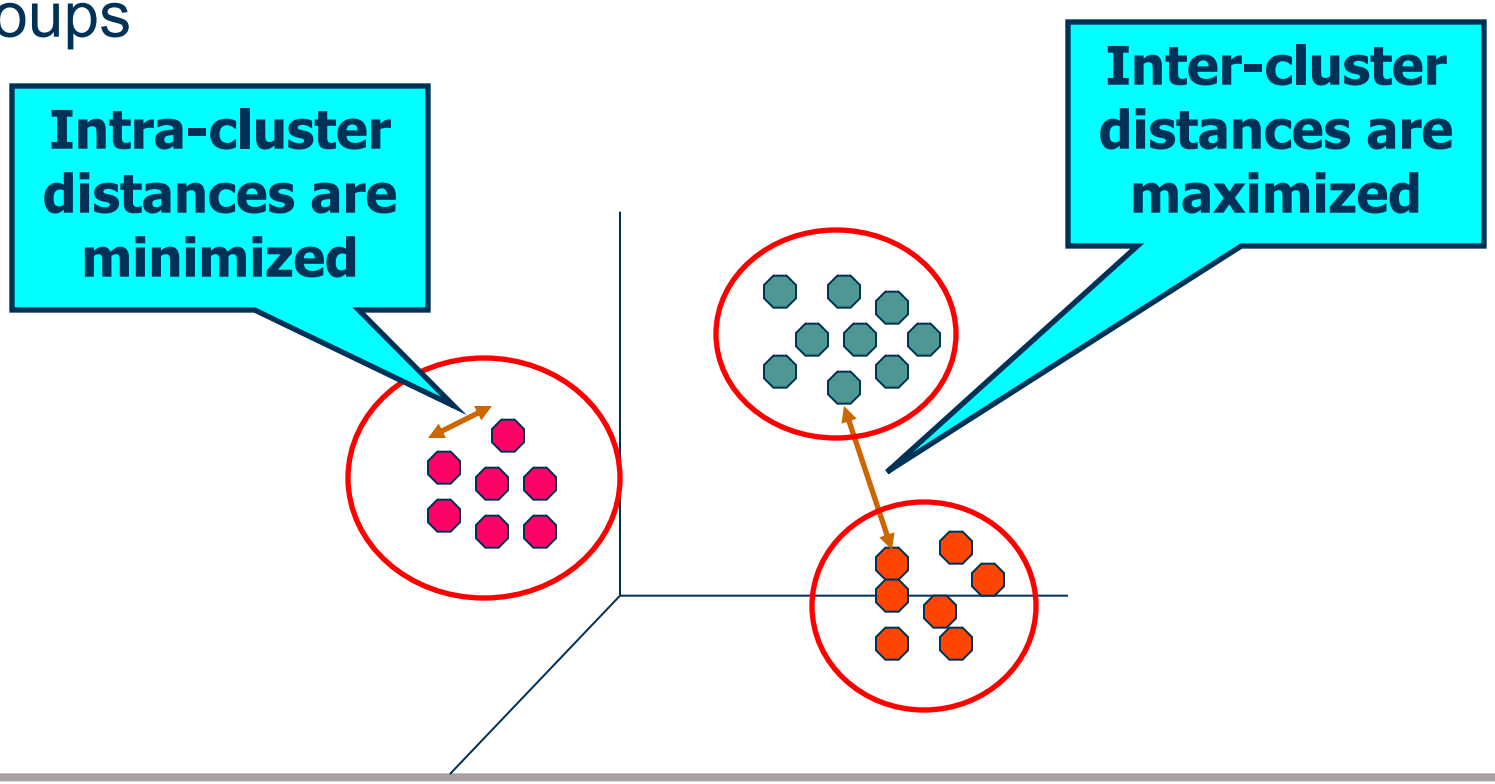
Unsupervised Learning

What is Clustering ?



What is Clustering?

- Finding groups of objects such that the objects in a group will be similar (or related) to one another and different from (or unrelated to) the objects in other groups

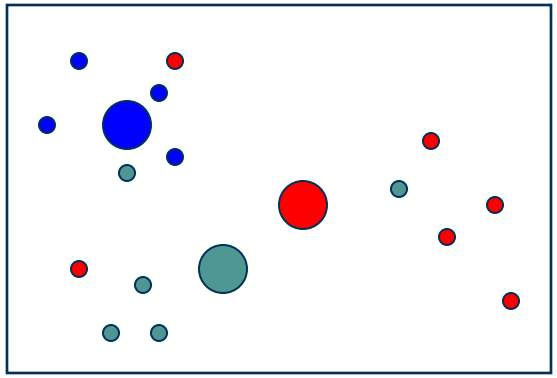


Examples of Clustering Applications

- Patient Stratification: finding groups of patients that have similar characteristics/responses
- Marketing: Help marketers discover distinct groups in their customer bases, and then use this knowledge to develop targeted marketing programs
- Land use: Identification of areas of similar land use in an earth observation database
- Insurance: Identifying groups of motor insurance policy holders with a high average claim cost

32

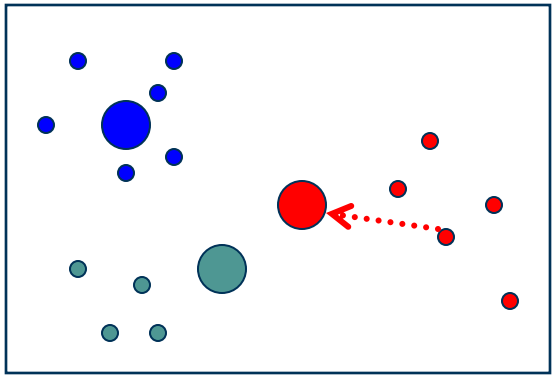
K-means: Example, k = 3

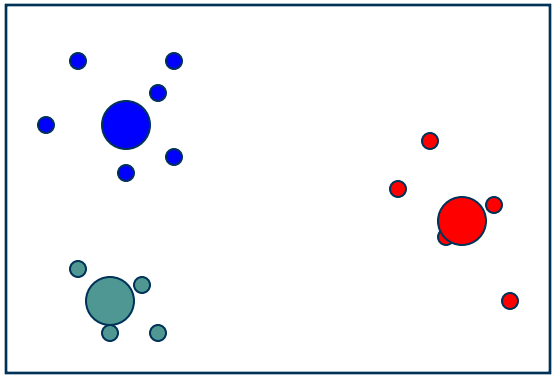


Step 1:

- Make Random assignments
- Compute centroids (big dots)

Step 2: Assign points to nearest centroids



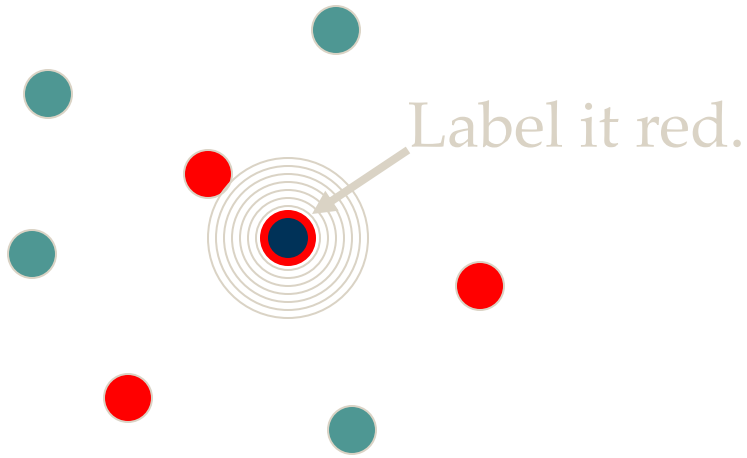


Step 3: Re-compute centroids

Supervised Learning

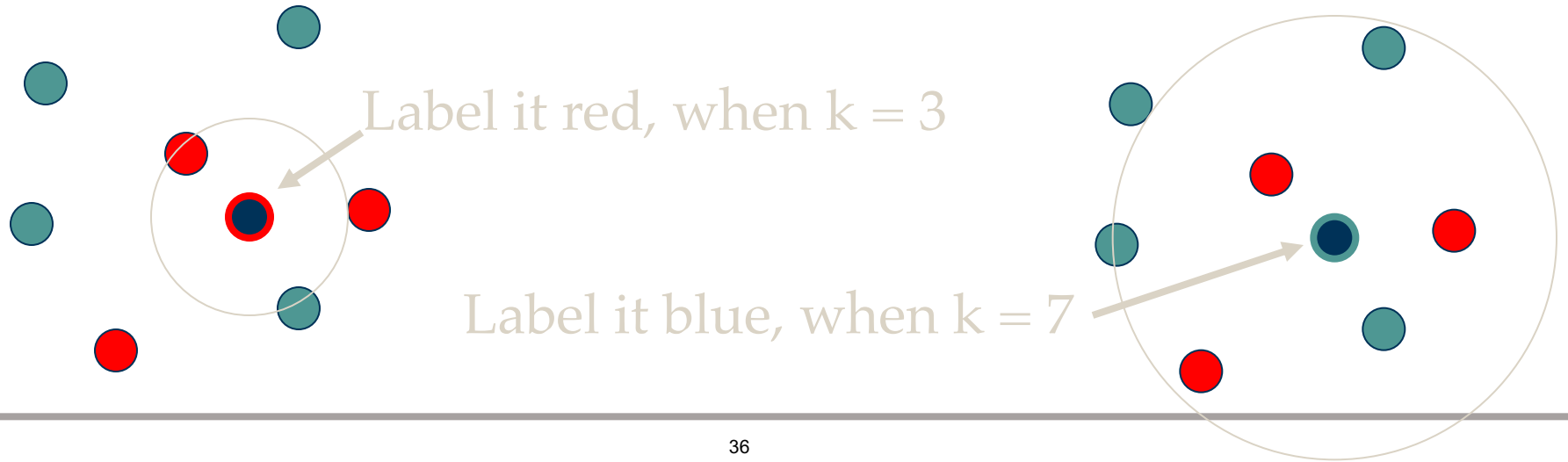
1-Nearest Neighbor

- Nearest Neighbor: Non-parametric pattern classification.
- One of the simplest of all machine learning classifiers
- Simple idea: Label a new point the same as neighbor

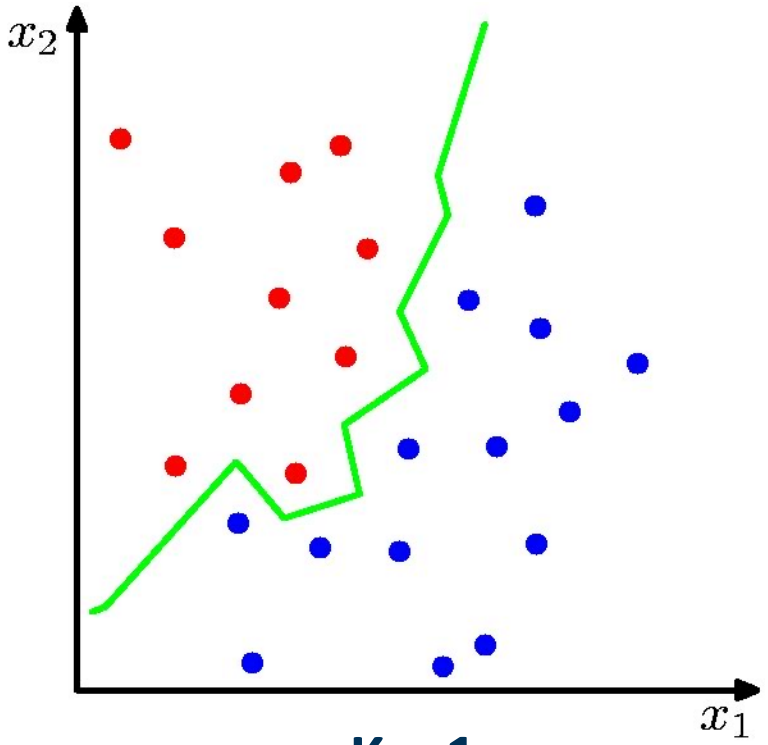


k-Nearest Neighbor

- Generalizes 1-NN to smooth away noise in the labels
- New point: Assigned to most frequent label of its *k* NN



Nearest-Neighbours for Classification

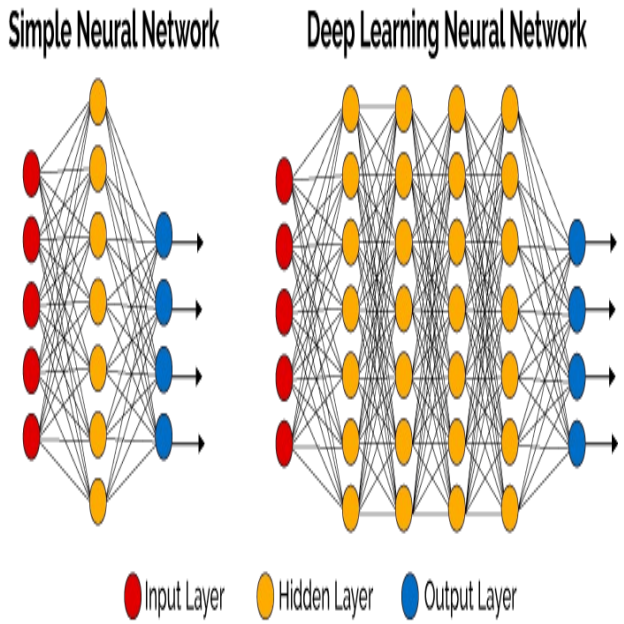


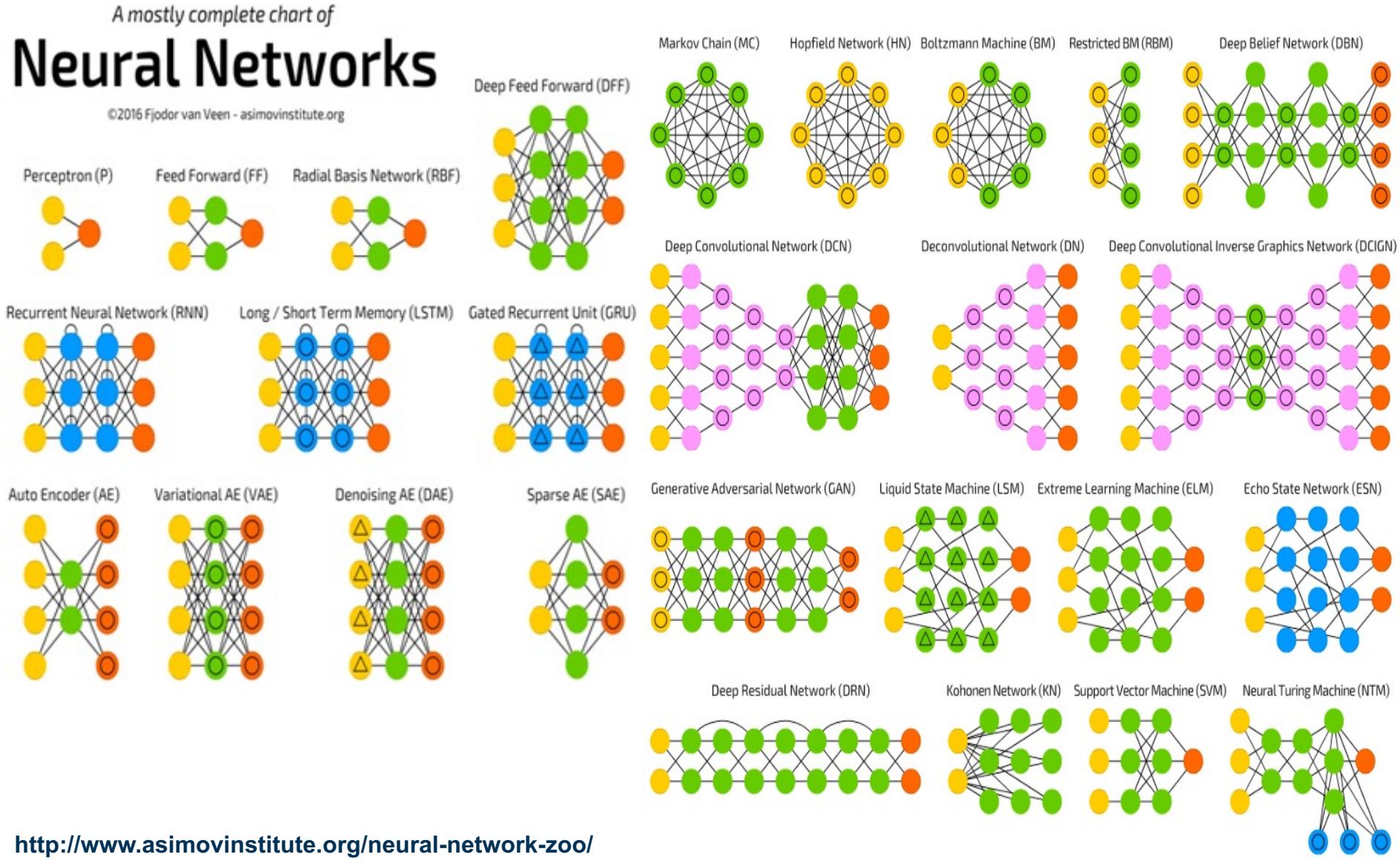
K = 1

Deep learning: bird view

Deep Learning

- **Utilizes learning algorithms that derive meaning out of data by using a hierarchy of multiple layers that mimic the neural networks of our brain.**

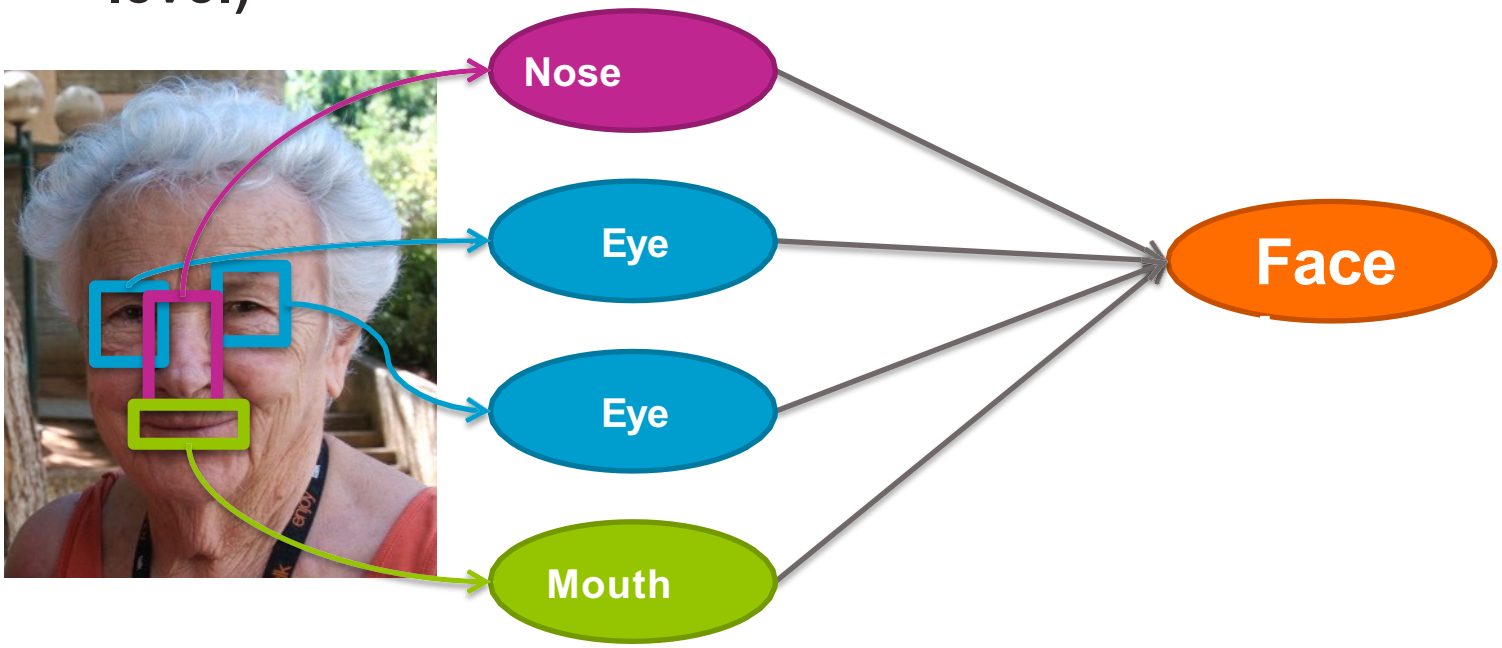




http://www.asimovinstitute.org/neural-network-zoo/

Standard Image Classifcation: Image features

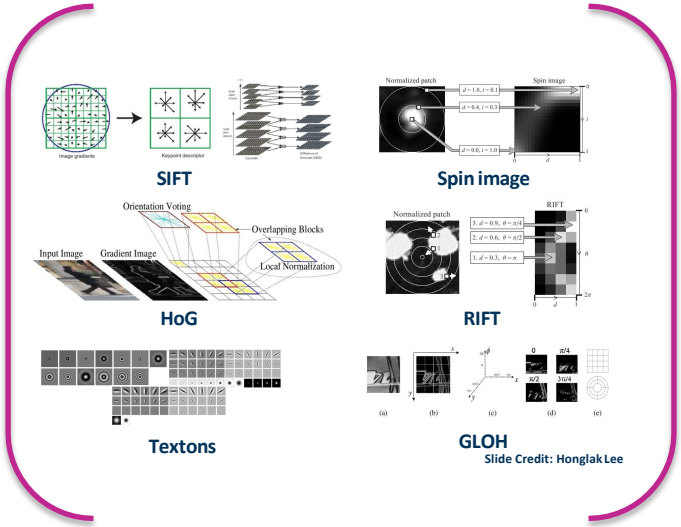
- **Features = local detectors**
  - **Combined to make prediction**
  - **(in reality, features are more low-level)**



Standard image classification approach

Input features

Extract

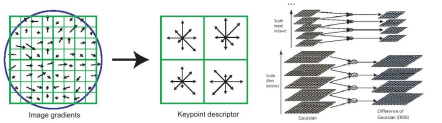


e.g., logistic regression, SVMs

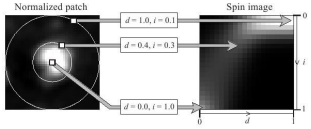
Car

Use simple classifier

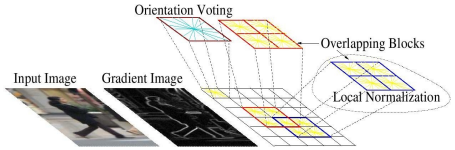
Many hand create features exist…



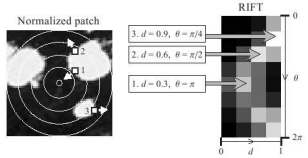
SIFT



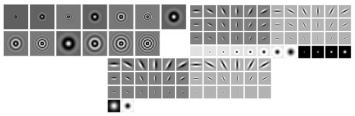
Spin image



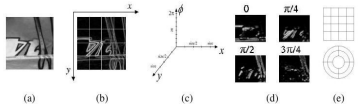
HoG



RIFT



Textons

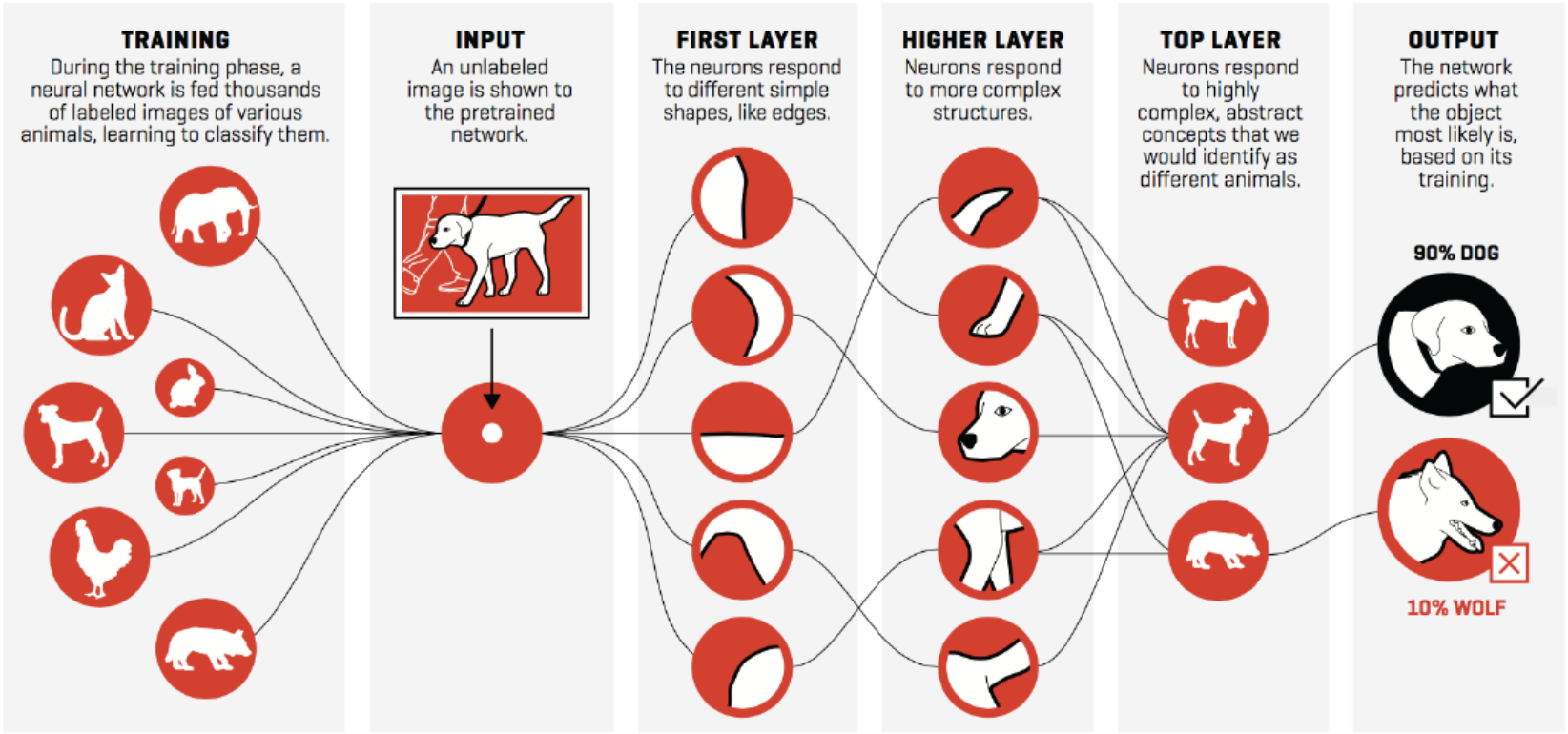


GLOH

Slide Credit: Honglak Lee

…but very painful to design

Deep Learning



Unethical usage/exploitation of AI

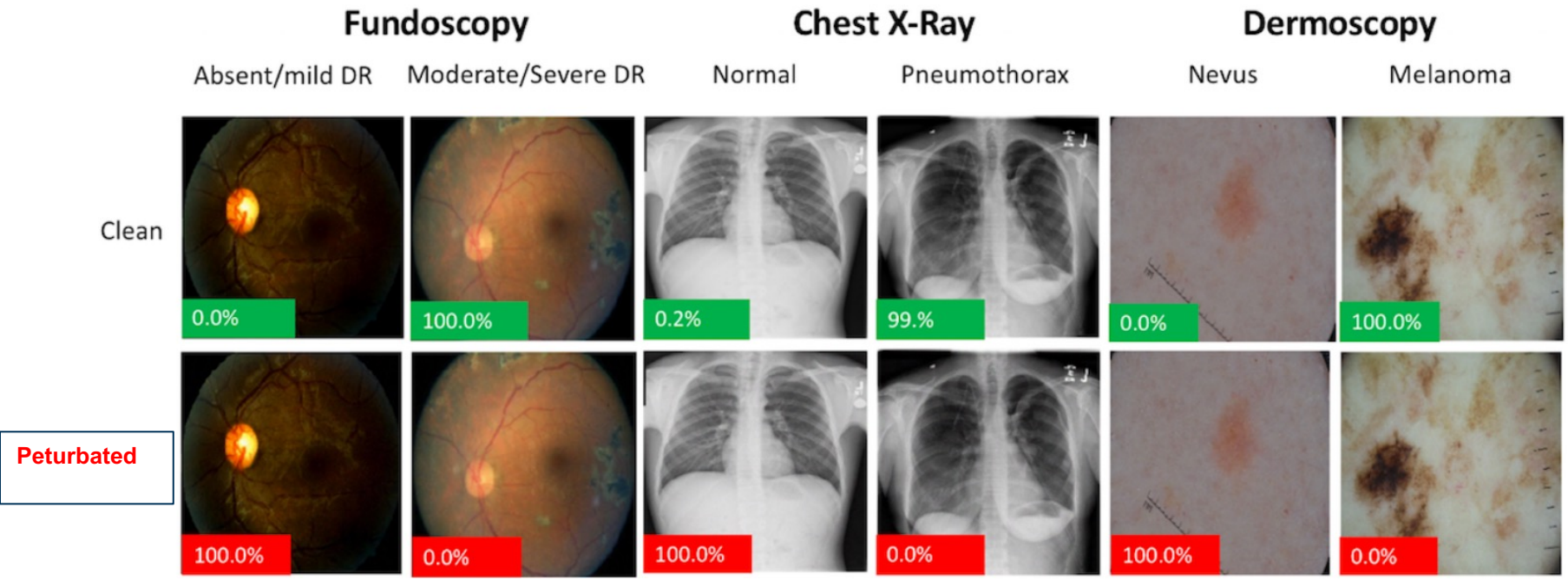
AI can be life threatening

- Security in digital world=
- Security in physical world

“Adversarial” attacks

- Researchers confused a computer vision system into thinking that a stop sign was a 45 mph sign, with just a few pieces of tape.
- Neural networks can be fooled in surprising ways.

“Adversarial” attacks

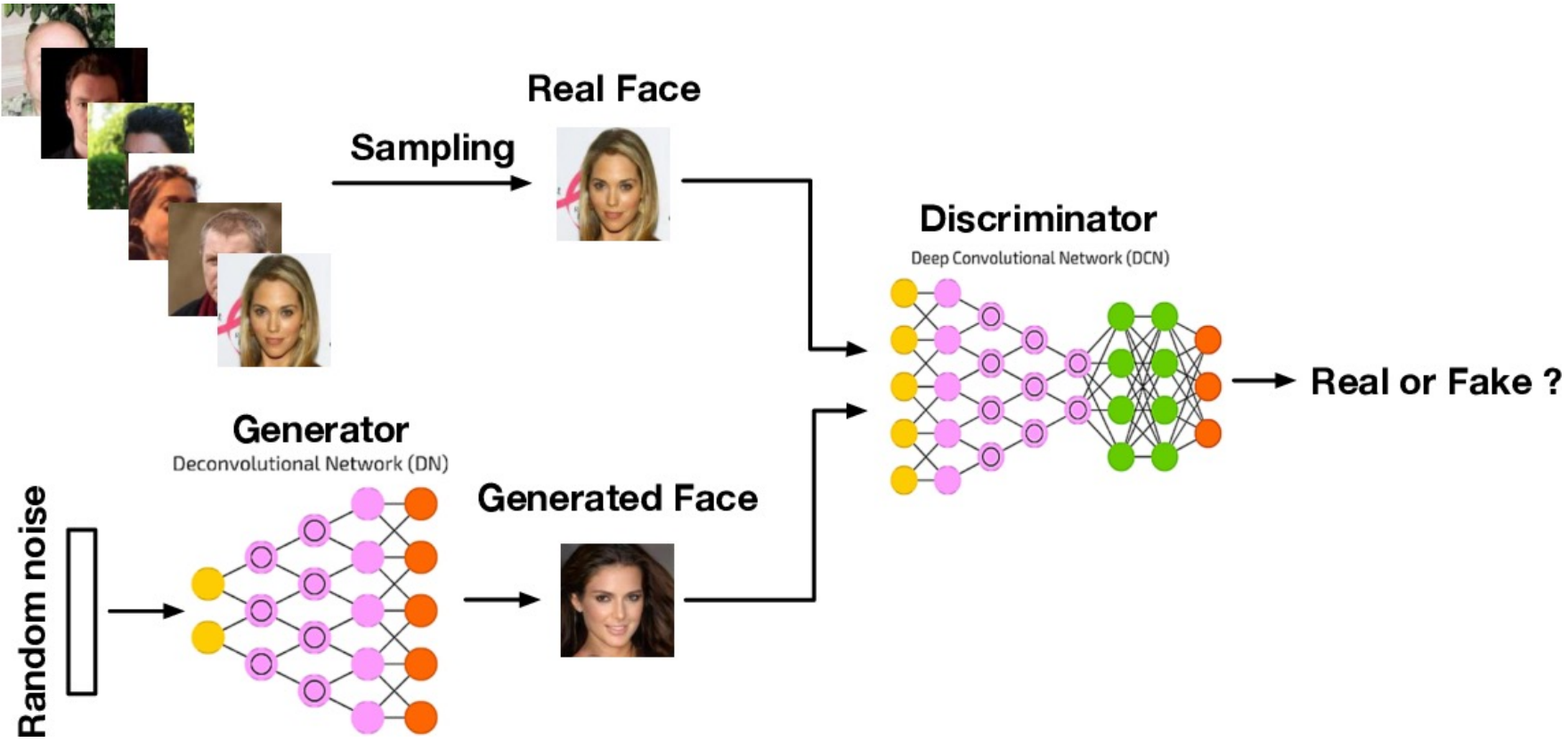


Proof of concept adversarial attacks on medical images. Image shown are pre- (Clean) and post-adversarial. The image perturbations are not perceptible to humans. The percentage displayed on the bottom left of each image represents the probability that the model assigns that image of being diseased. Green = Model is correct on that image. Red = Model is incorrect. Image from [Finlayson].

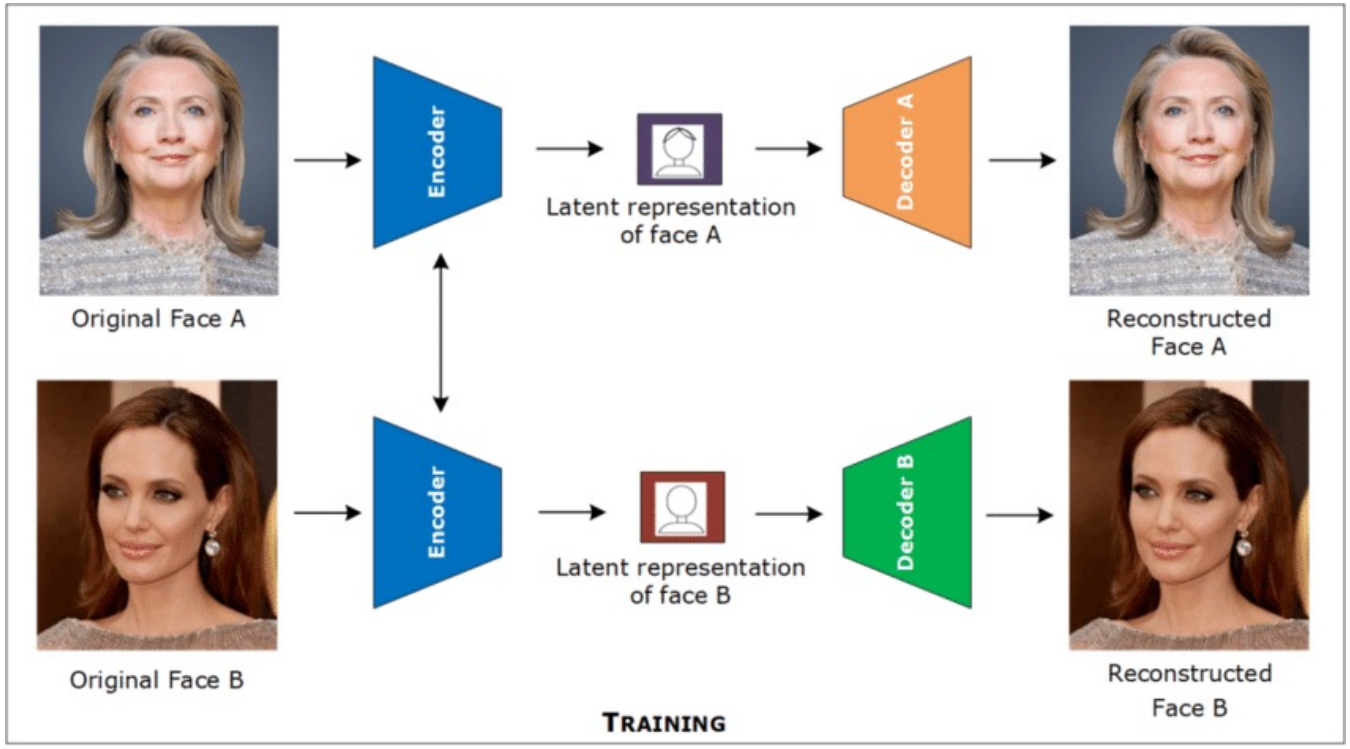
Do you recognize one of them?

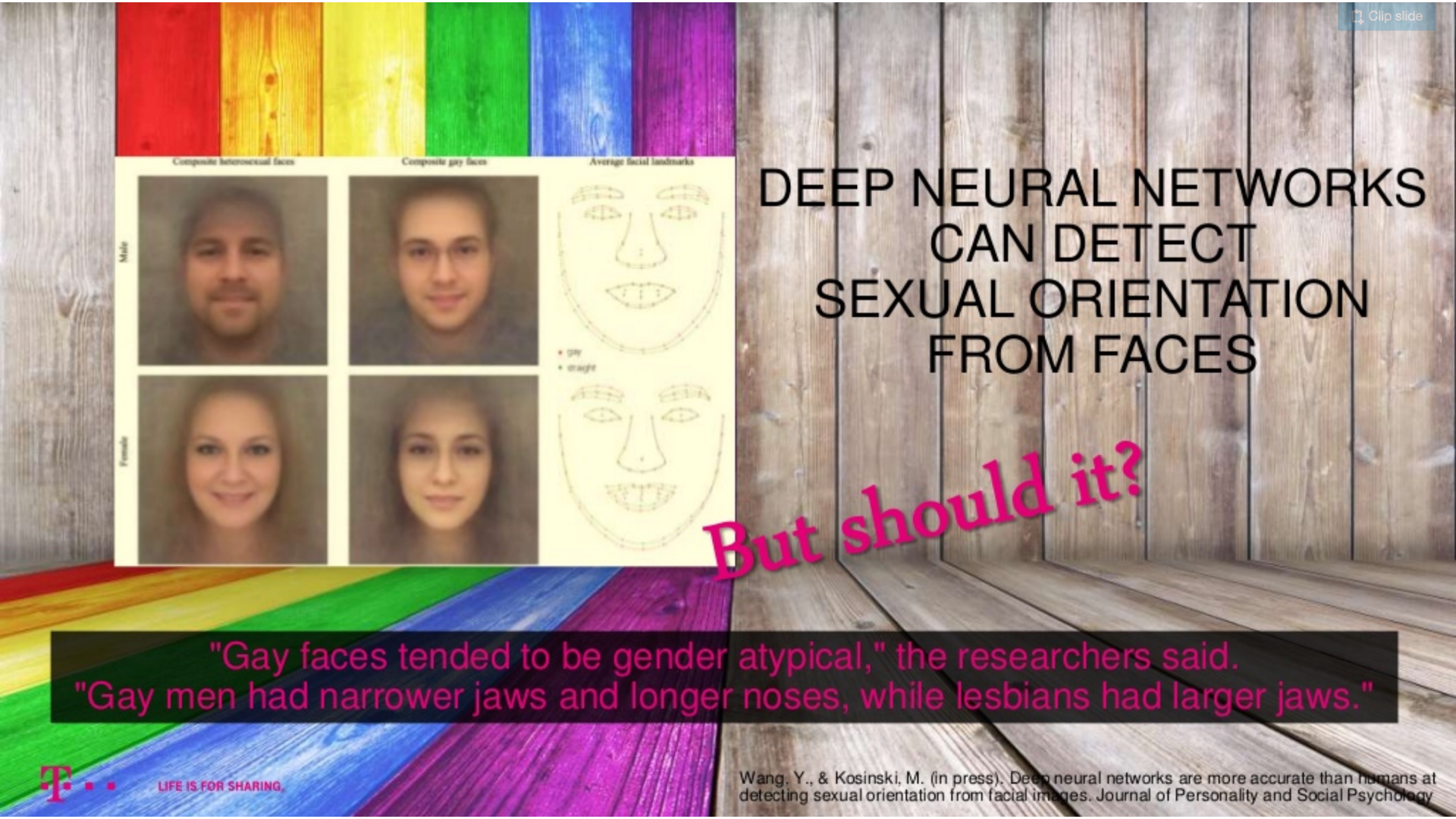
Nvidia’s artificial intelligence can produce images of fake celebrities that look scarily real

Generative adversarial Networks



Deepfake


Original Face A
Encoder
Latent representation of face A
Decoder A
Reconstructed Face A
Original Face B
Encoder
Latent representation of face B
Decoder B
Reconstructed Face B
TRAINING
Original Face A
Encoder
Latent representation of face A
Decoder B
Reconstructed Face B from A
GENERATION



Source: Kyllesbech Larsen, A Tutorial to AI Ethics – Fairness, Bias & Perception

Is Google Translate misogynist?

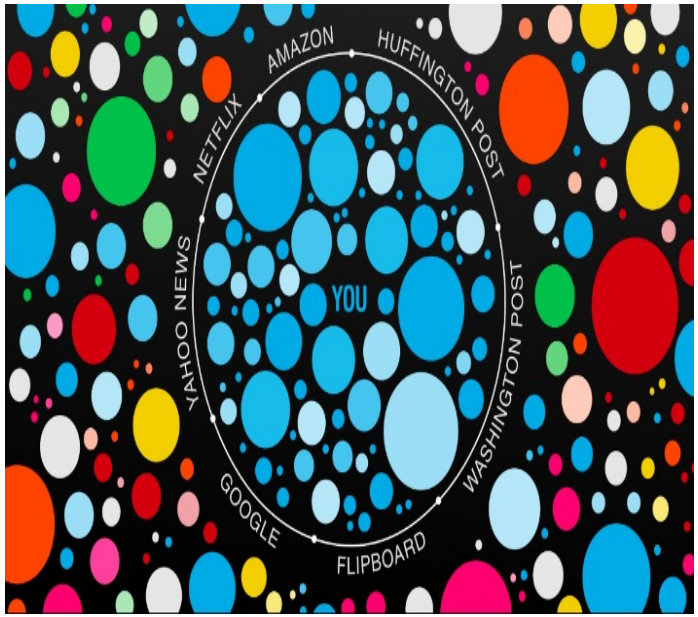
Misogyny is the hatred of, contempt for, or prejudice against women or girls.

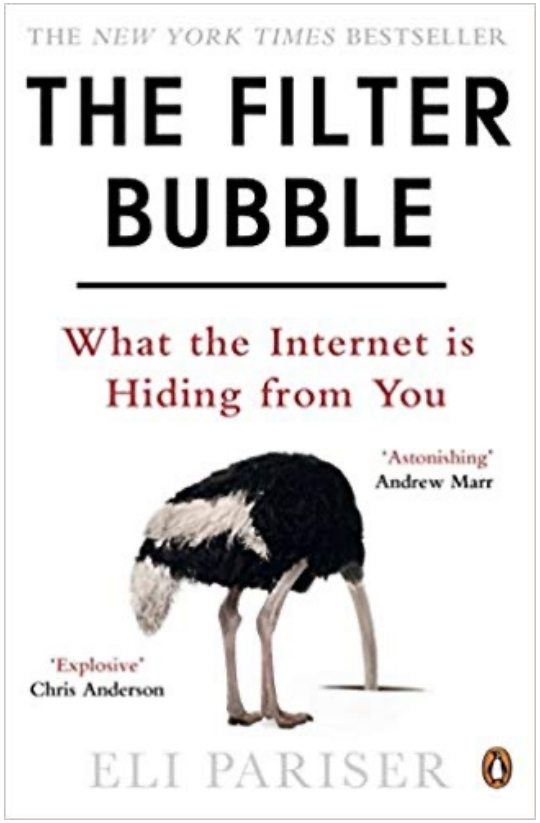
AI shapes our view of the world

Filter Bubble

- Filter Bubble and web search engines
- Reinforcement effect: more and more of what you like

➔extremism and bias





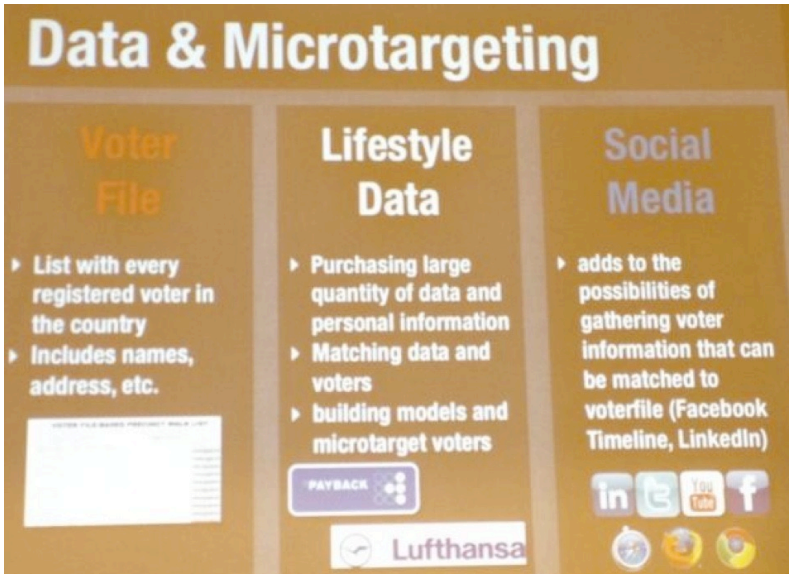
Obama: Narwhal project

- Project Narwhal is the name of a computer program used by the 2012 campaign by Barack Obama.
- It was contrasted in the Mitt Romney presidential campaign by Project Orca, so named because the orca is one of the few predators of the narwhal.

Merged databases on voters

a team of 120 people:

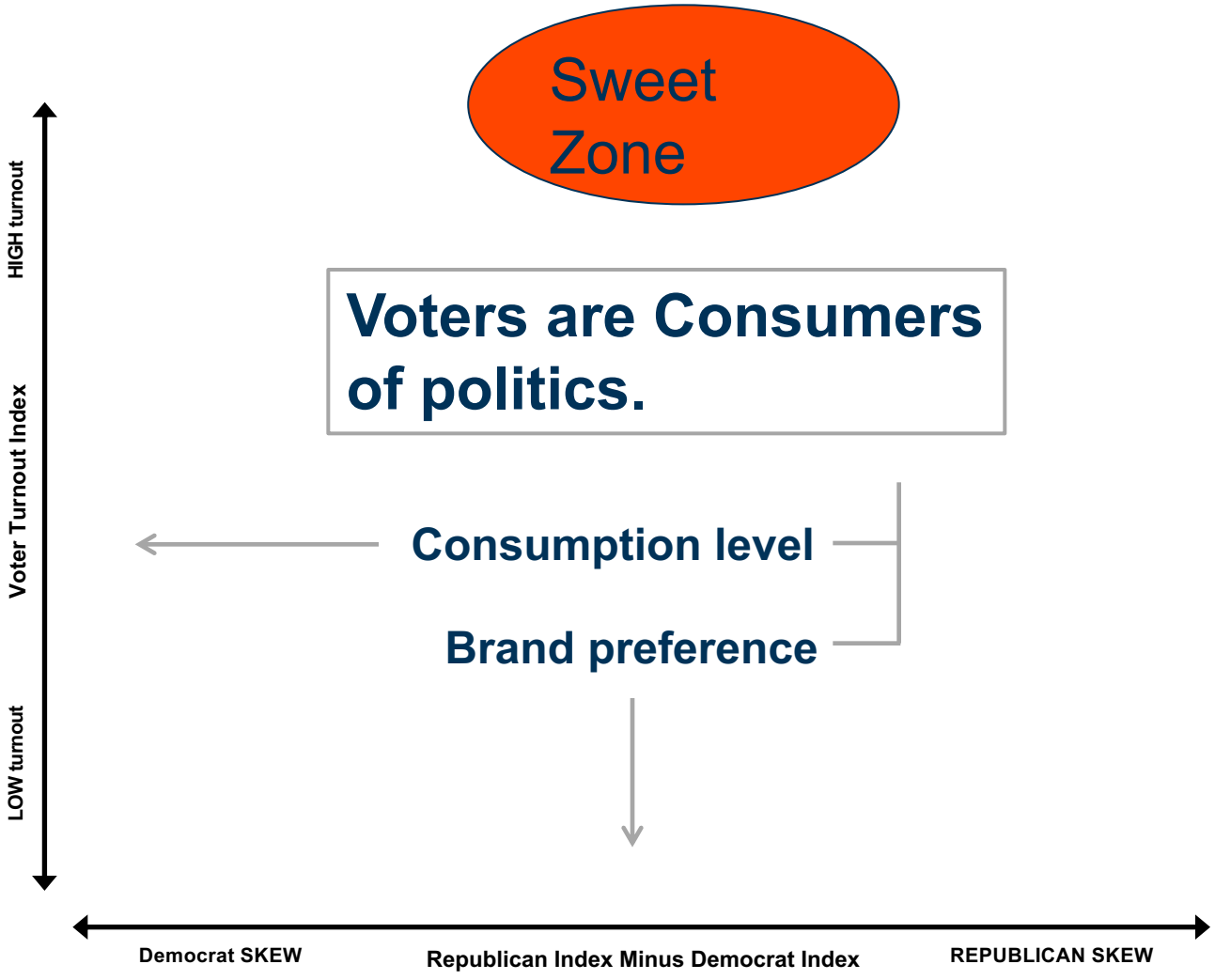
Programmers, statisticians, mathematicians, and marketing Experts from google and twitter



The team worked exclusively on creating tools that collect and analyze data of voters.

Target Group: most uncertain candidates and higher probability to vote

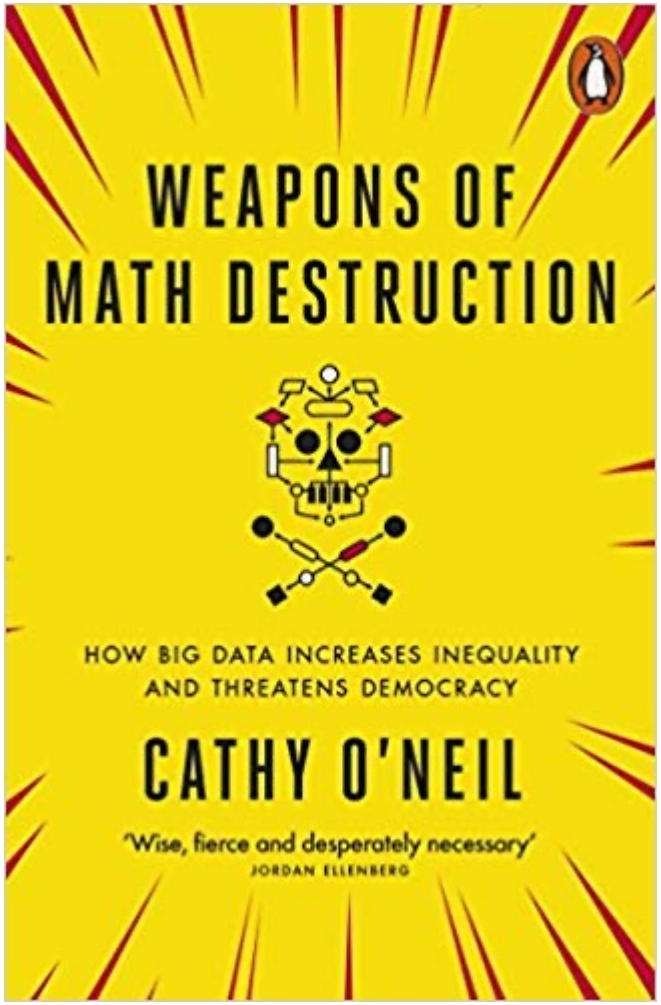
- In 2008 and 2012 elections, Obama campaign created statistical models to predict both the probability of an individual choosing to turn to polls (giving their vote), and the probability to vote for one candidate.
- About 75% of the deciding factors: age, sex, race, neighborhood and voting history.
- Thus he was able to get maximum benefits out of its funds, and focus on influencing **the most uncertain candidates to their advantage**


Sweet Zone
Voters are Consumers of politics.
Consumption level
Brand preference
HIGH turnout
Voter Turnout Index
LOW turnout
Democrat SKEW
Republican Index Minus Democrat Index
REPUBLICAN SKEW

Social media

Democrats tend to use Spotify, while Republicans tend to use Pinterest. Good to Know when selecting social media platform.

AI Bias


WEAPONS OF
MATH DESTRUCTION
HOW BIG DATA INCREASES INEQUALITY
AND THREATENS DEMOCRACY
CATHY O'NEIL
'Wise, fierce and desperately necessary'
JORDAN ELLENBERG

AI Bias

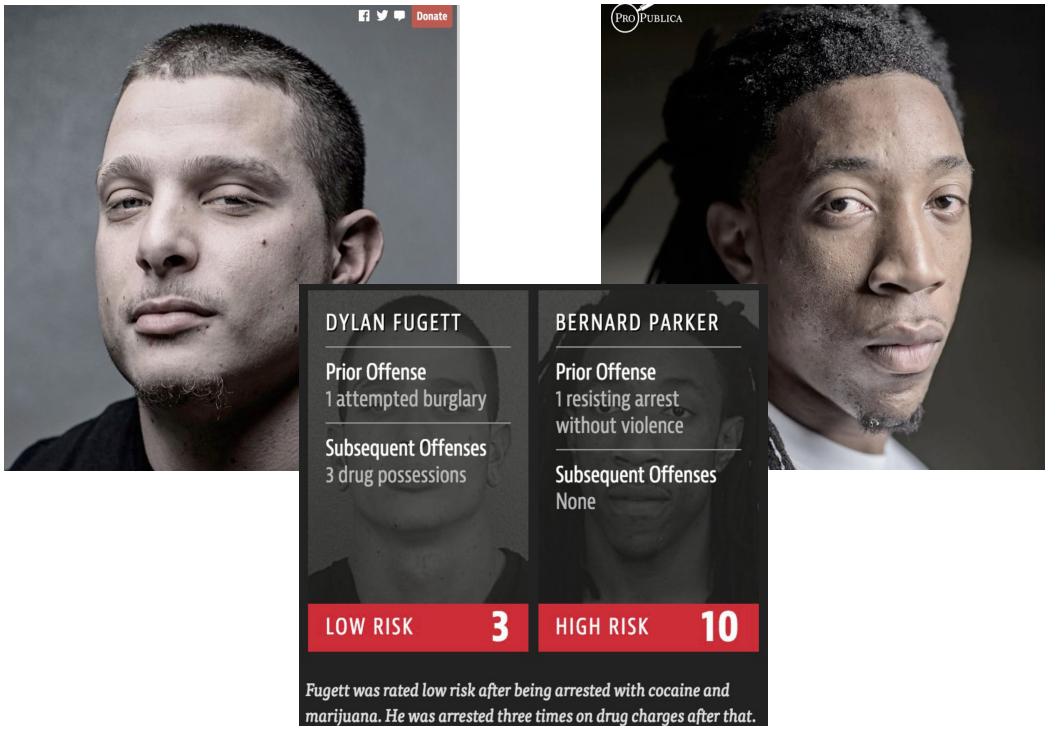
- AI Bias: amplification of error based on race or demographic group.

- Danger:
  - Loan
  - Admission to university
  - Insurances
  - Urgent treatment (Emergency)

Discrimination in COMPAS

- COMPAS used in US for predicting the likelihood of a criminal reoffending based on 137 questions.
- The predictions of COMPASS might decide who continues in prison and who regains his freedom.

- The system predicts that black defendants pose a higher risk of recidivism than they do, and the reverse for white defendants.



Jeff Larson, Surya Mattu, Lauren Kirchner and Julia Angwin, "How We Analyzed the COMPAS Recidivism Algorithm," ProPublica, May 23, 2016, https://www.propublica.org/article/how-we-analyzed-the-compas-recidivism-algorithm.

Color matters in AI

Color Matters in Computer Vision

Facial recognition algorithms made by Microsoft, IBM and Face++ were more likely to misidentify the gender of black women than white men.

Gender was misidentified in **up to 1 percent of lighter-skinned males** in a set of 385 photos.

Gender was misidentified in **up to 7 percent of lighter-skinned females** in a set of 296 photos.

Gender was misidentified in **up to 12 percent of darker-skinned males** in a set of 318 photos.

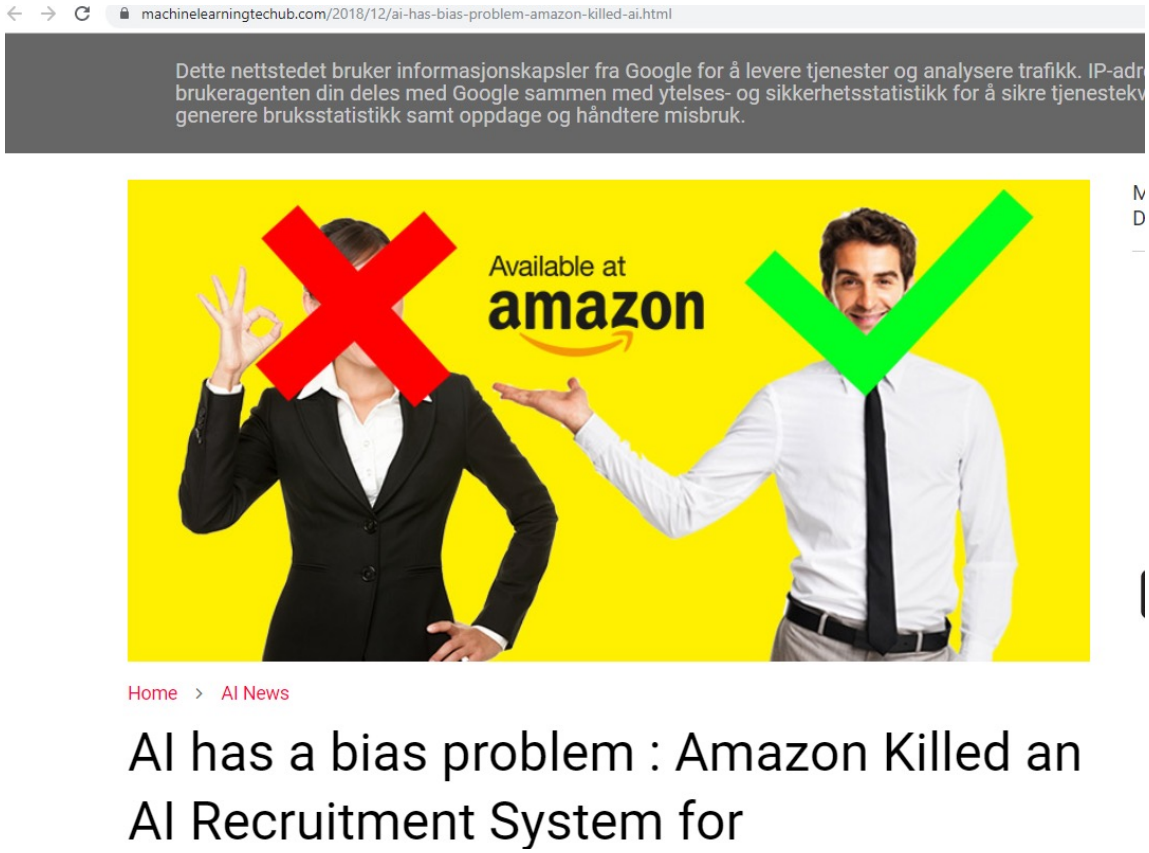
Gender was misidentified in **35 percent of darker-skinned females** in a set of 271 photos.

Photos were selected from among those used in Joy Buolamwini's study.

Source: Joy Buolamwini, M.I.T. Media Lab

Amazon

- The machine learning algorithm was fed with a decade's worth of resumes of people applying for jobs at Amazon.



- Search query in *XING* orders less qualified male candidate higher than more qualified female candidate)

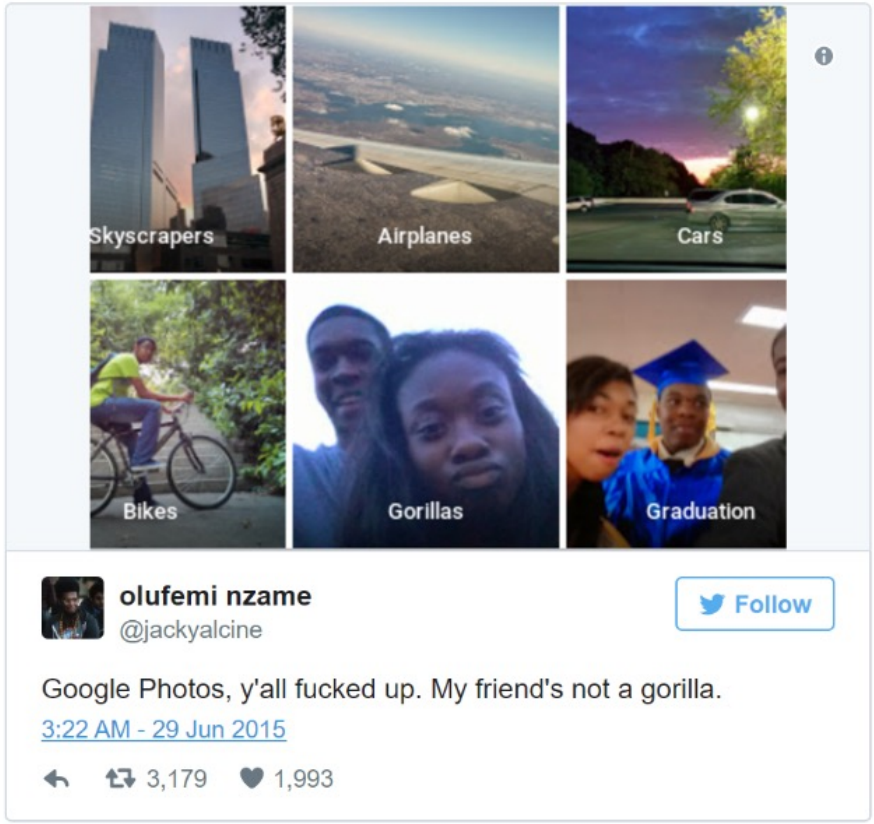
Search query	Work experience	Education experience	Profile views	Candidate	Xing ranking
Brand Strategist	146	57	12992	male	1
Brand Strategist	327	0	4715	female	2
Brand Strategist	502	74	6978	male	3
Brand Strategist	444	56	1504	female	4
Brand Strategist	139	25	63	male	5
Brand Strategist	110	65	3479	female	6
Brand Strategist	12	73	846	male	7
Brand Strategist	99	41	3019	male	8
Brand Strategist	42	51	1359	female	9
Brand Strategist	220	102	17186	female	10

TABLE II: Top k results on www.xing.com (Jan 2017) for the job serach query "Brand Strategist".

Bias: Sometimes Data Problem not algorithmic problem

- The Amazon system has learned to downgrade resumes with the word "women" or "female" and assigned lower scores.
- The developers said it was impossible to stop the system from finding new ways to discriminate women.
- Apparently, the biggest issue was the data itself that.

Bias because of “non-inclusive” data set



Bias: hidden in the data

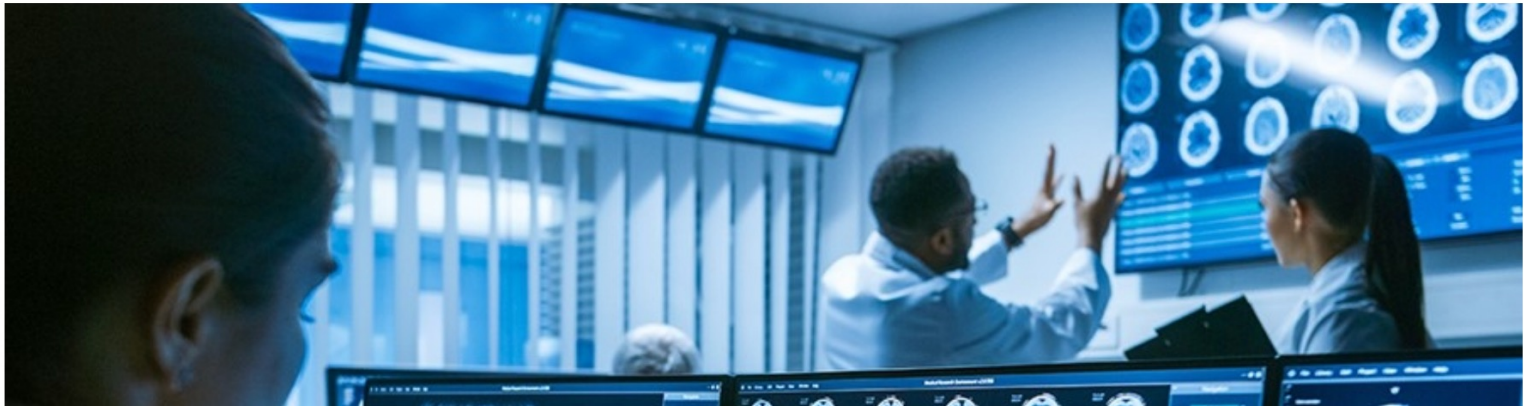
- Our names are gendered
- Resident cities, School names, postal code are correlated with ethnicity and socioeconomic status

Artificial intelligence predicts patients' race from their medical images

Study shows AI can identify self-reported race from medical images that contain no indications of race detectable by human experts.

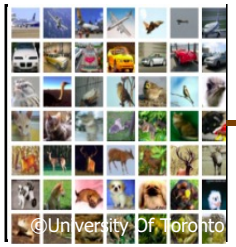
Rachel Gordon | MIT CSAIL

May 20, 2022



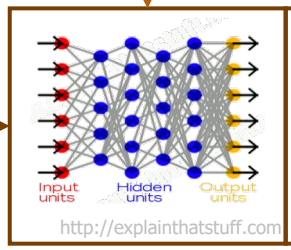
XAI

Today



Training Data

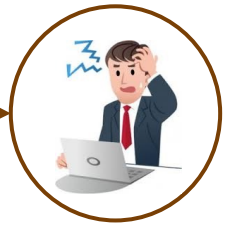
Learning Process



Learned Function

This is a cat
(p = .93)

Output



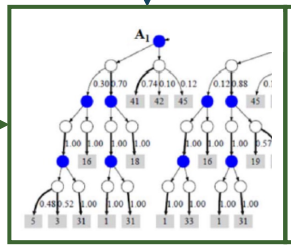
User with a Task

- Why did you do that?
- Why not something else?
- When do you succeed?
- When do you fail?
- When can I trust you?
- How do I correct an error?

Tomorrow

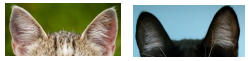
Training Data

New Learning Process



Explainable Model

This is a cat:
- It has fur, whiskers, and claws.
- It has this feature:



Explanation Interface

User with a Task

- I understand why
- I understand why not
- I know when you'll succeed
- I know when you'll fail
- I know when to trust you
- I know why you erred

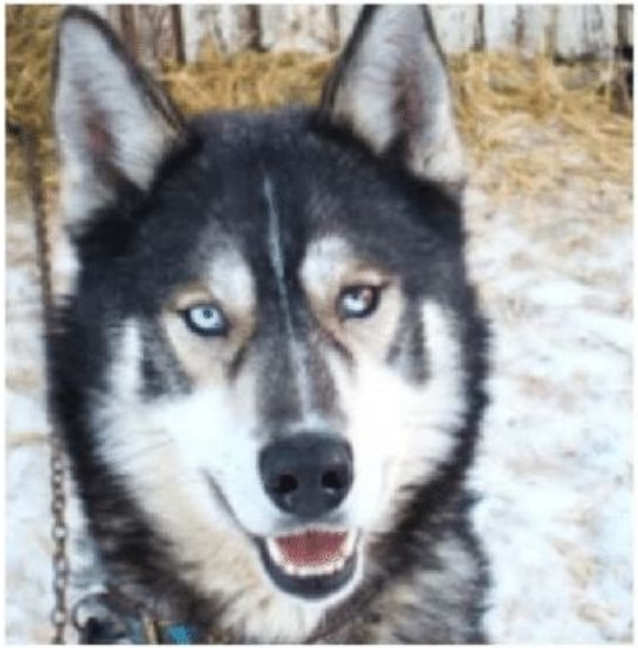
Motivation - Do we really need this?

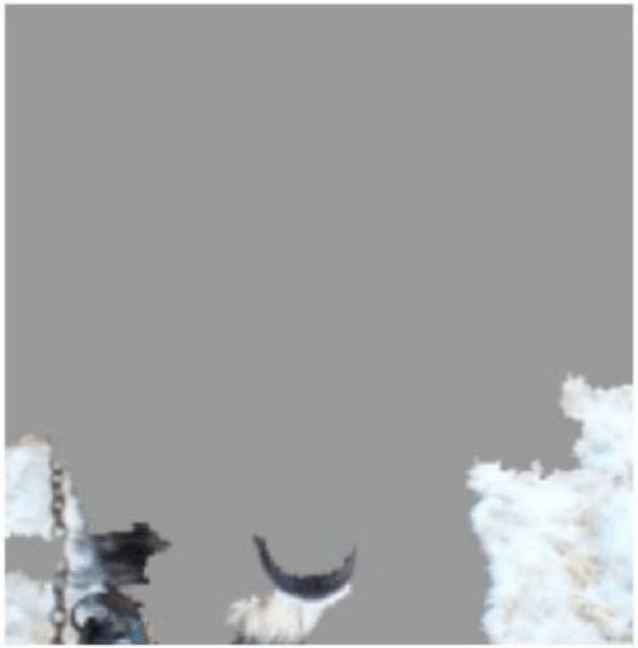
Understanding the model

- **increases trust**
- **helps us improve the model**

Why Should I Trust You? Ribeiro, Marco & Singh, Sameer & Guestrin, Carlos (2016)

Motivation - Do we really need this?
Husky classified as wolf





Why Should I Trust You? Ribeiro, Marco & Singh, Sameer & Guestrin, Carlos (2016)

Do we really need this?

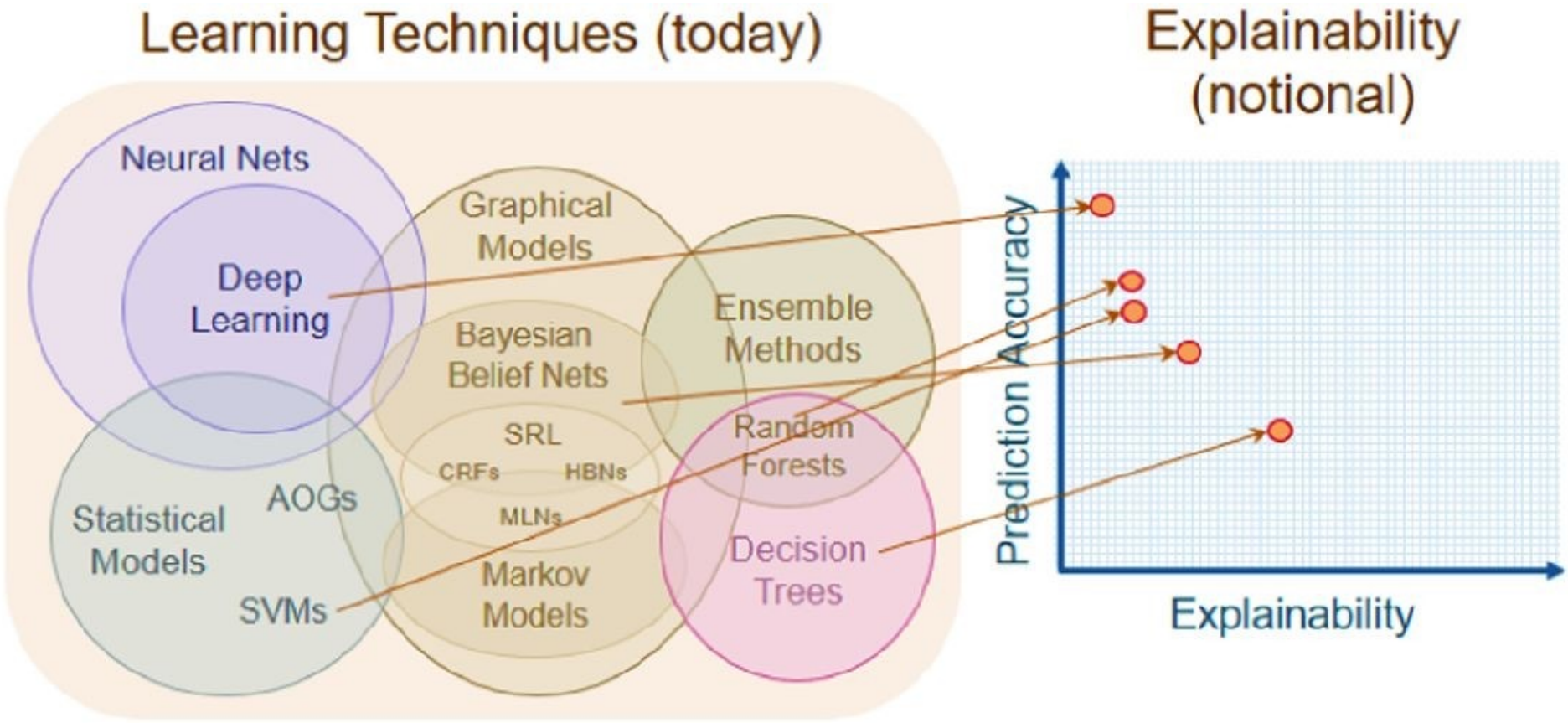
- **Legally, yes!**

  GDPR Articles 13-14-15 give individuals the right to be informed of the existence of solely automated decision-making, meaningful information about the logic involved, and the significance and envisaged consequences for the individual.

- **Crucial in other domains: medicine, law-enforcement, security, finance, etc.**

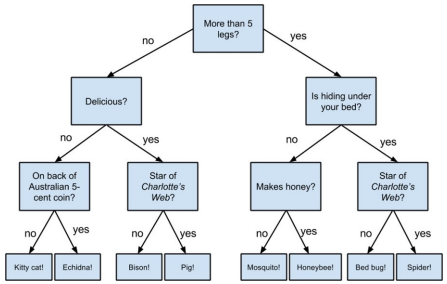
***The impact of the General Data Protection Regulation (GDPR) on artificial intelligence*, 2020**

Map of ML methods and their Explainability



XAI

Directly explainable model



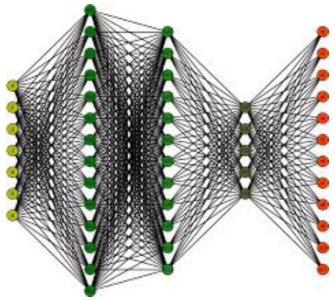
- Linear model
- Decision tree
- Rule-based model

7
8

Breaking the trade-off

- Generalized linear rule model
- Generalized additive models
- ...

Post-hoc explainability



- Deep neural networks
- Ensemble models

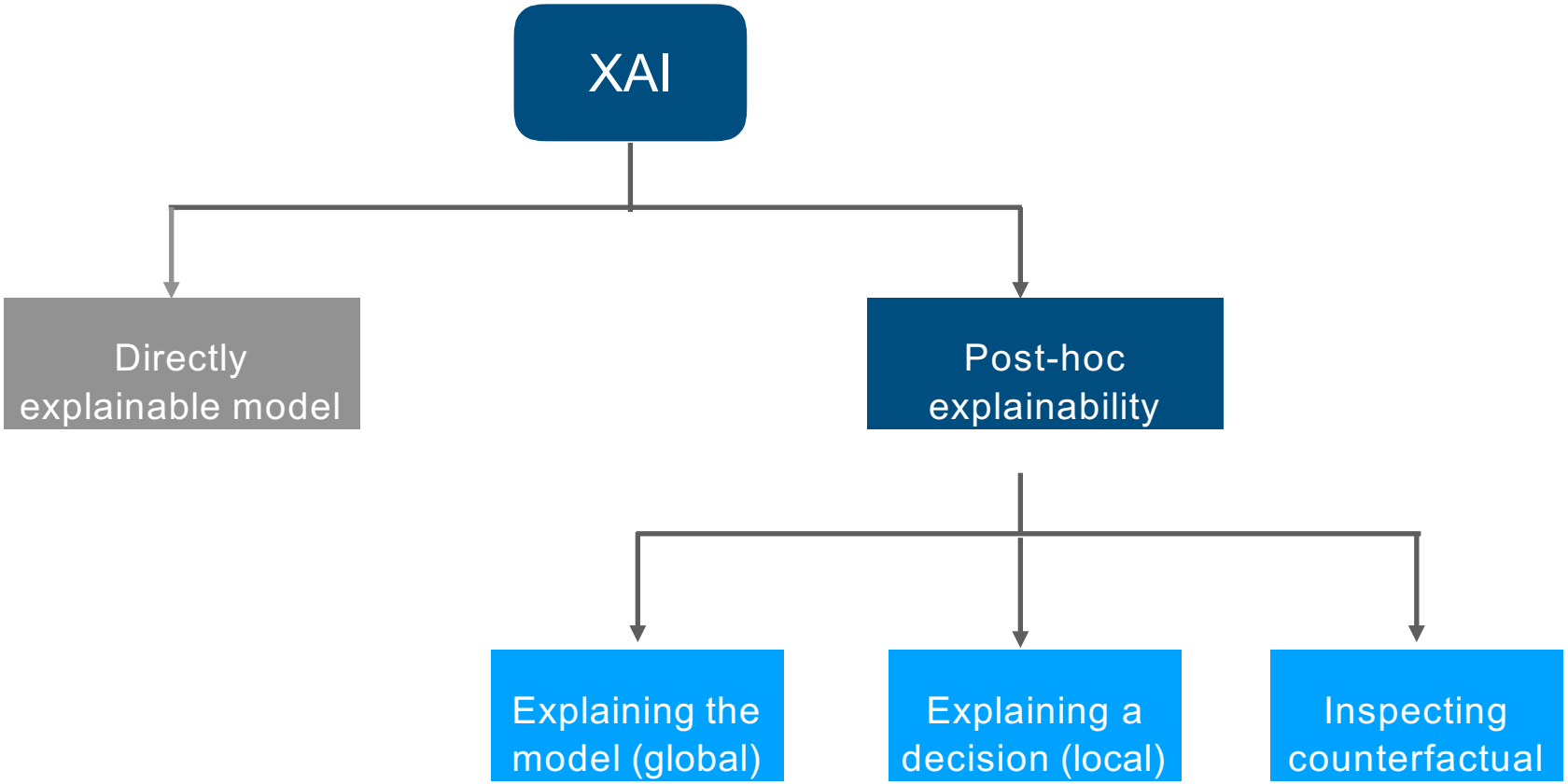
Examples of high-performing directly explainable models

Generalized Linear Rule Model (GLRM) (Wei et al., 2019)

Wei et al. Generalized Linear Rule Models. ICML 2019 (**GLRM** for regression: https://github.com/IBM/AIX360/blob/master/aix360/algorithms/rbm/GLRM.py)

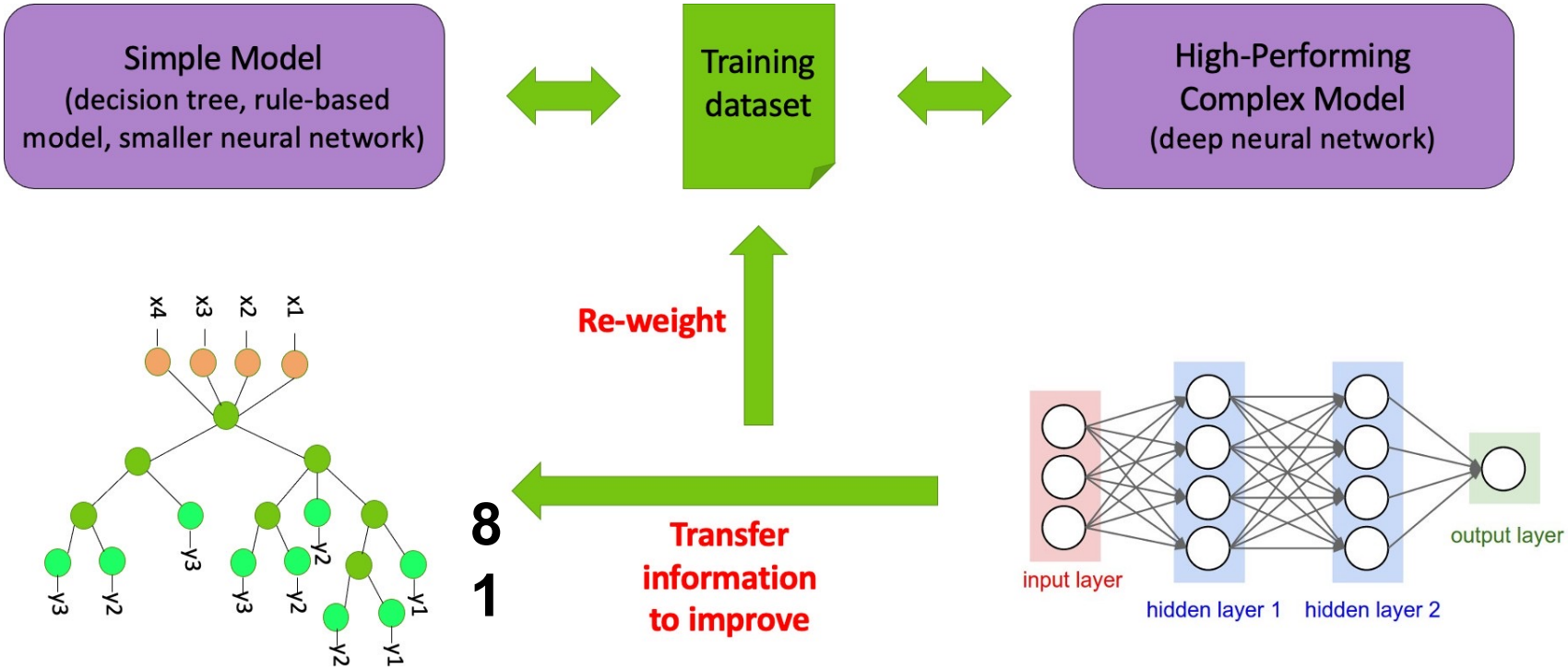
Dash et al. Boolean Decision Rules via Column Generation, NeurIPS 2018 (**BRCG** for classification: https://github.com/IBM/AIX360/blob/master/aix360/algorithms/rbm/BRCG.py)

Wang & Rudin (2015). Falling rule lists. In *Artificial Intelligence and Statistics*



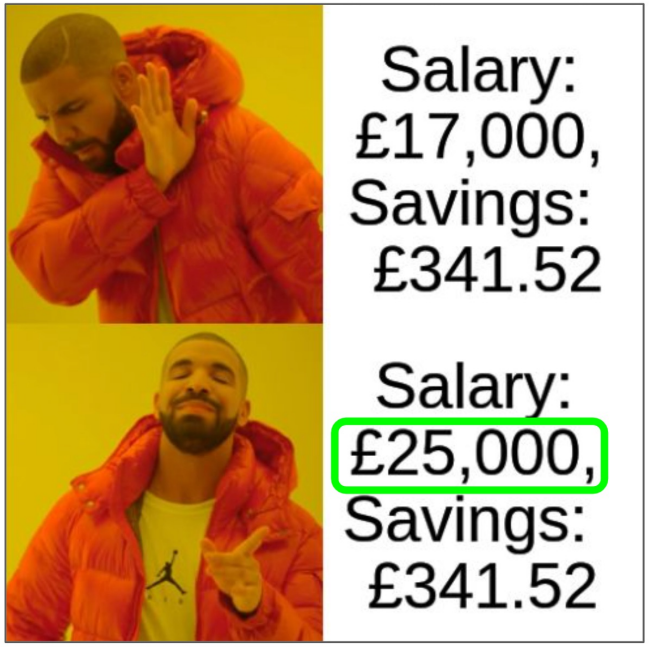
Guidotti et al. (2018). A survey of methods for explaining black box models. *ACM computing surveys (CSUR)* .

Global: knowledge distillation (approximation)



Local explanation

Counterfactual explanations



LOAN DENIED

*How would **the numbers** need to change the least to flip the decision?*

Dealing with Uncertainty in AI

Models assign high confidence predictions for **out-of-distribution (OOD) inputs**

Example images where model assigns >99.5% confidence.

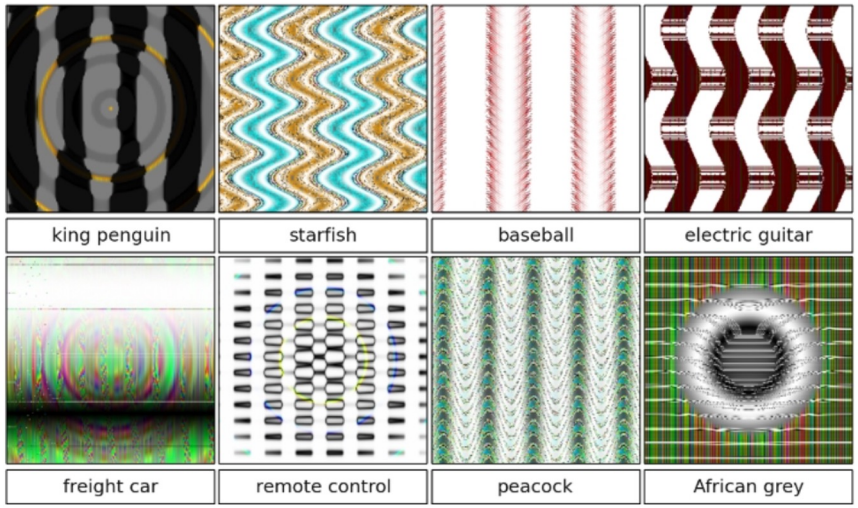
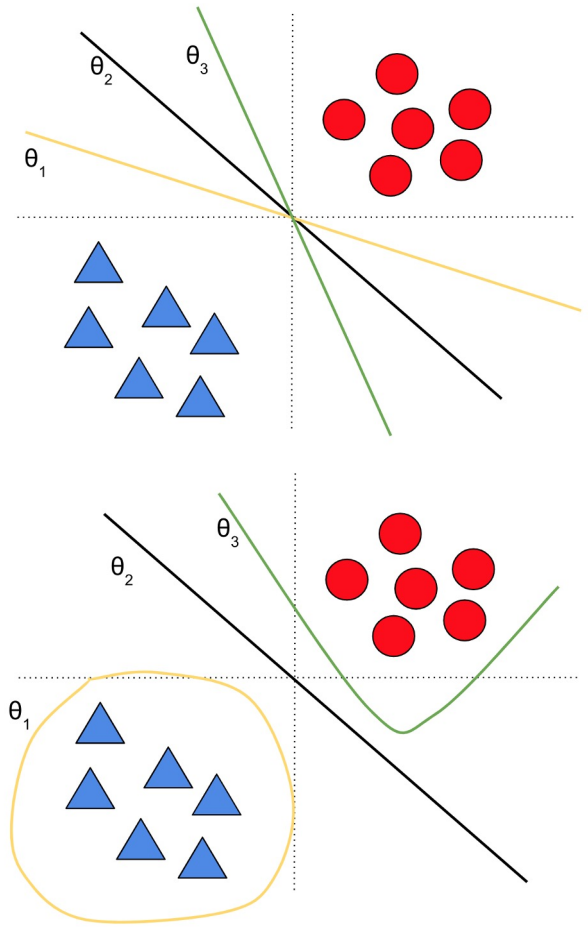


Image source: “Deep Neural Networks are Easily Fooled: High Confidence Predictions for Unrecognizable Images” Nguyen et al. 2014

Sources of uncertainty: *Model uncertainty*

- Many models can fit the training data well
- Also known as ***epistemic uncertainty***
- Model uncertainty is "**reducible**"
  - Vanishes in the limit of infinite data (subject to model identifiability)
- Models can be from same hypotheses class (e.g. linear classifiers in top figure) or belong to different hypotheses classes (bottom figure).



Sources of uncertainty: *Data uncertainty*

- Labeling noise (ex: human disagreement)
- Measurement noise (ex: imprecise tools)
- *Missing* data (ex: partially observed features, unobserved confounders)
- Also known as ***aleatoric uncertainty***
- Data uncertainty is "**irreducible***"
  - Persists even in the limit of infinite data
  - *Could be reduced with additional features/views

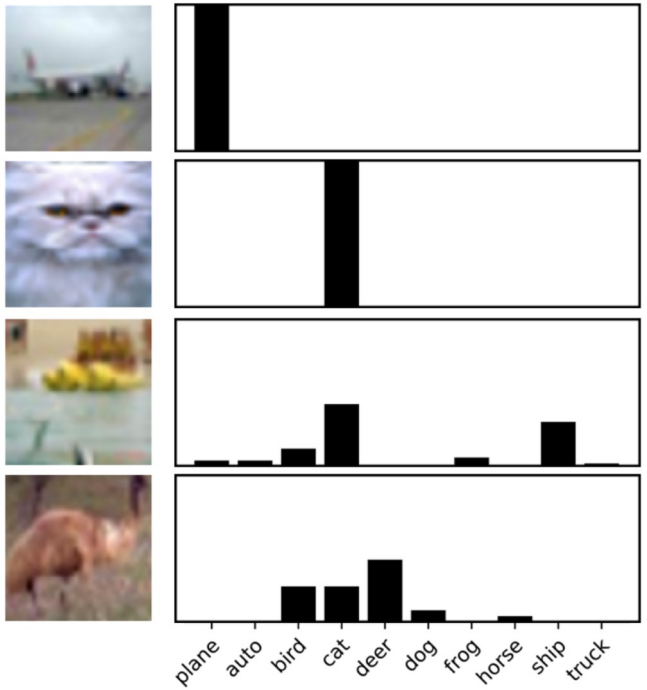
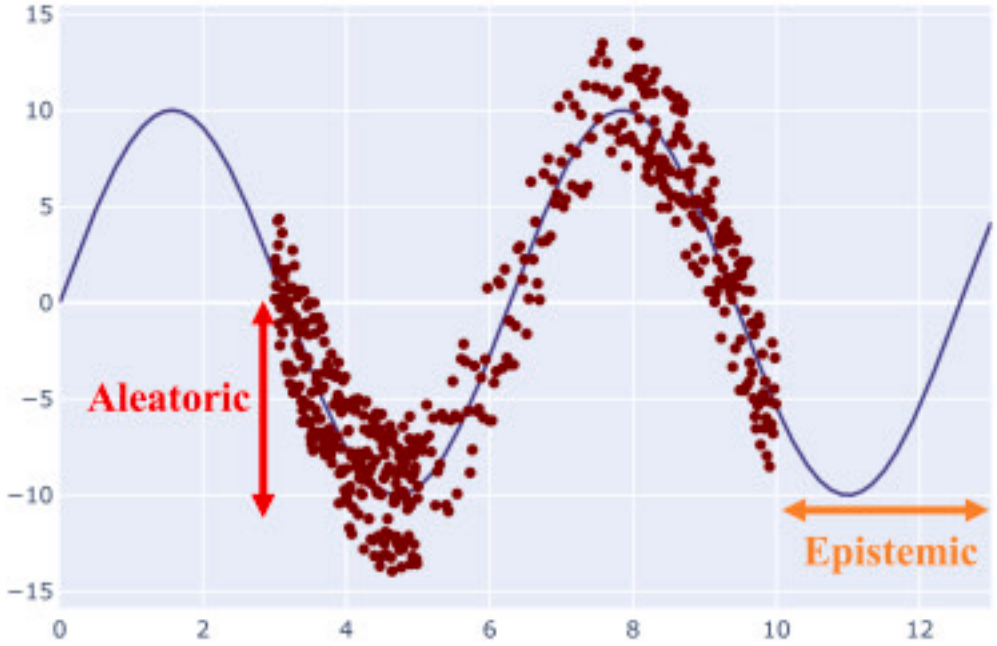


Image source: Battleday et al. 2019 "Improving machine classification using human uncertainty measurements"

Uncertainty estimation

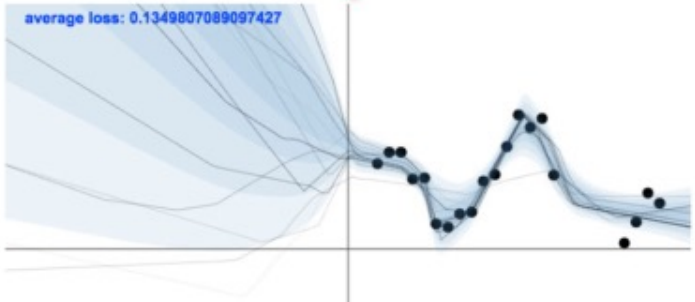


Abdar, Moloud, et al. "A review of uncertainty quantification in deep learning: Techniques, applications and challenges." *Information Fusion* 76 (2021): 243-297.

In addition to interpretability and explainability, trustworthiness is key

Bayesian approach

Monte Carlo dropout = variational inference [Gal & Ghahramani, 2015]

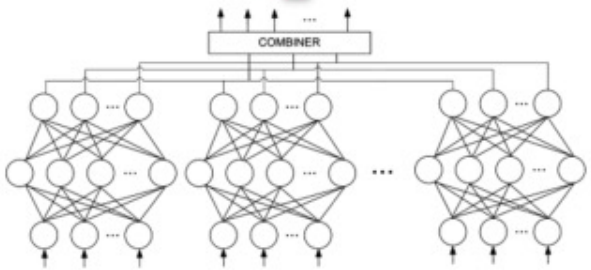


No post-hoc application

No coverage guarantees…

Deep ensembles

Explicitly train many networks and assume the prediction is their average



The National Strategy for AI

- The National Strategy for AI points out that Norway can become a leader in applying AI, particularly in sectors where the country already has a strong global position, such as energy, ocean industries and health.

Völur

- “Making optimal utilization of resources and effective processes through the value chain is a continuous challenge. From slaughtering the optimal number of animals that are required by the demand of finished products, to executing the right production cuttings, processing recipes and manufacturing plans to deliver market demand. All without leading to overproduction of undesired goods and waste, non-optimal inventories, excess of purchasing costs, lower product quality and unnecessary high CO2 emissions.”

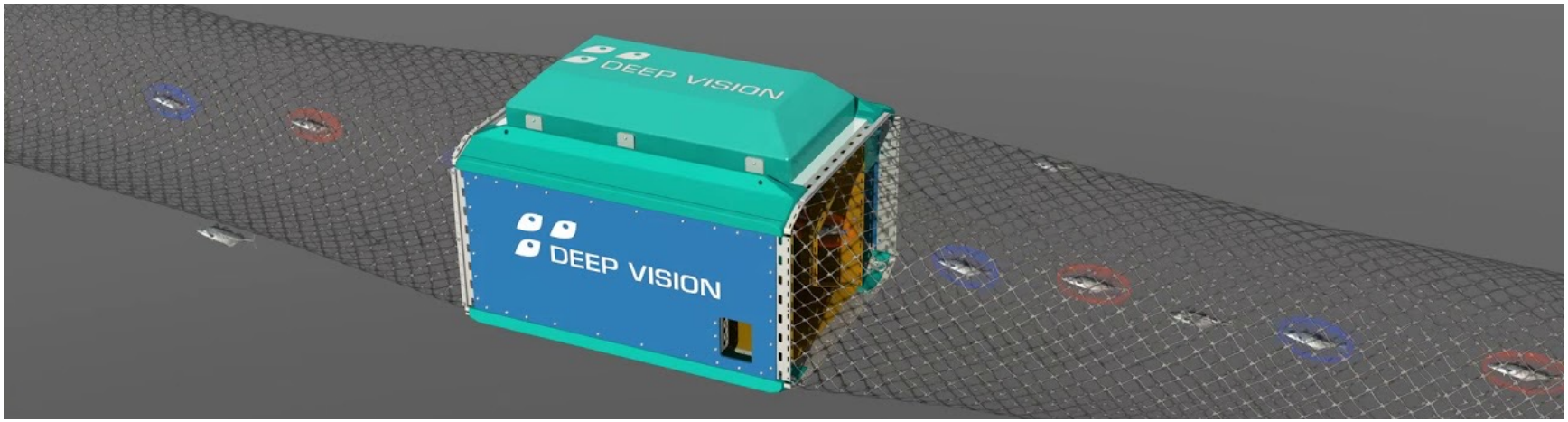
eSmart Systems

- eSmart Systems is using artificial intelligence to make it easier to maintain the electricity grid.
- Taditially, helicopter are used to detect failure in power lines after huricane.
- *In collaboration with KONGSBERG, eSmart Systems aims towards fully autonomous flight.*

AI in fisheries and aquaculture

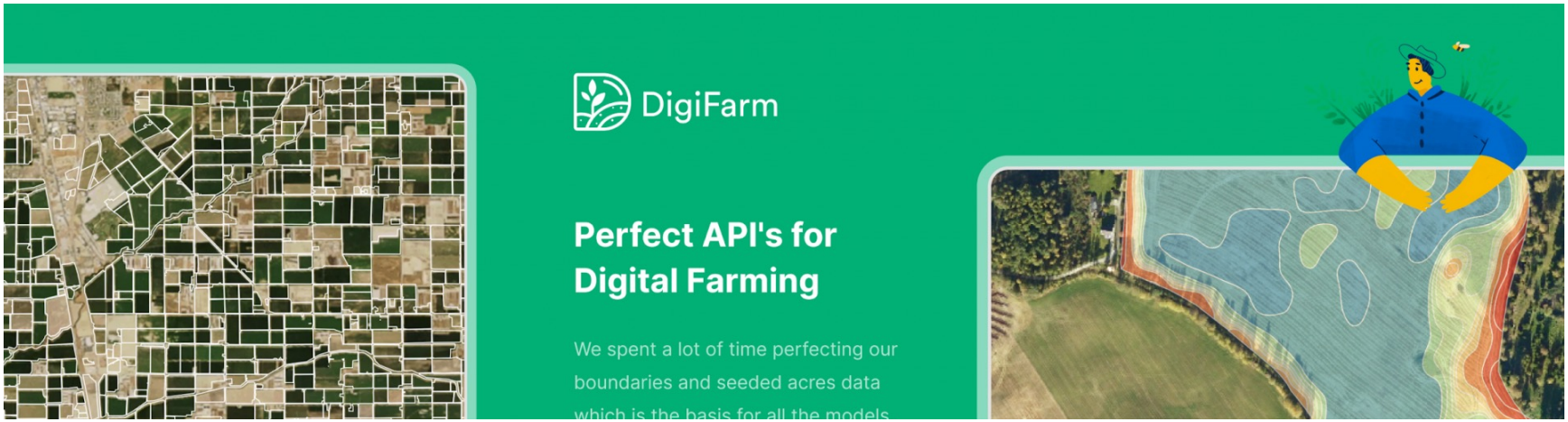
Scantrol

The Norwegian company Scantrol Deep Vision has developed a revolutionary, AI-based tool to help trawlers to catch the right fish. Using a subsea camera, the Deep Vision system identifies and measures fish under water – without bringing the catch onboard the vessel. This makes it easier to stop the trawl when the catch quota has been filled and to reduce bycatch.



DigiFarm

- **DigiFarm: Ag-Tech Startup Using AI for Accurate Field Boundaries**
- DigiFarm is an ag-tech startup that detects the world's most accurate field boundaries through using super-resolution satellite imagery. With its focus on agriculture and AI, the company is well-positioned to help farmers increase their yield and optimize their operations.



The Human Touch Robotics

- All robotic grippers to date miss one key component to automate the food packing process: the human touch.
- Our core innovation is precisely that, a robotic gripper that perfectly adapts to the softness of the object it holds. Kind of like a Golden Retriever holding an egg in its mighty jaw without breaking the shell. Plus, it is food-agnostic and perfectly aligned with the latest health and safety regulations, making it ideal for handling food.

Thank You


Sikt

Sikt

Sikt – Norwegian Agency for Shared Services in Education and Research

- Sikt develops and delivers services for education and research that makes life easier for students and employees
- Sikt aims to ensure that everyone working in the education and research sector has access to secure, stable and comprehensive services

Universities

Nord University
Norwegian University of Life Sciences
Norwegian University of Science and Technology
OsloMet
University of Agder
University of Bergen
University of Oslo
University of South-Eastern Norway
University of Stavanger
University of Tromsø

University colleges

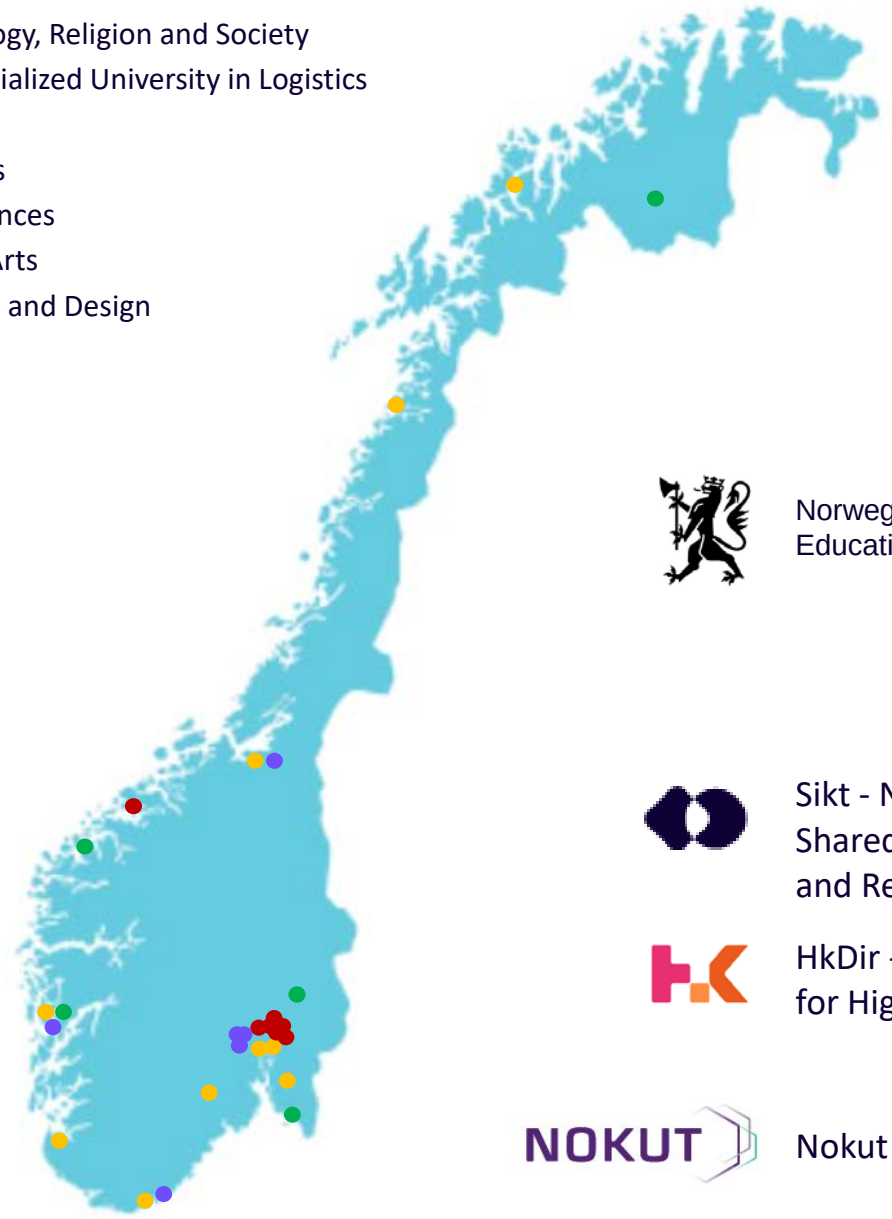
Inland Norway University of Applied Sciences
Sámi University of Applied Sciences
Volda University College
Western Norway University of Applied Sciences
Østfold University College

Private colleges

Ansgar University College
Fjellhaug International University College
Kristiania University College
Lovisenberg Deaconal University College
NLA University College
Queen Maud University College of Early Childhood Education
and more…

Specialized University Institutions

BI Norwegian Business School
MF Norwegian School of Theology, Religion and Society
Molde University College - Specialized University in Logistics
Norwegian Academy of Music
Norwegian School of Economics
Norwegian School of Sport Sciences
Oslo National Academy of the Arts
The Oslo School of Architecture and Design
VID Specialized University



Norwegian Ministry of Education and Research

Sikt - Norwegian Agency for Shared Services in Education and Research

HkDir - Norwegian Directorate for Higher Education and Skills

Nokut

Sikt - services

Education and administrative services

Vitnemålsportalen diploma registry

Samordna opptak

OPENedX

NVB - National Diploma database

DLR

Work Life Portal

STAR

GAUS - Recogntion of foreign studies

Data ware house

canvas

URKUND

WISEflow

Panopto video platform

Leganto

inspera

TimeEdit

Public 360°

UNIT4

Jobbnorge

asana

SAP

servicenow

Research and knowledge resources

CRISTIN

National Science Archive

DUCT

BiRD

Brage

microdata.no

License negotiations

Openscience.no

Data management plan

Privacy Services

NIB – National infrastructure for bibliometrics

Research data services – NORDI

Data archive

ExLibris Alma

OJS Open Journal Systems

doi

oria.no

ORCID

Data and infrastructure

Feide

Network connection - The research network

Feide-hotell

Local network (Cnaas)

Wireless guest network

Net administration

Cybersecurity Center for Research and Education :
Analysis – Advice – Response
40 security services

eduroam

Access control - IAM

zoom

Skype for Business

Skyavtaler

Azure

amazon web services

Real time speech

Switchboard/contact center support system

safespring

printix

TRIO

sigma2

Sikt

Sikt – Infrastructure for Education

Services for the education sector

- Developed by Sikt or acquired through joint procurement
- Student Information
- Admission
- Diploma Portal / results from education
- Learning management systems
- Digital exam systems
- …

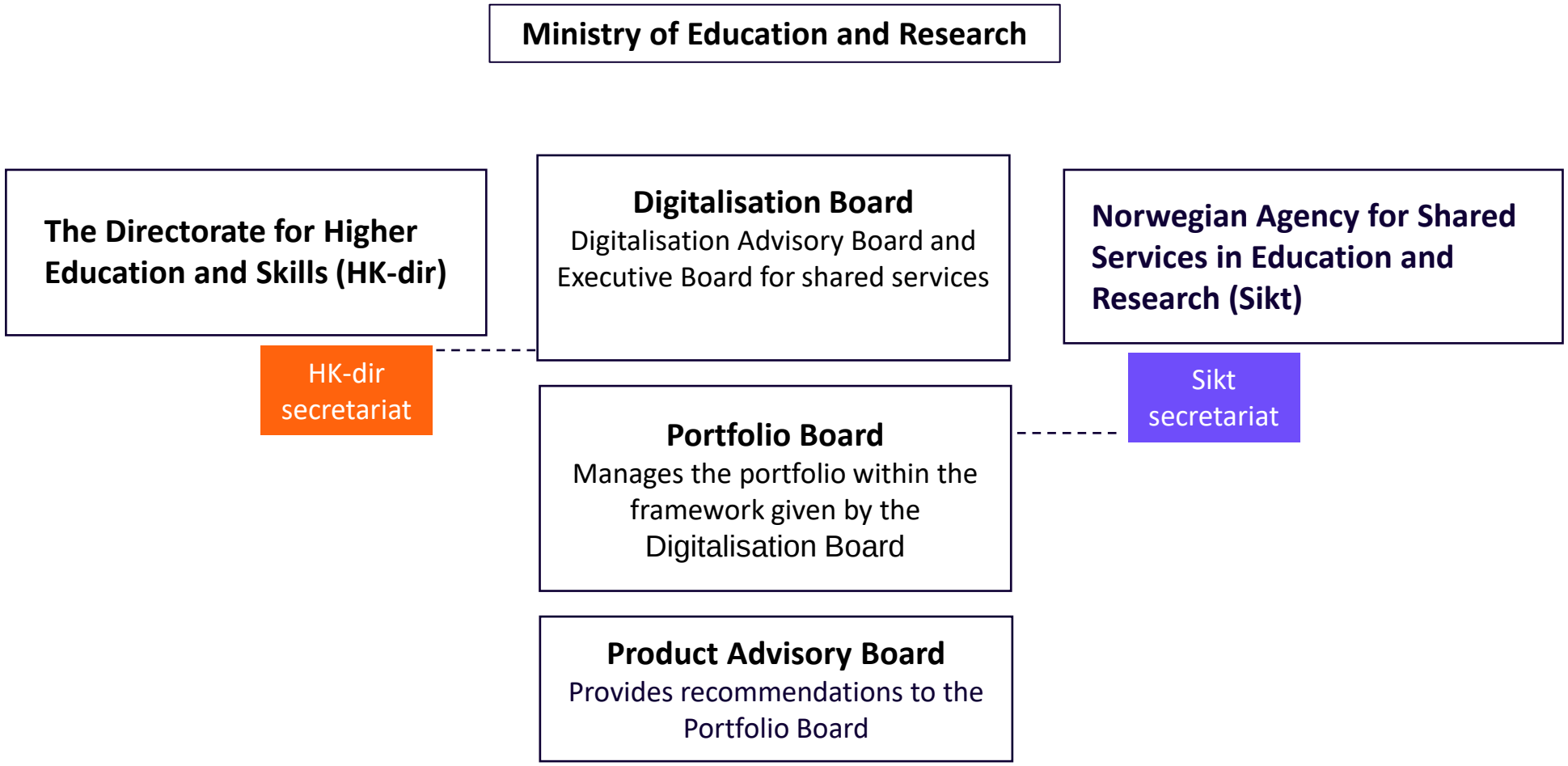
GAUS – Recognition of foreign studies

NVB – Register for results Upper Sec School

RUST - Register for expelled students

Sikt

Collaborative governance for Norwegian universities and university colleges

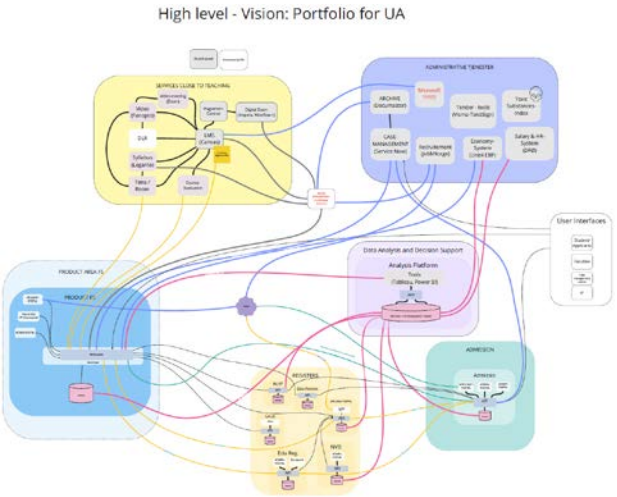


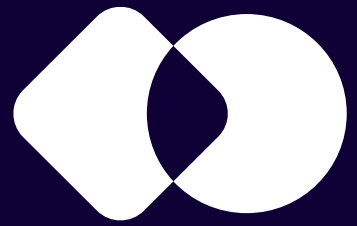
Geir Magne Vangen

Technical Director

Sikt, Division for education and adminstrative services

geir.vangen@sikt.no





OsloMet as a digital university

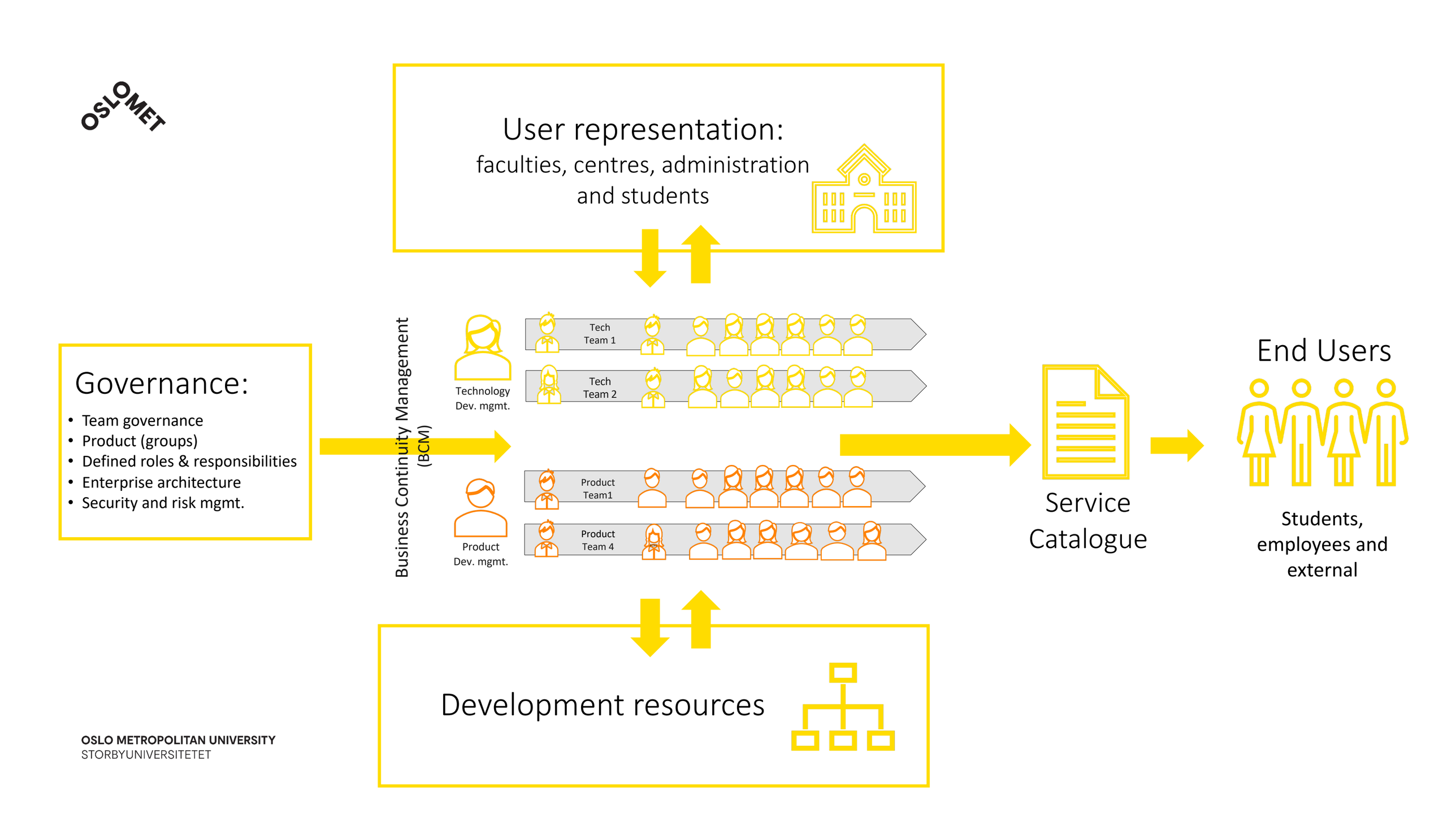
Ketil Are Lund, CIO

OSLO METROPOLITAN UNIVERSITY
STORBYUNIVERSITETET

OsloMets
digital development
is based on an increasing demand for IT services and increased expectations from the government

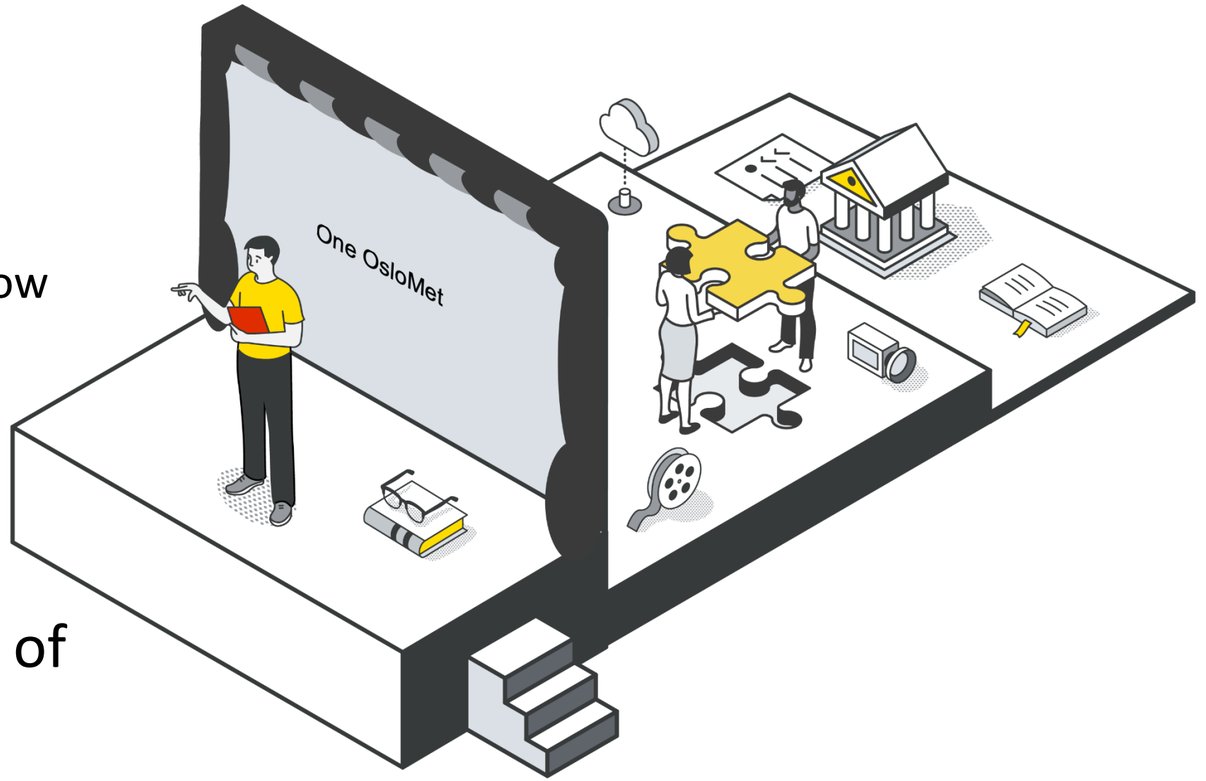
Governance

link between business and IT development


User representation:
faculties, centres, administration and students
Governance:
Team governance
Product (groups)
Defined roles & responsibilities
Enterprise architecture
Security and risk mgmt.
Business Continuity Management (BCM)
Technology Dev. mgmt.
Tech Team 1
Tech Team 2
Product Dev. mgmt.
Product Team1
Product Team 4
Service Catalogue
End Users
Students, employees and external
Development resources

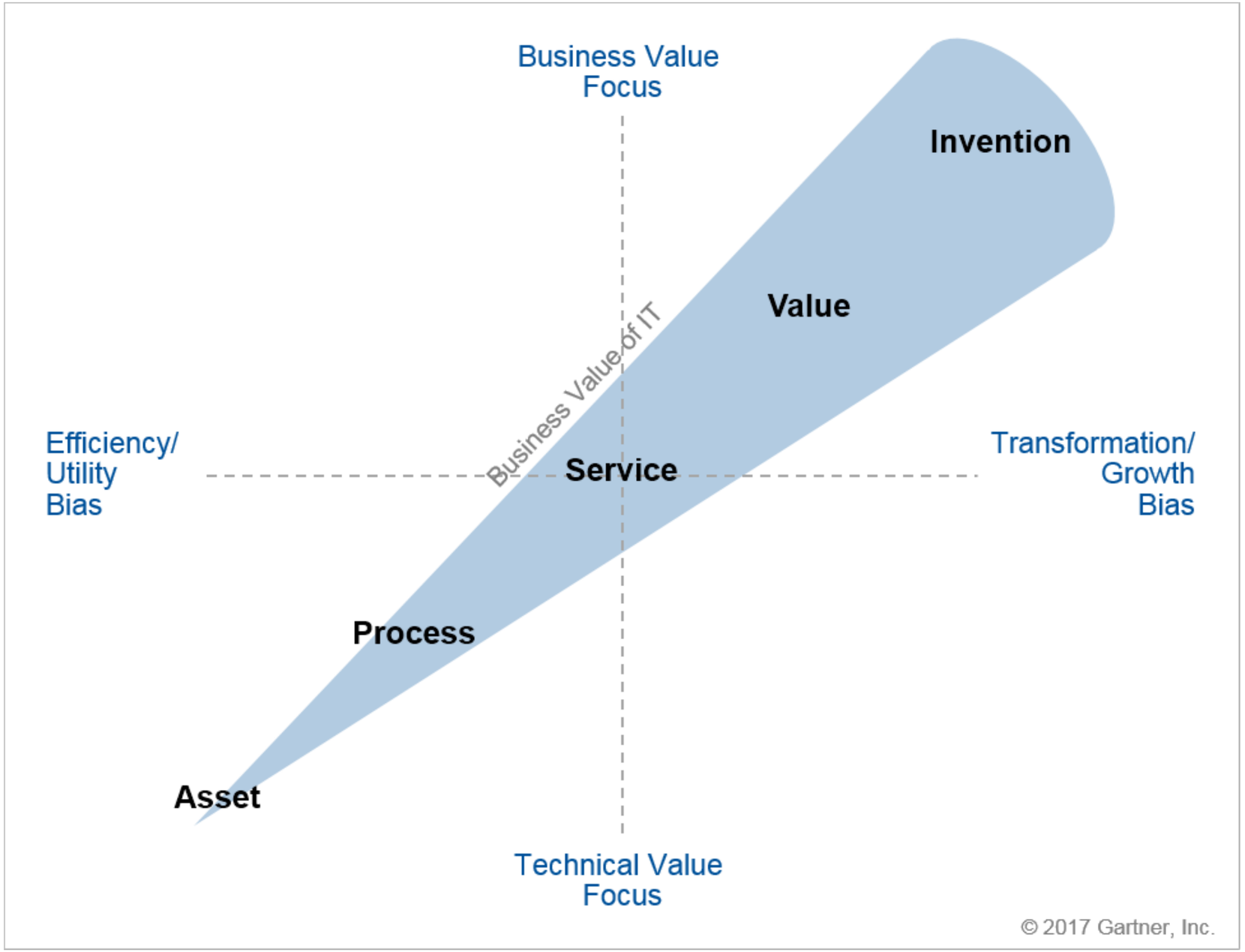
Service as a platform

- Users (students, employees & externals) in focus
- Develop and improve (continuously) services using ServiceNow
- Cooperate across the whole sector, government entities and commercial markets
- Ensure compliance

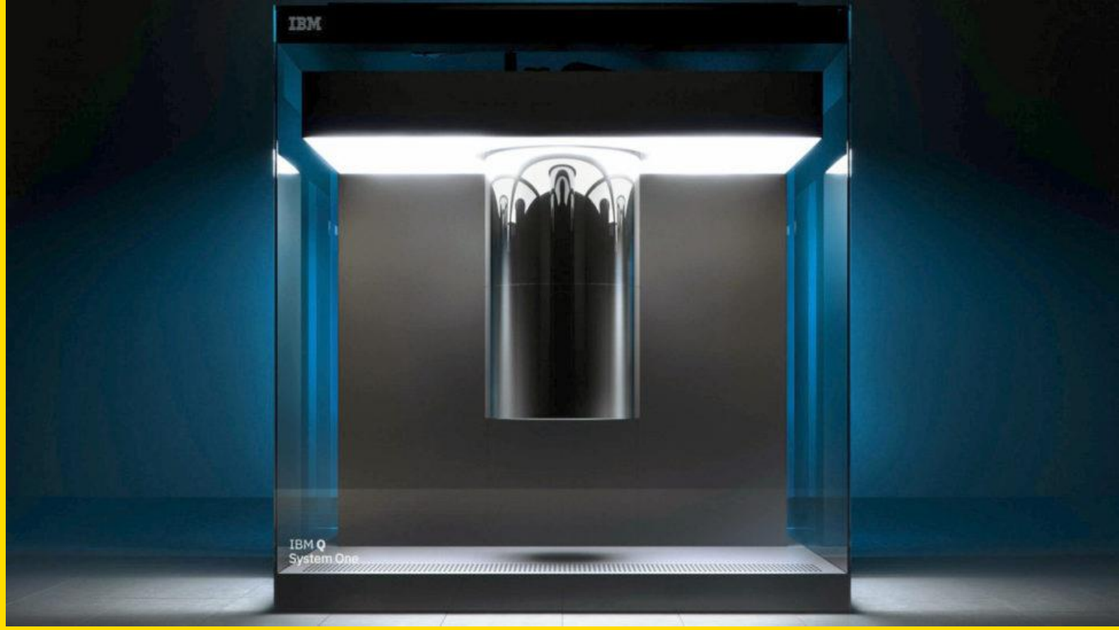


This will challenge the whole university in terms of business models, organizational development, investment and competency

The Gartner Five Operating Model Patterns



THE SECRET OF DIGITALIZATION IS ANALOG



Brief intro to Quantum Computing

Sergiy Denysov

OSLO METROPOLITAN UNIVERSITY
STORBYUNIVERSITETET

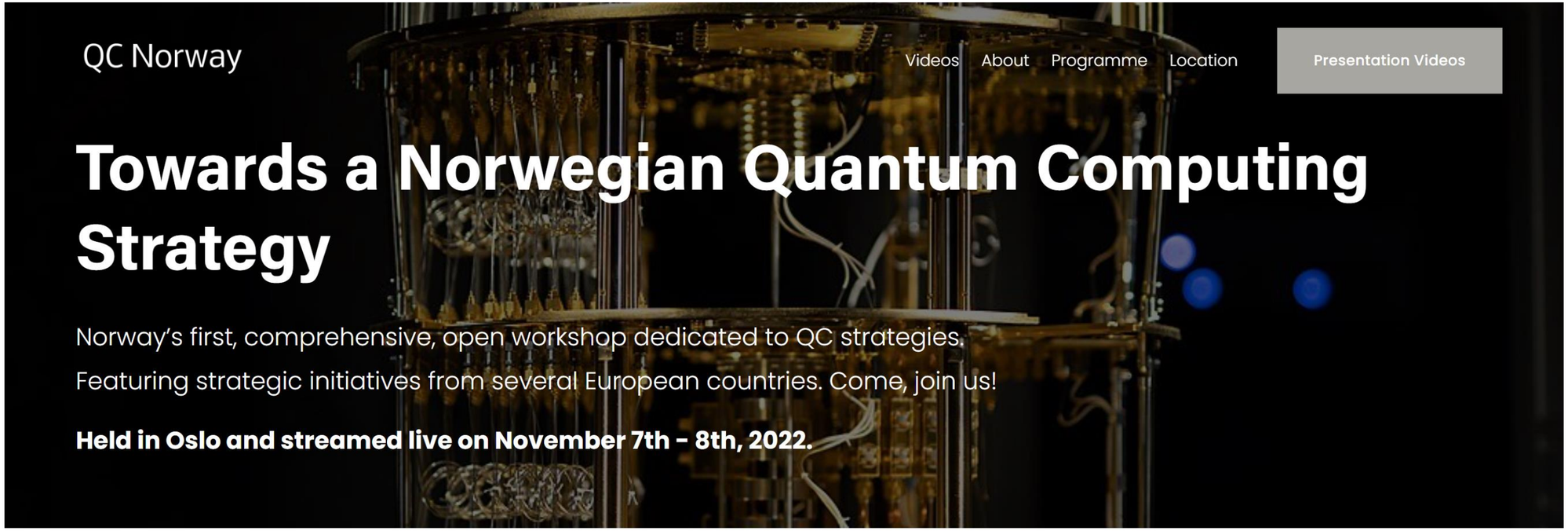
The OsloMet Quantum Hub

Brief intro to Quantum Computing at OsloMet

Sergiy Denysov

OSLO METROPOLITAN UNIVERSITY
STORBYUNIVERSITETET

The OsloMet Quantum Hub



The need for a Norwegian QC strategy

The international footprint of Quantum Computing (QC) is growing, with new & planned infrastructures around the globe. Meanwhile, leaders in education, research and industry are paving the way for greater access to QC.

QC holds enormous potential for accelerating important parts of computationally demanding workflows. At the same time, this unprecedented computational power brings with it tough challenges, in particular concerning security and privacy.

https://www.qcnorway.no te its vast potential, the national strategies and policies addressing QC,

How are leaders in quantum strategising for both the game-changing potential and known challenges?

To learn from those at the forefront, we've gathered an international group of speakers with strategic experience in QC and the underlying science and technology for a workshop. Presentations and discussions will address both the high potential of QC and the challenges that this technology brings along. We believe open sharing of current findings and approaches will be a strong foundation for the Norwegian QC strategy needed now.

Ruter#

Are you a student and familiar with Quantum AI?

Industry
Transportation

ruter.no/

Contact →

Expires:	09.03.2022
Education level:	Started bachelor/master (1.-3. yr)
	Started master (4.-5. yr)
Field of study:	Computer Science and Information Technology
Type:	Part-time work
	Summer work
Work place:	Queen's Gate 40
Responsibilities:	Analytics, Computing and Reporting
	IT – Development and Design
County:	Oslo

How to apply

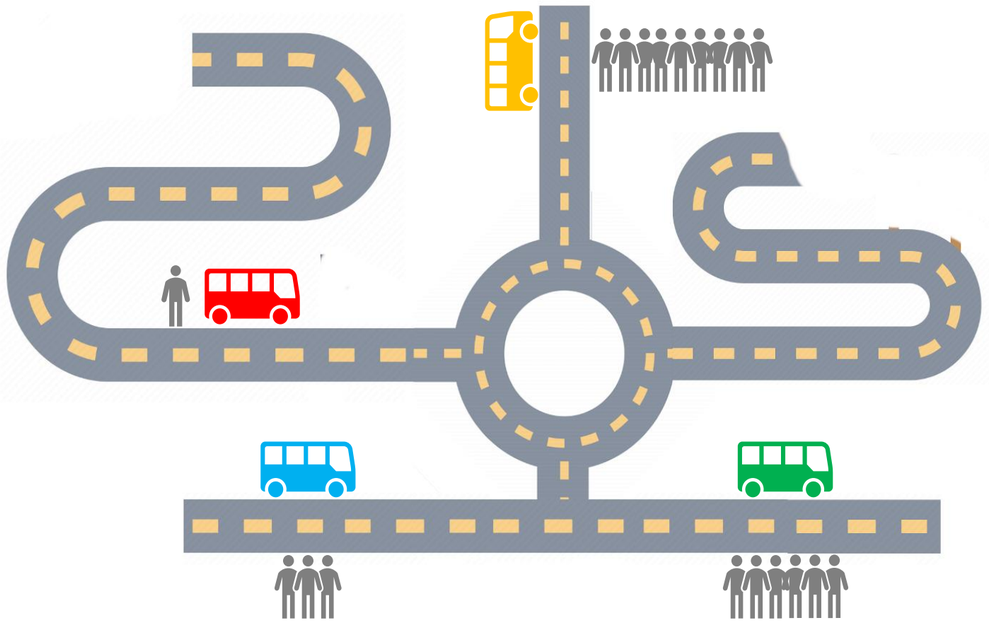
We have AI, data and access to Quantum computers and we need your help to use this in Ruter. Join Ruter's AI lab as a Quantum AI student employee! **The mobility services of the future are created through innovation. Routes must offer sustainable freedom of movement for all residents of Oslo and parts of Viken. Data is the fuel that drives this development. Artificial intelligence (and subsequently Quantum AI) is central to transforming digital services to become more intelligent.**

Quantum AI is an emerging disruptive technology that combines the advantages of Quantum Computing and AI. Now it is very important to find out the potential of this technology as a tool to solve practical everyday problems

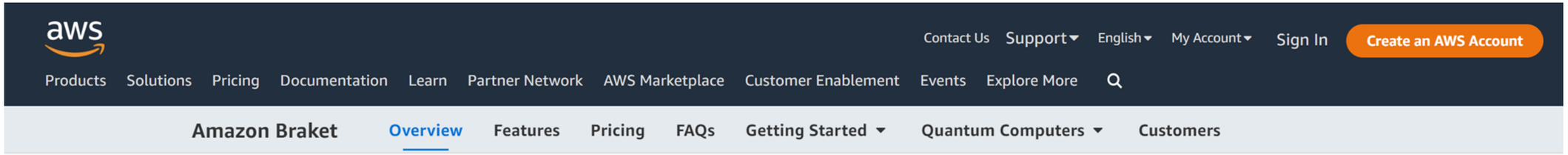
OSLOMET Ruter#

Capacity prediction with Quantum AI

Sebastian Testanière Overskott
, **OsloMet,** MSc student



- A real-life use case
- Implementation of quantum AI algorithm (*Qboost*) on *D-Wave* annealer (5000+qubits)
- Training the algorithm with an actual database
- Benchmarking and comparative analysis of the performance



Quantum Hardware Technologies

Quantum annealers

Quantum annealing uses a physical process to find a low energy configuration that encodes the solution of an optimization problem. Amazon Braket provides access to quantum annealing technology based on superconducting qubits from D-Wave.

D-Wave

Learn more about quantum annealers »

Gate-based ion-trap processors

Trapped-ion quantum computers implement qubits using electronic states of charged atoms called ions. The ions are confined and suspended in free space using electromagnetic fields. Amazon Braket provides access to ion-trap quantum computers from IonQ.

IONQ

Learn more about gate-based ion-trap processors »

Gate-based superconducting processors

Superconducting qubits are built with superconducting electric circuits operating at cryogenic temperature. Amazon

Gate-based photonic quantum computers

Photonic quantum computers utilize quantum light sources that emit squeezed-light pulses, with qubit-equivalents that


Problem Details
Solver Details
1
2
Target - QPU
Target - Samples - Histogram
NODE 1734
VARIABLE v7,0
BIAS 0.12876699
SOLUTION -1
Ising
Bias
Solution
+1
0
-1
SOLUTION OCCURRENCES
-635
-630
-625
-620
-615
ENERGY (TARGET)
Console
1 — 21 OF 21
Type
Description
Source
Target
Chain Length Warning
Chain length greater than 7
v0,1
1315, 1443, 1713, 1585, 1436, 1444, 1457, 1452, 1460
Chain Length Warning
Chain length greater than 7
v0,2
1824, 1198, 1190, 1184, 1696, 1568, 1312, 1440
Chain Length Warning
1820, 1836, 1844, 1843, 1715, 1587, 1479, 1471,
D-Wave

OSLOMET

```python
# Copyright 2019 D-Wave Systems Inc.
#
# Licensed under the Apache License, Version 2.0 (the "License");
# you may not use this file except in compliance with the License.
# You may obtain a copy of the License at
#
#     http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.

from __future__ import print_function

from dwave.system.composites import EmbeddingComposite
from dwave.system.samplers import DWaveSampler

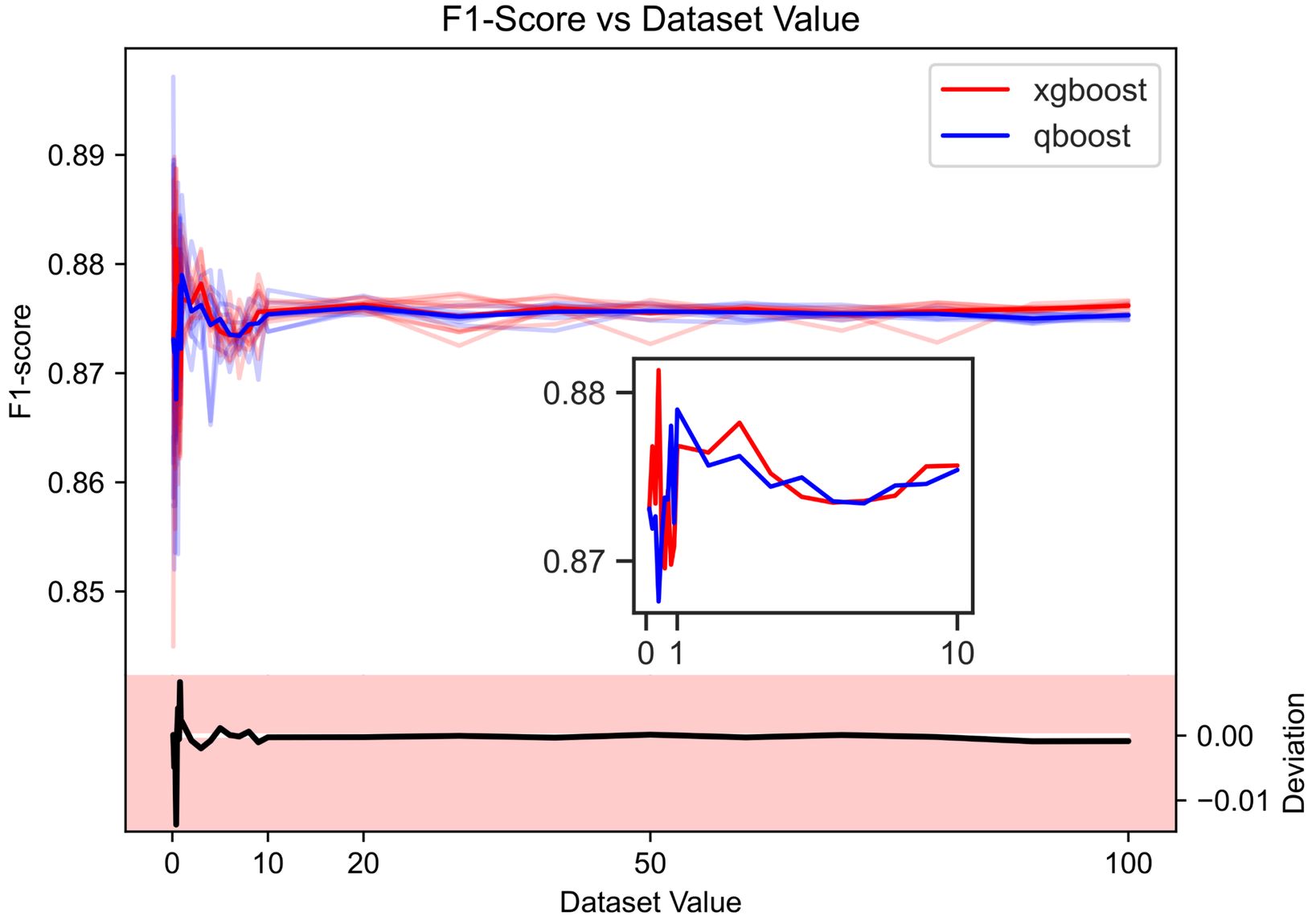
from job_shop_scheduler import get_jss_bqm

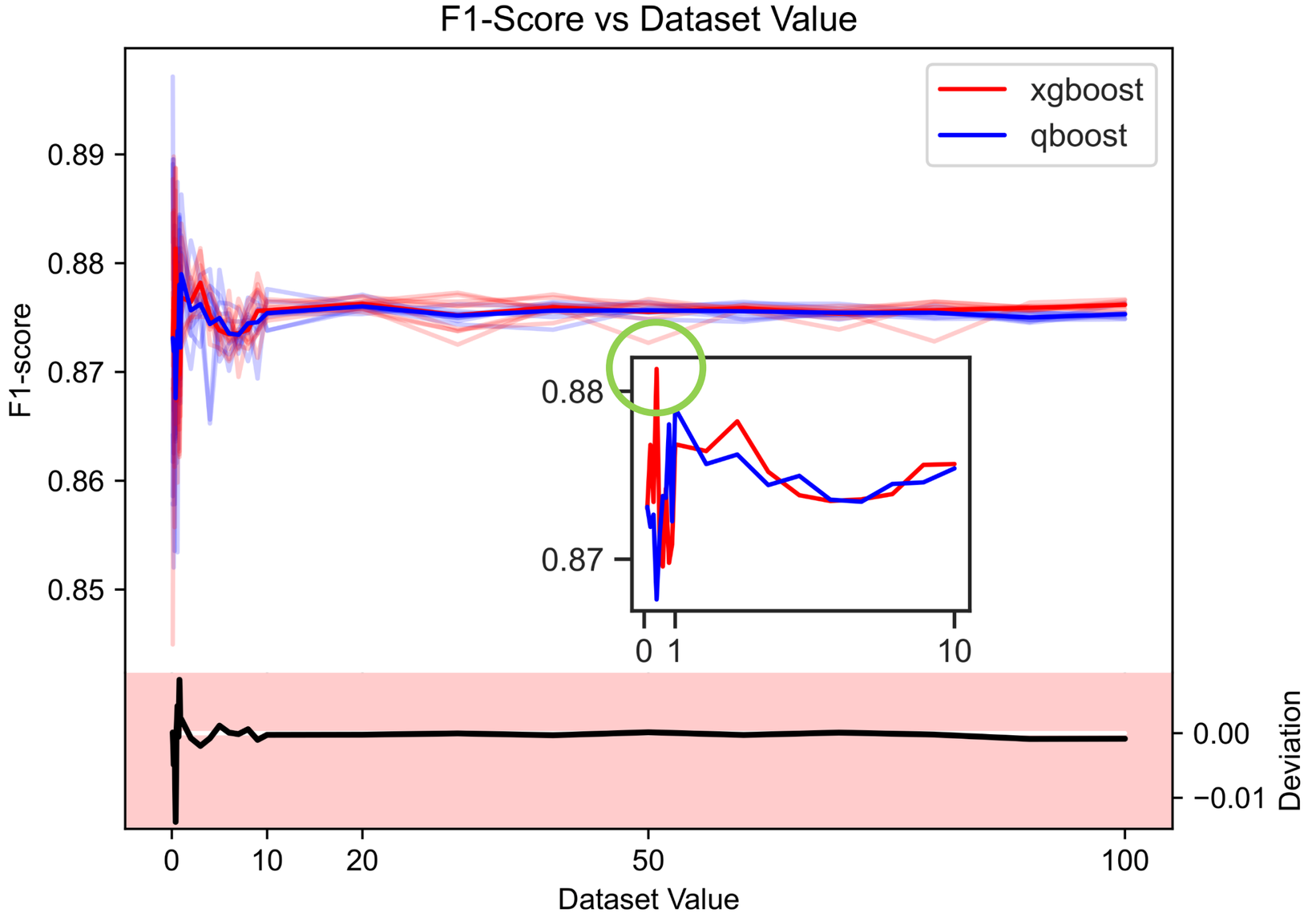
# Construct a BQM for the jobs
jobs = {"cupcakes": [("mixer", 2), ("oven", 1)],
        "smoothie": [("mixer", 1)],
        "lasagna": [("oven", 2)]}
max_time = 4      # Upperbound on how long the schedule can be; 4 is arbitrary
bqm = get_jss_bqm(jobs, max_time)

# Submit BQM
# Note: may need to tweak the chain strength and the number of reads
sampler = EmbeddingComposite(DWaveSampler(solver={'qpu':True}))
sampleset = sampler.sample(bqm, chain_strength=2, num_reads=1000)

# Grab solution
solution = sampleset.first.sample

# Visualize solution
# Note0: we are making the solution simpler to interpret by restructuring it
#  into the following format:
#   task_times = {"job": [start_time_for_task0, start_time_for_task1, ..],
#                 "other_job": [start_time_for_task0, ..]
#                 ..}
#
# Note1: each node in our BQM is labelled as "<job>_<task_index>,<time>".
#  For example, the node "cupcakes_1,2" refers to job 'cupcakes', its 1st task
```


F1-Score vs Dataset Value
xgboost
qboost
F1-score
0.89
0.88
0.87
0.86
0.85
0.88
0.87
0 1
10
0.00
−0.01
Deviation
0
10
20
50
100
Dataset Value


F1-Score vs Dataset Value
xgboost
qboost
F1-score
0.89
0.88
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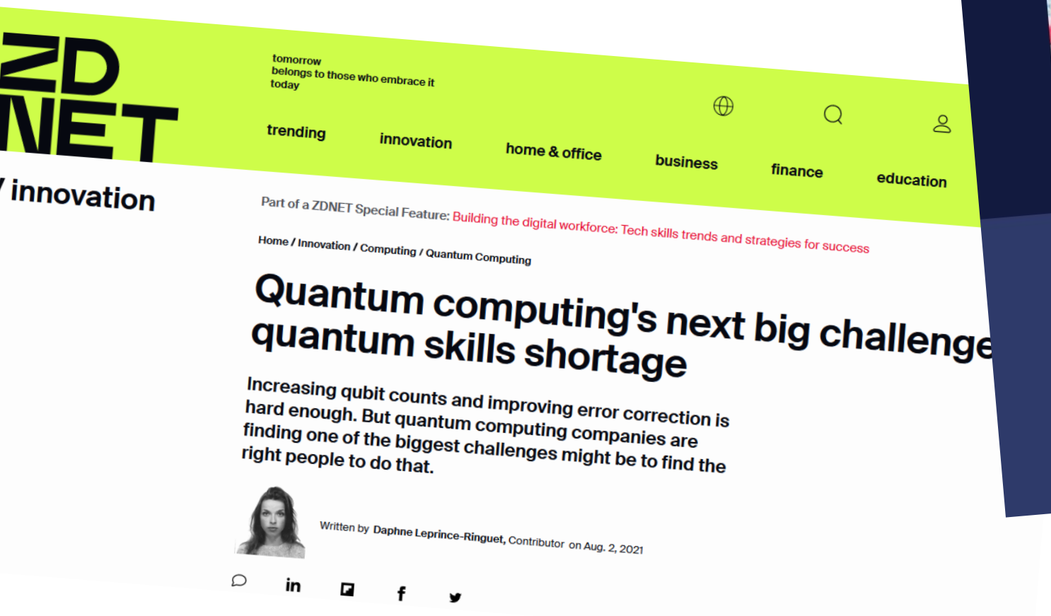
0.86
0.85
0.88
0.87
0 1
10
0.00
−0.01
Deviation
0
10
20
50
100
Dataset Value

QC expertise & literacy

We see a need for edcuating our **Computer Science and IT students** within this emerging technology because

We believe this will give our students a substantial advantage in the job market; the demand already exceeds the supply when it comes to **quantum literate** computer science professionals.

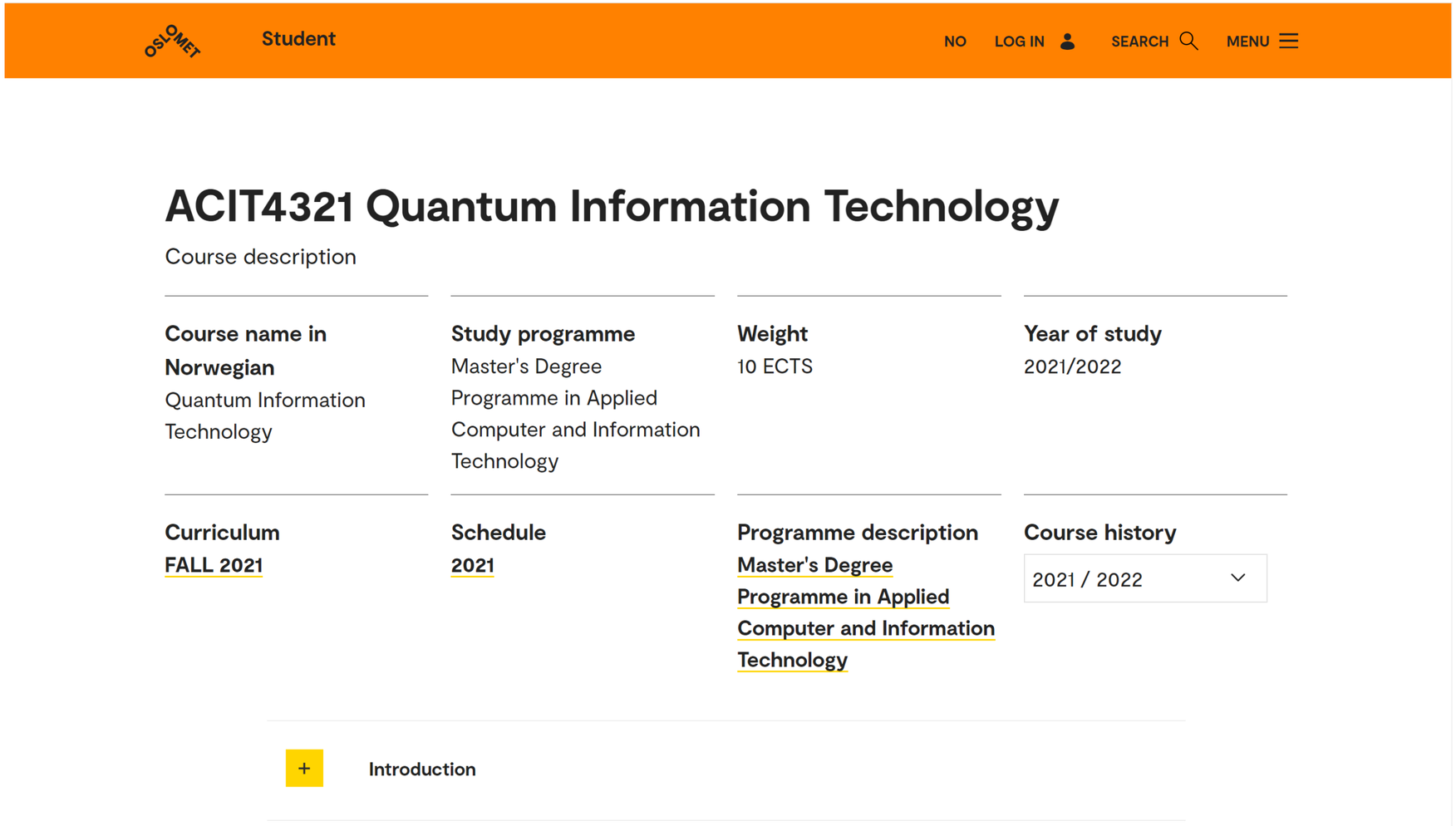


Quantum Computing for future IT experts

Our approach:

- QC can be taught to students with no prior knowledge of quantum physics
- The corresponding course would be a short-cut for IT/CS students, by leading them directly into the QC realm
- The course should incorporate coding and execution of programs on the current QC prototypes (e.g., on the cloud-accessible IBM Quantum platform) and our two QCs.

Quantum Computing as an CS & IT subject



Student NO LOG IN SEARCH MENU

ACIT4321 Quantum Information Technology

Course description

Course name in Norwegian
Quantum Information Technology

Study programme
Master's Degree Programme in Applied Computer and Information Technology

Weight
10 ECTS

Year of study
2021/2022

Curriculum
FALL 2021

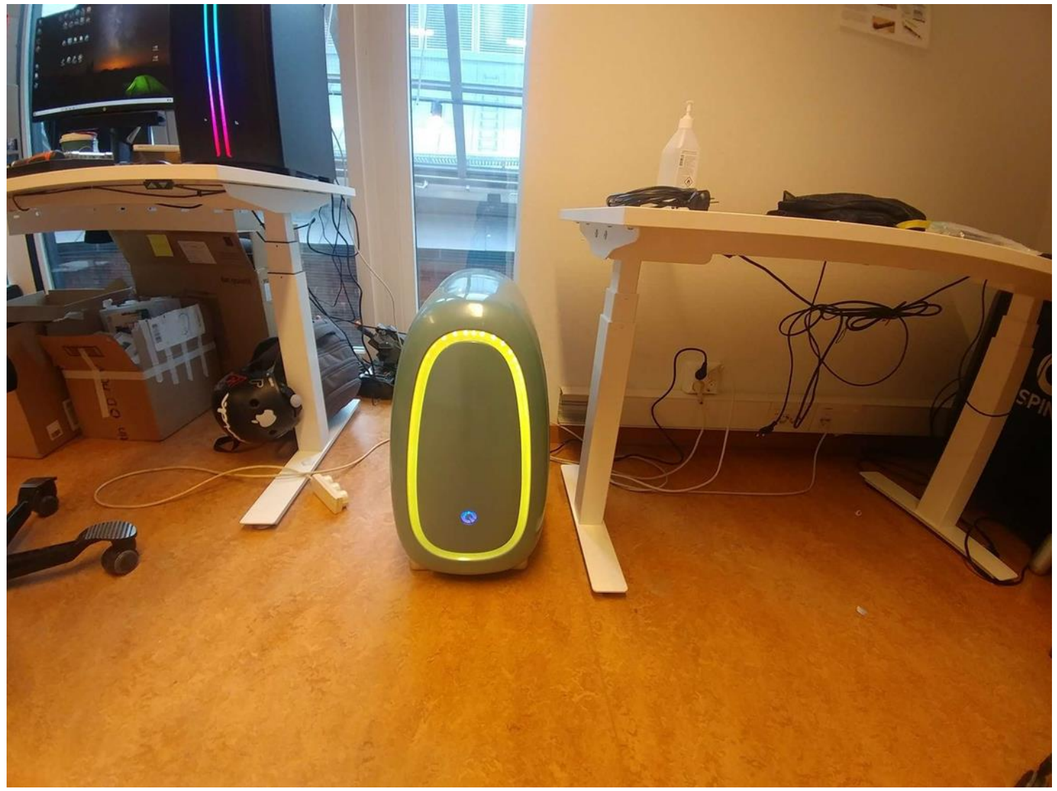
Schedule
2021

Programme description
Master's Degree Programme in Applied Computer and Information Technology

Course history
2021 / 2022

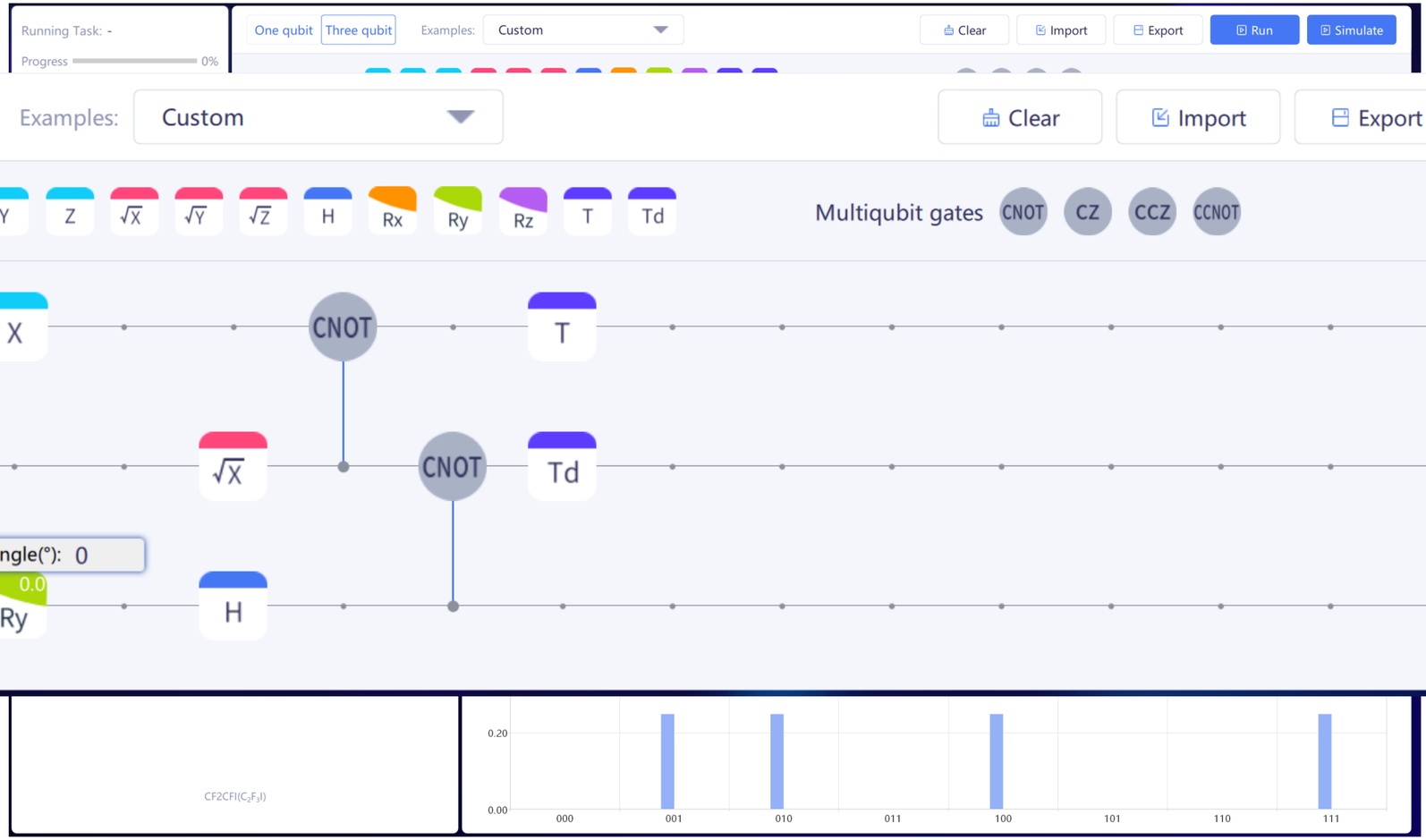
\+ Introduction

Our quantum computers



Our quantum computers

Our quantum computers



OsloMet's Quantum Hub: The QH is a virtual center for quantum computing in OsloMet/Oslo/Norway: bridging the gap between academia, industry, public sector, and the general public. The activities in the hub will focus on education and public awareness, as well as serving as an incubator for collaborations

- a meeting place for academia, industry, and media to discuss, advance, and popularize QC in the societal context.
- development of a new education program on QC across disciplines.
- a platform to organize thematic workshops and facilitate interaction with other research institutions in Norway and internationally.

OSLOMET

NordSTAR

Nordic Center for Sustainable and Trustworthy AI Research

The main goal of NordSTAR is to develop AI tools, which embed all key aspects related with trustworthiness and sustainability. To do this the centre has established five research areas:

- **+ Security, safety and reliability**
- **+ Human factors in AI**
- **+ Quantum AI**
- **+ Biologically-inspired computational systems**
- **+ Understandable and explainable models**

Pedro Lind, Prof. , *OsloMet*
Leader of NordSTAR

Anis Yazidi, Prof. , *OsloMet*
Leader of NordSTAR

OSLO METROPOLITAN UNIVERSITY
STORBYUNIVERSITETET

HUB
The OsloMet Quantum Hub

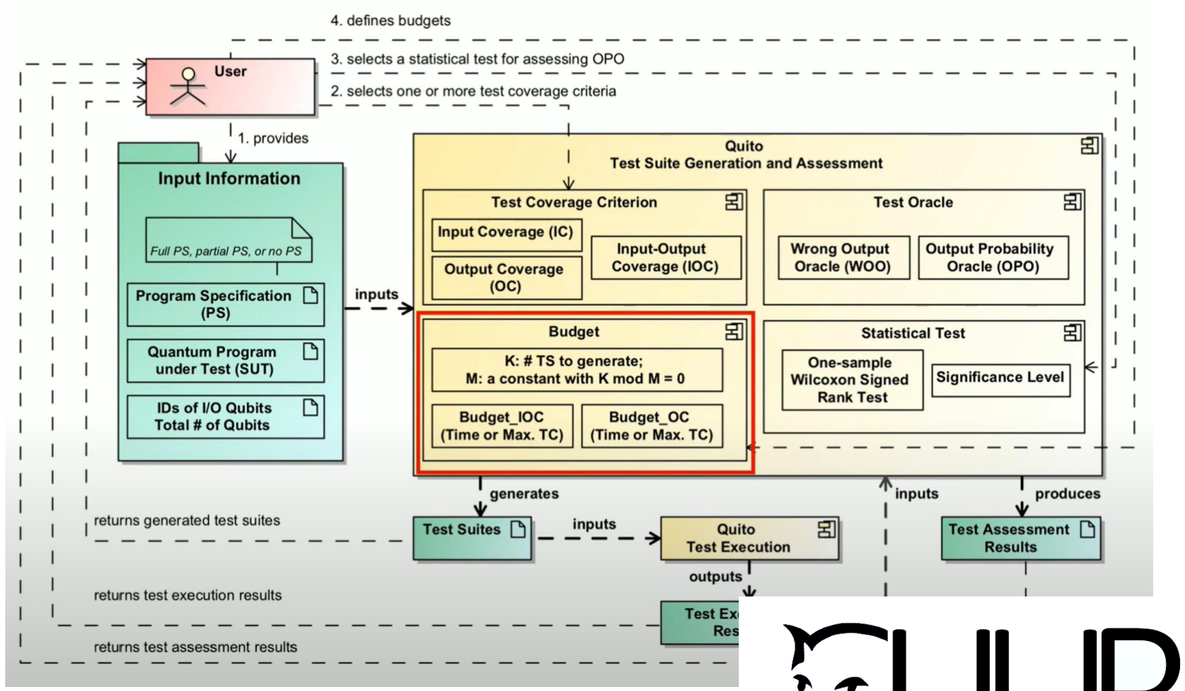
Cooperation in research & education

Are Magnus Bruaset, Research Director, Software Engineering and HPC

Shaukat Ali, Head of Department, Engineering Complex Software Systems

Tao Yue, Chief Scientist, Engineering Complex Software Systems

- Joint effort to push forward QC agenda in Norway
- *Shaukat Ali* is Professor II (Adjunct Professor) at OsloMet (supervision of MSc students and contribution to our QIT course and outreach activity)
- Collaboration in research (QC software)



OSLO METROPOLITAN UNIVERSITY
STORBYUNIVERSITETET

The OsloMet Quantum Hub

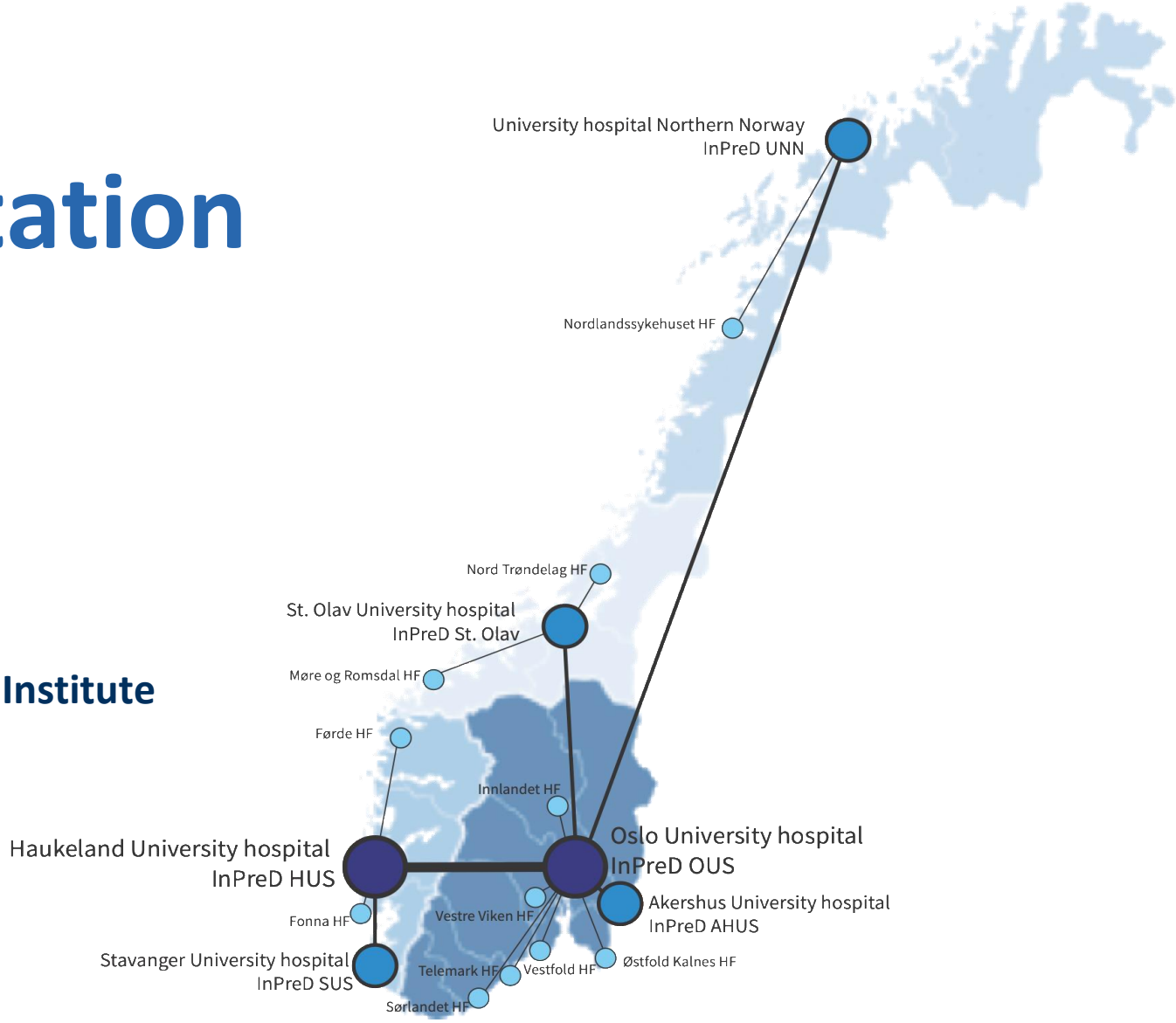
Strategies:

- Popularize but not trivialize
- Increase level of quantum literacy
- Maintain – and increase – level of trust in QC

The precision cancer medicine implementation initiative in Norway

Hege Russnes, Prof., MD, PhD
Dept. of pathology and dept. of cancer genetics, Institute for cancer research
Oslo University Hospital, Norway

2023 Cisco Higher Education Study Tour
31.05.2023



How to implement precision medicine for cancer in Norway?

Public health care – equal access to diagnostic service and clinical care

For precision medicine in cancer, key components are

- Interaction between research – diagnostics – clinical care
- Clinical trials
- Molecular testing
- Infrastructures:
  - Competence
  - IT
  - Advanced/expensive technology

Key establishment - 1

National Competence Network for Personalised medicine – Precision medicine
NorPreM

Focus on standardisation, harmonisation and equal access to PM directed diagnostics and care (2019-)

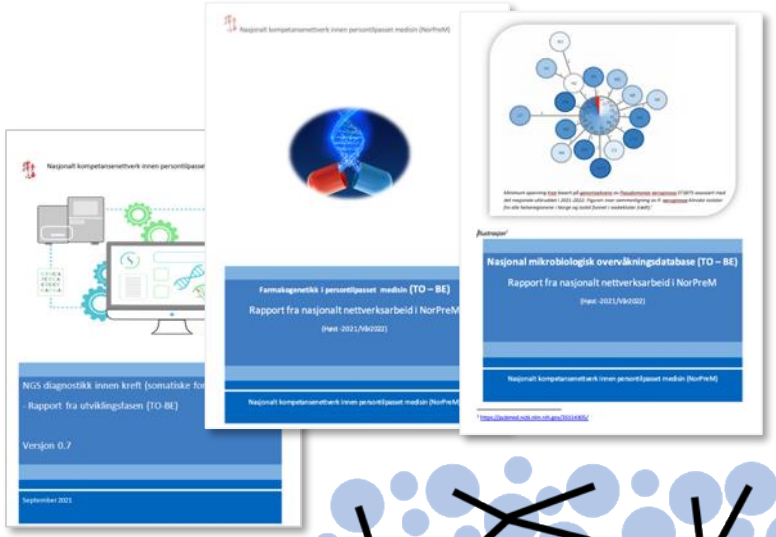
- **Steering group:** the 4 CMO's at the regional health trusts
- **Disease agnostic** (cancer, rare disease, microbiology/infectious disease ++)
- **Part of the public specialist health care system**
- **Four regional networks** and multiple subnetworks
- Close interaction with the health authorities (Directory of Health and Directory of eHealth)

HELSE VEST HELSE MIDT-NORGE

HELSE NORD HELSE SØR-ØST

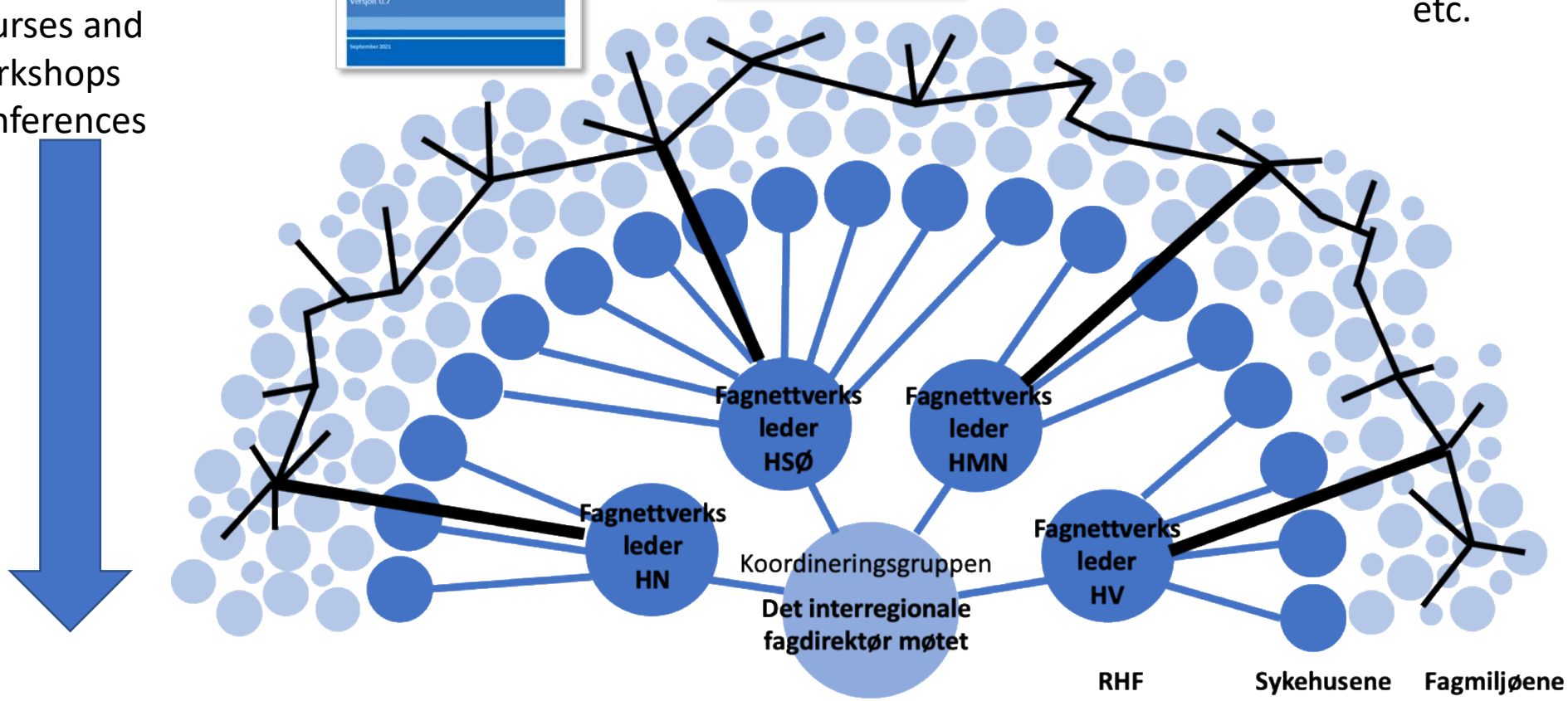
NorPreM projects:

- Status reports, recommendations etc.
- Implementation: protocols, ring-tests etc.
- Courses and workshops
- Conferences



CMO's at the four Regional Health Trusts:

Ask for implementation plans, advices, status reports etc.



HELSE VEST HELSE MIDT-NORGE HELSE SØR-ØST HELSE NORD

Regional meeting Northern Norway

National NorPreM network for NGS analysis in cancer

Bioinformatics for pathologist

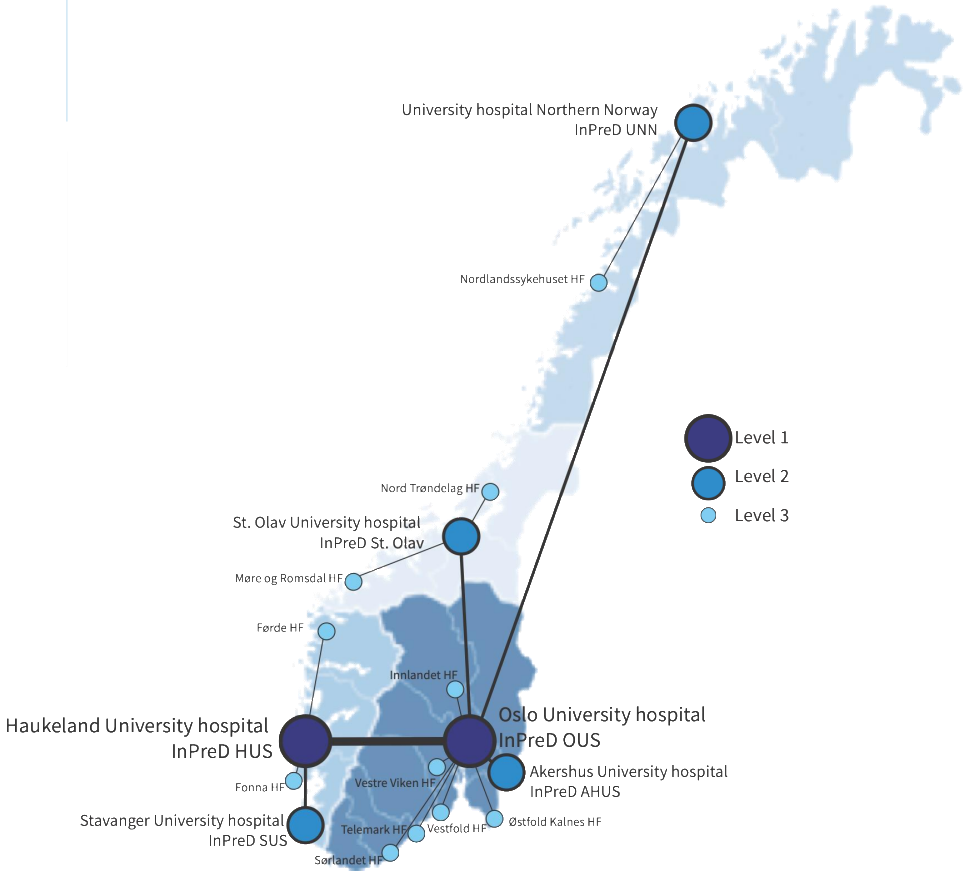
National conference in Precision Medicine, Tromsø 2022

Key establishment - 2

National **In**frastructure for **Pr**ecision **D**iagnostics – cancer

Aim: *Equal access to expanded molecular testing – and access to experimental treatment for cancer patients*

National competence building – ***bridging research and diagnostics***



The six pathology departments at the university hospitals as core of InPreD-Norway

- Network - providing NGS for all pathology departments
- Patient identification to biomarker driven clinical trials available for all hospitals
- Facilitate trial specific diagnostics

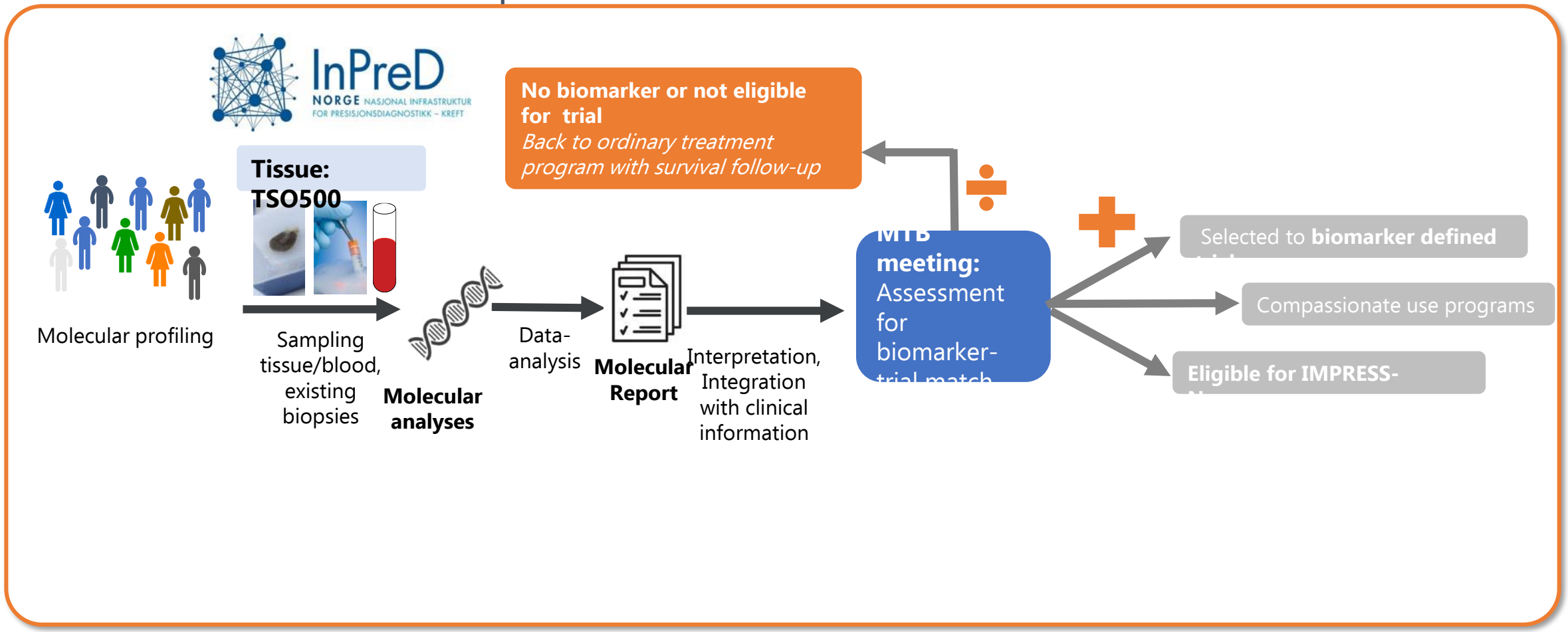
Funding:

- 150 MNOK + + from

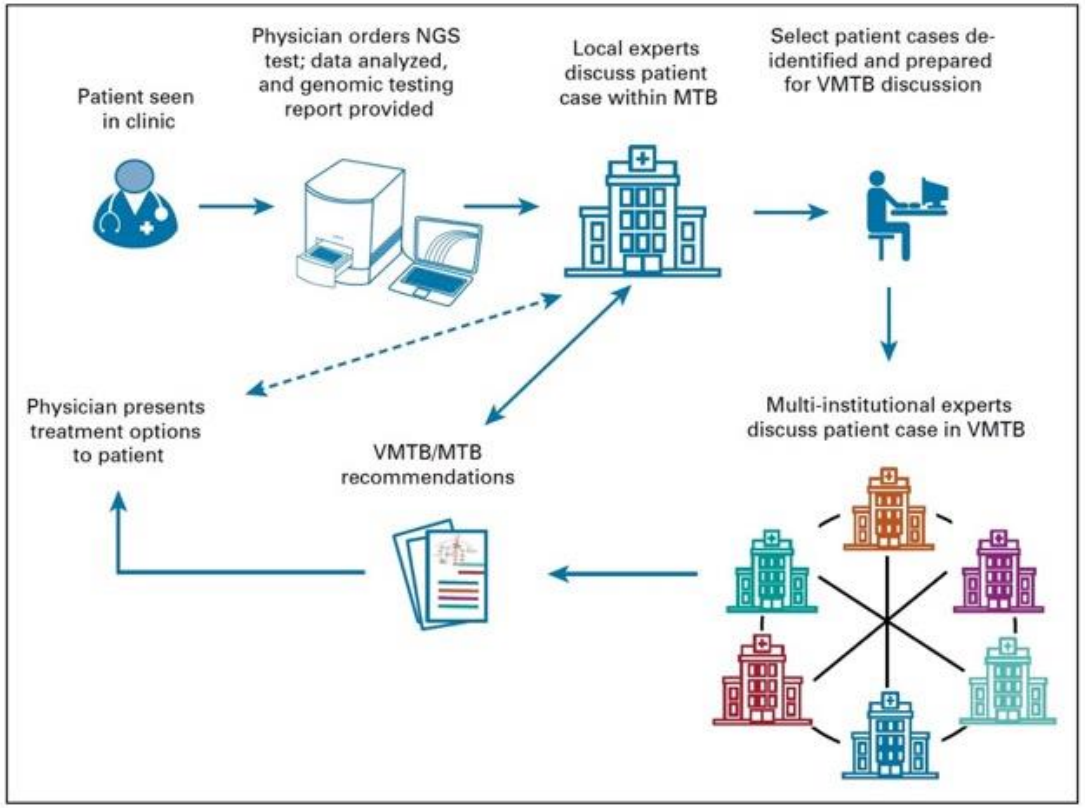
reimbursed

InPreD: Infrastructure for precision diagnostics

Diagnosis and assessment for cancer patients where experimental treatment and clinical trial inclusion is an option



Regional and national Mol-MDT structure



Rao et al., JCO Clin Canc Inform 2020

Now developing the first **regional** pre-Mol-MDT meeting. Cases with no clinical impact will be closed here, while cases with actionable findings will be discussed nationally. Secure harmonisation of standardisation of interpretation and reporting

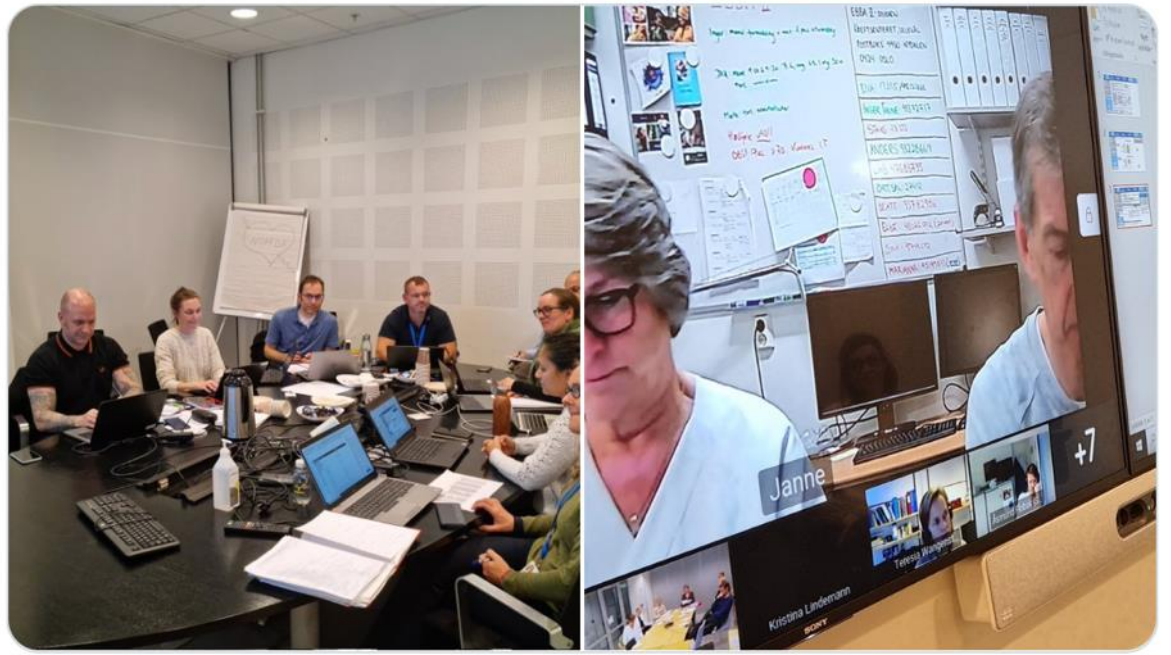
Mol-MDT: a virtual tumor board meeting

<u>Trained staff from OUS:</u>

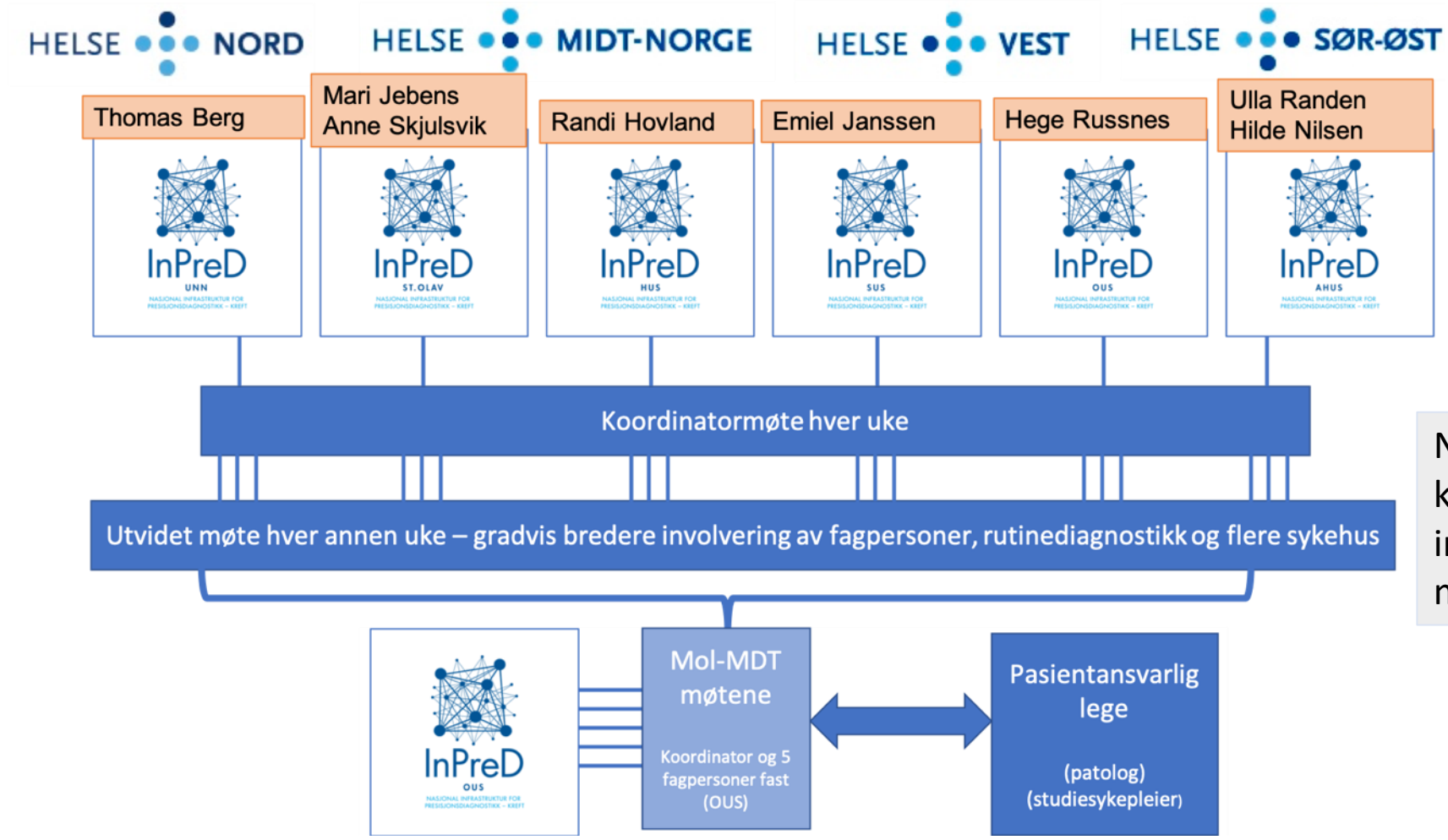
- *Oncologist*
- *Pathologist*
- *Medical geneticist*
- *Molecular biologist*
- *Bioinformatician*

STATUS (Feb. 2023):

- *Started April 2021 (2 cases per week)*
- *Scales regularly; now 20 cases per week*



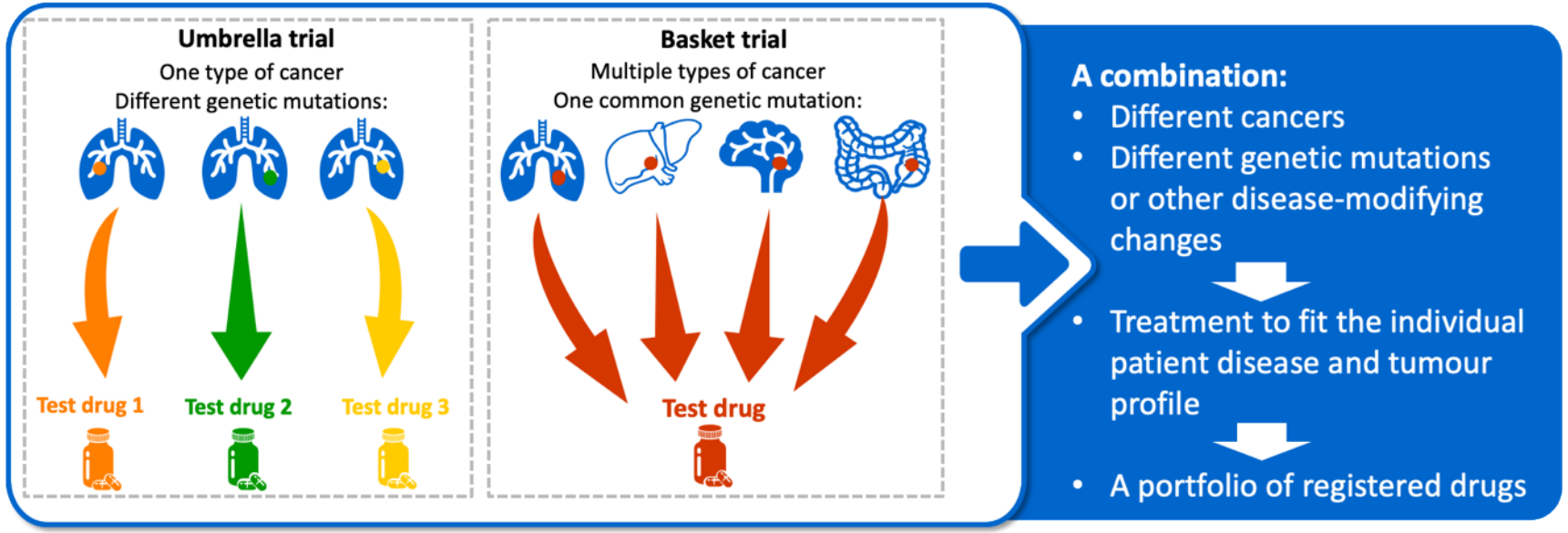
Connections between InPreD and NorPreM



Nasjonalt kompetansenettverk innen persontilpasset medisin (NorPreM)

Key establishment - 3

IMPRESS-Norway: Improving public cancer care by implementing **pre**ci**s**ion medicine in Norway

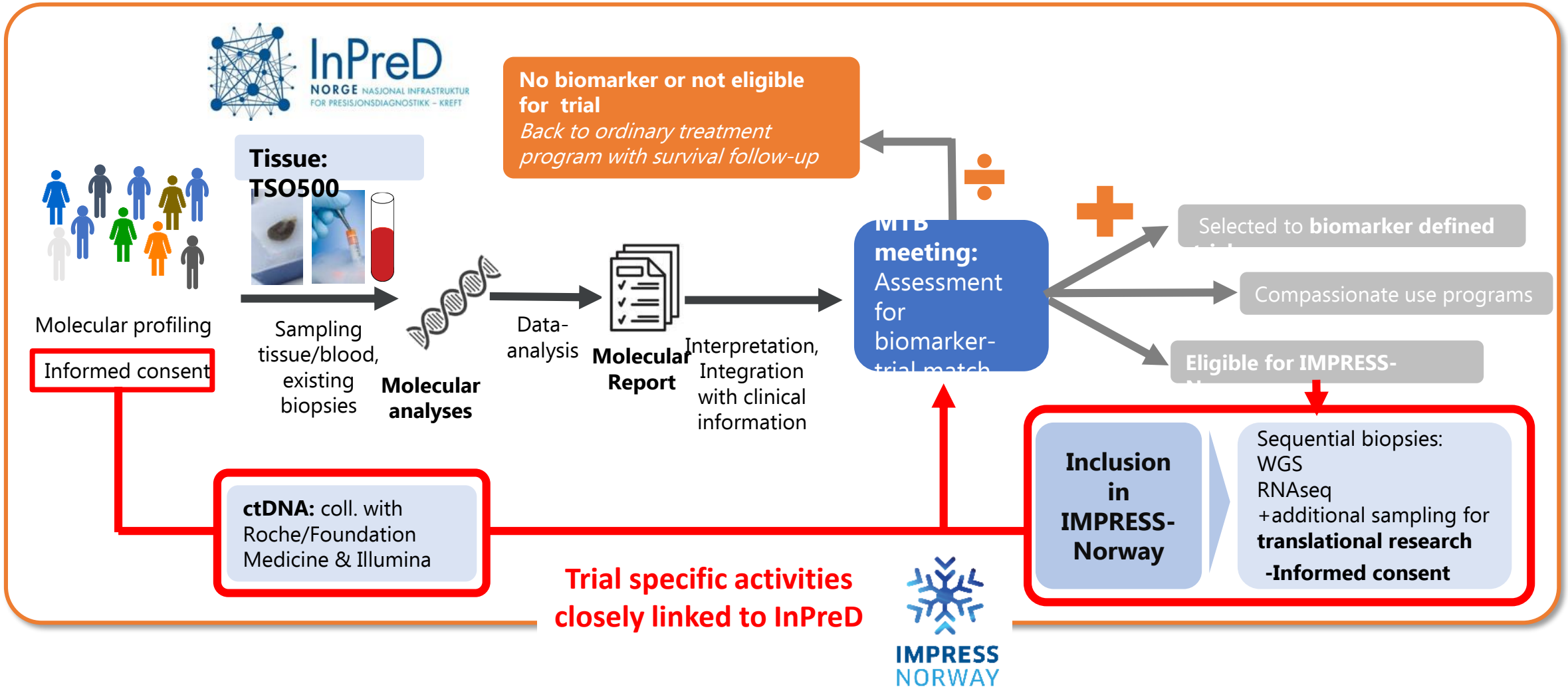


Collaboration with the other PCM trials including DRUP in the Netherlands and similar studies in the Nordics and other European countries are ongoing or about to start

Figure adapted from: West HJ. *JAMA Oncology* 2017; 3:423.

InPreD: Hybrid activity research and routine

Diagnosis and assessment for cancer patients where experimental treatment and clinical trial inclusion is an option



Interim results from April 1, 2021 to May 12, 2023 (2 years)

IMPRESS NORWAY

Consented for screening:

1043 patients included for molecular profiling

894 patients discussed in National MTB

- 21%(176 patients) included in IMPRESS cohorts
- 1% included in other clinical trials
- 10% referred to early access programmes / compassionate use
- 68% referred back to standard treatment programme (palliative care)

Found drug / treatment opportunity for 32%

Included in treatment

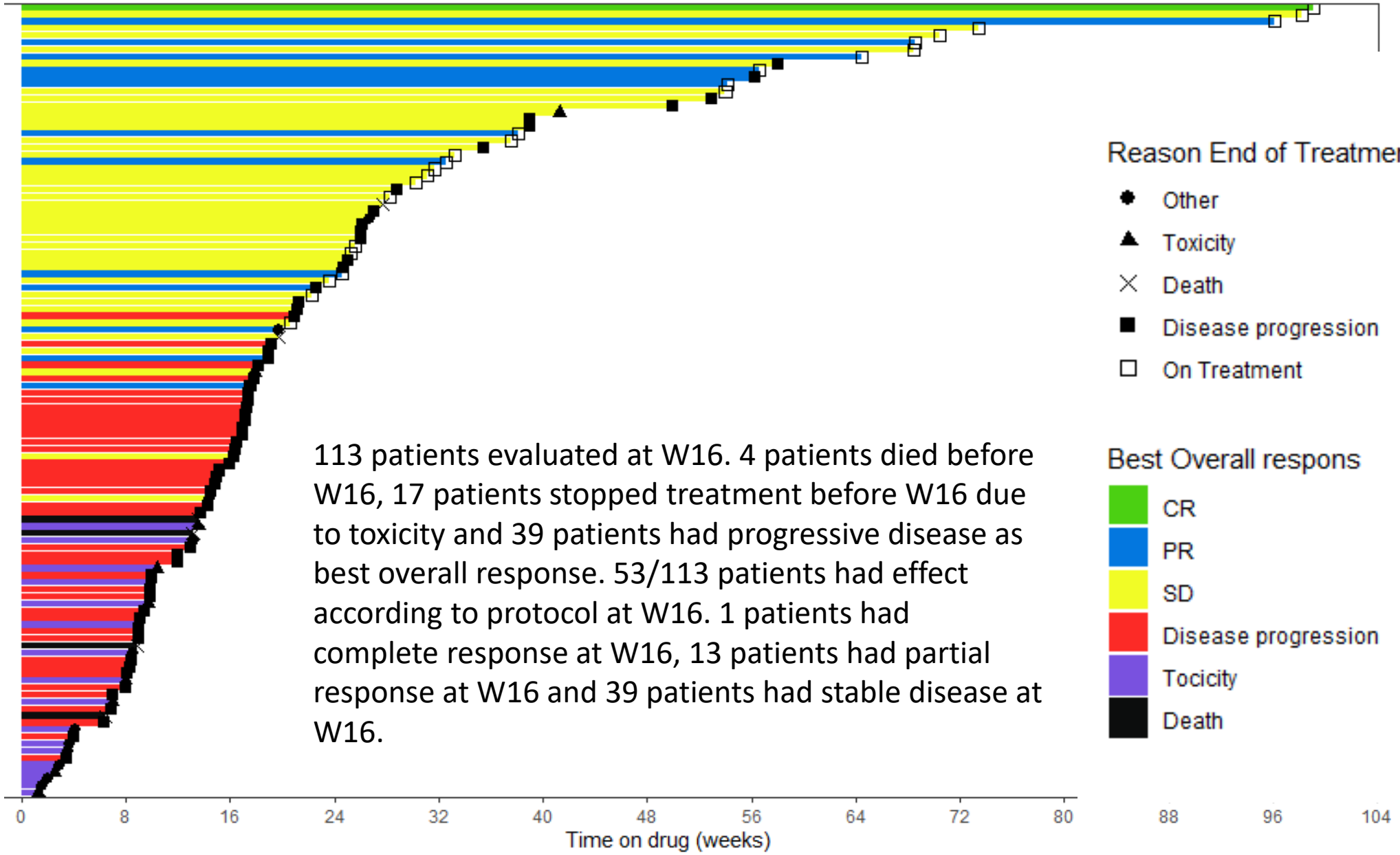
186 patients included in cohorts:

- 135 patients started treatment (lag mainly due to ongoing last line of SoC treatment)
- Many different cohorts, number of cancer diagnoses, number of different drugs
- 113 patients evaluated at 16 weeks across all cohorts
- 53/1113 clinical benefit (CR/PR/SD) at 16 weeks

Clinical benefit in approx 47% at 16 weeks across all cohorts so far

slide KT

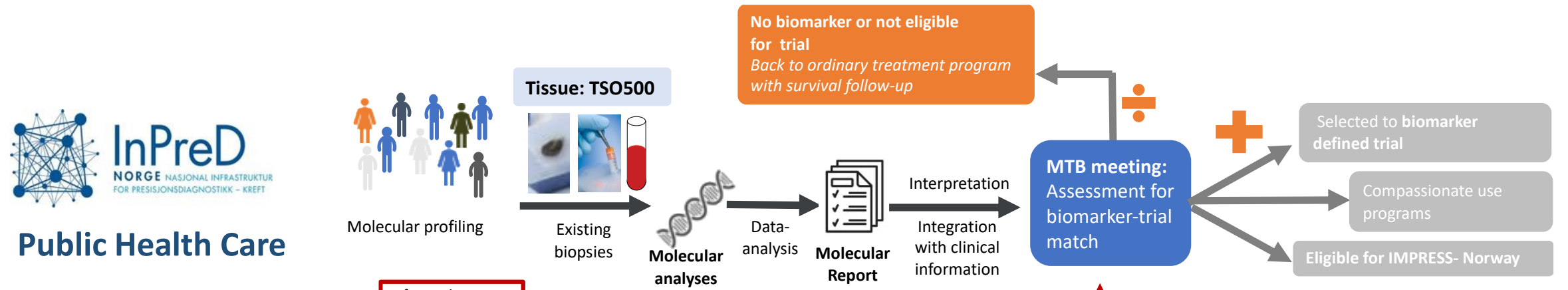
Early aggregated results (April 1, 2021-May12, 2023 – 2 yrs)



113 patients evaluated at W16. 4 patients died before W16, 17 patients stopped treatment before W16 due to toxicity and 39 patients had progressive disease as best overall response. 53/113 patients had effect according to protocol at W16. 1 patients had complete response at W16, 13 patients had partial response at W16 and 39 patients had stable disease at W16.

slide KT

Public health care – Clinical trials – Research



InPreD NORGE NASJONAL INFRASTRUKTUR FOR PRESISJONSDIAGNOSTIKK – KREFT

Public Health Care

IMPRESS NORWAY

From trial to implementation

Informed consent

ctDNA: coll. with Roche/Foundation Medicine & Illumina

Inclusion in IMPRESS-Norway

Sequential biopsies: WGS
RNAseq
+additional sampling for **translational research**
-Informed consent

MATRIX NORWEGIAN CENTRE FOR CLINICAL CANCER RESEARCH

Novel trial diagnostics

Funded 2022-2030 (12.8 M Euro, The Norwegian Research Council and the Norwegian Cancer Society)

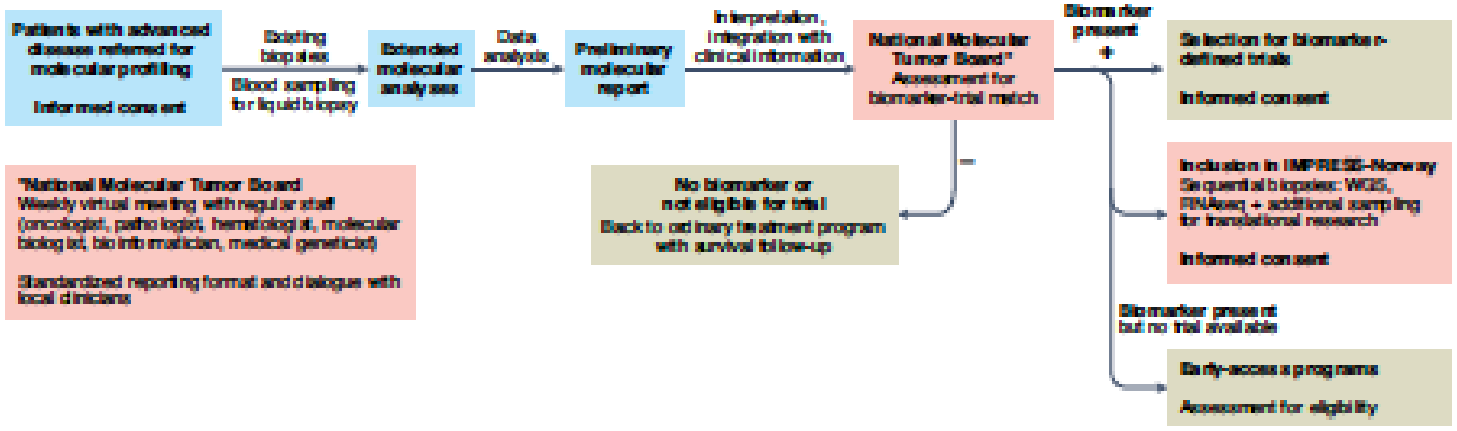
WGS, WTS
Genomic signatures
Single-cell analyses
Proteomics
Digital pathology
Drug Sensitivity Screening
Advanced radiology
AI based solutions
…

Novel trial designs
Tumor-type specific
Pan-Cancer
…

Extensive biobanking
Translational research
…

Nature Med. May 5th 2022

A national precision cancer medicine implementation initiative for Norway



correspondence

Table 1 | CONNECT: a public–private partnership of stakeholders in precision cancer medicine

CONNECT working-groups interfacing			
InPreD (WG1)	**IMPRESS (WG2)**	**Innovative implementation methods (WG3)**	**Data governance, storage and sharing for secondary use and analysis (WG4)**
InPreD national testing infrastructure	IMPRESS-Norway national PCM trial	INSIGHT-INCLUDE: impact of precision cancer medicine health economics and regulatory framework for implementation	INSIGHT-INCLUDE legal framework InPreD ICT solution: IMPRESS aggregation of data in Europe

CONNECT is operationalized via working groups (WG1–WG4) that engage experts from the public and private sector. p ICT, information and communications technology; PCM, precision cancer medicine.

Kjetil Taskén[1,2,28], Hege E. G. Russnes[2,3,4], Eline Aas[5,6], Line Bjørge[7,8,9], Egil S. Blix[10,11], CONNECT Public–Private Partnership Consortium*, Espen Enerly[12], Gro L. Fagereng[13], Åsmund Flobak[14,15], Bjørnar Gilje[16], Bjørn T. Gjertsen[8,17], Tormod K. Guren[18], Jutta Helx[19], Eivind Hovig[20,21], Randi Hovland[22], InPreD-Norway and National Molecular Tumor Board Consortium*, IMPRESS-Norway Consortium*, Per E. Lønning[8,23], Leonardo A. Meza-Zepeda[20,24], Per M. Mæhle[25], Hilde L. Nilsen[2,26], Steinar Ø. Thoresen[18,27], Ketil Widerberg[18], Sigbjørn Smeland[2,25] and Aslaug Helland[2,4,18]

correspondence

CONNECT Public–Private Partnership Consortium

Steinar Ø. Thoresen[18,27], Sigbjørn Smeland[2,25], Eline Aas[5,6], Terje C. Ahlquist[28], Nyosha Alikhani[29], Ali Araffard[30], Eli Bergli[31], Hege Edvardsen[32], Gry Festervoll[33], Åsmund Flobak[14,15], GretheS. Foss[33], Petter Foss[31], Bjørn T. Gjertsen[8,17], Ingvild Hagen[34], Kåre B. Hagen[5], Håvard H. Hauge[34], Bjørn V. Herikstad[35], Kristian Hveem[36,37,38], Elisabeth Jarnaess[39], Kristin Kittelsen[40], Kristin Krogsrud[28], Monica Larsen[32], Mariam Lofwander[41], Birgitte Lygren[28], Aslaug Muggerud[42], Cathrine S. Notland[43], Ole A. Oppdalshol[44], Hege E. G. Russnes[2,3,4], Ravinder Singh[45], Svein Skale[46], Fredrik Sund[30], Lars P. Strand[40], Kjetil Taskén[12], Lidziya Ulvenes[47], Giske Ursin[32], Svenn Valgardsson[48], Katti Widerberg[18], Pål Wilk[49], Naoko Yamagata[50] and Jutta Helx[19]

[5]Roche Norge AS, Oslo, Norway. [6]Bayer AS, Oslo, Norway. [7]Bristol-Myers Squibb Norway Ltd NUF, Oslo, Norway. [8]Novartis Norge AS, Oslo, Norway. [9]Association of the Pharmaceutical Industry in Norway, Oslo, Norway. [10]Norwegian Directorate of Health, Oslo, Norway. [11]Pubgene AS, Oslo, Norway. [12]AstraZeneca AS, Oslo, Norway. [13]Department of Oncology, Nord-Trøndelag Hospital Trust, Levanger, Norway. [14]K.G. Jebsen Center for Genetic Epidemiology, Department of Public Health and Nursing, NTNU, Norwegian University of Science and Technology, Trondheim, Norway. [15]HUNT Research Centre, Department of Public Health and Nursing, NTNU, Norwegian University of Science and Technology, Levanger, Norway. [16]AbbVie AS, Oslo, Norway. [17]MSD Norge AS, Oslo, Norway. [18]Amgen AB Norway NUF, Oslo, Norway. [19]GlaxoSmithKline AS, Oslo, Norway. [20]Pfizer Norge AS, Oslo, Norway. [21]Norwegian Cancer Society, Oslo, Norway. [22]Eli Lilly Norge AS, Oslo, Norway. [23]Department of Research, Stavanger University Hospital, Stavanger, Norway. [24]Takeda AS, Oslo, Norway. [25]Janssen-Cilag AS, Oslo, Norway. [26]Unit for Medicine and Health Sciences, Akershus University Hospital, Lørenskog, Norway. [27]NEC Corporation, Tokyo, Japan.

InPreD-Norway and National Molecular Tumor Board Consortium

Hege E. G. Russnes[2,3,4], Thomas Berg[51], Egil S. Blix[10,11], Diana L. Bordin[36], Hans-Rickard Brattbakk[52], Richard Doughty[53], Kari Ersland[32], Åsmund Flobak[14,15], Rakel Forthun[32], Bjørnar Gilje[16], Einar Gudlaugsson[52], Hanne Hamre[54], Hans Kristian Haugland[32,55], Eivind Hovig[20,21], Randi Hovland[22], Emiel Janssen[52,56], Mari Jobsen[57], Tonje Lien[3,4], Susanne Lorenz[24], Torben Lüders[58], Leonardo A. Meza-Zepeda[20,24], Per M. Mæhle[25], Pitt Niehusmann[7], Hilde L. Nilsen[2,26], John C. Nooné[59], Vigdis Nygaard[5], Ulla Randen[2,52], Anne Rancien[3], Anne J. Skjulsvik[57], Sigmund V. Sperstad[52], Olav K. Vintermyr[8,22,53], Daniel Vodak[24], Teresia Wangensteen[28], Ragnhild M. Wold[18], Kristin Åberg[28] and Tormod K. Guren[18]

[31]Department of Clinical Pathology, University Hospital of North Norway, Tromsø, Norway. [32]Department of Pathology, Akershus University Hospital, Lørenskog, Norway. [33]Department of Pathology, Stavanger University Hospital, Stavanger, Norway. [34]Department of Oncology, Akershus University Hospital, Lørenskog, Norway. [35]Department of Pathology, Haukeland University Hospital, Bergen, Norway. [36]Department of Chemistry, Bioscience and Environmental Engineering, University of Stavanger, Stavanger, Norway. [37]Department of Pathology, St. Olav University Hospital, Trondheim, Norway. [38]Department of Medical Genetics, Oslo University Hospital, Oslo, Norway.

IMPRESS-Norway Consortium

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8. CONNECT. Norwegian Cancer Precision Medicine Implementation Consortium, https://www.connectnorway.org/ (2020).

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Author contributions
K.T. wrote the manuscript and integrated edits from other authors. Important discussions and contributions to the initiatives described were made by all authors. All authors have approved the final version of the text.

Competing interests
Participation in the CONNECT Public–Private Partnership is regulated by a consortium agreement that handles conflicts of interest and regulates interaction with the publicly funded infrastructure InPreD-Norway and the investigator-initiated and publicly funded trial IMPRESS-Norway. IMPRESS-Norway (principal investigator Å.H.) has company contributions from Roche, Novartis, Incyte and Eli Lilly and collaboration projects with Roche Foundation Medicine and Illumina, regulated by separate agreements with Oslo University Hospital as the coordinating institution. The authors declare no competing interests.

DLCT– DRUP–Like Clinical Trials ecosystems

Advanced
Molecular Diagnostics

Clinical trial
with matched therapies

pentahelix ecosystem: formal and informal interaction with national decision-makers-payers, HTA; commercial sector, civil society

PRIME-ROSE
Precision Cancer Medicine Repurposing System Using Pragmatic Clinical Trials

DLCT– DRUP–Like Clinical Trials ecosystems

Netherlands

Norway

national

Advanced Molecular Diagnostics

Clinical trial with matched therapies

pentahelix ecosystem: formal and informal interaction with national decision-makers-payers, HTA; commercial sector, civil society

PRIME-ROSE
Precision Cancer Medicine Repurposing System Using Pragmatic Clinical Trials

DLCT– DRUP–Like Clinical Trials ecosystems

Netherlands

CPCT Center for Personalized Cancer Treatment

Hartwig MEDICAL FOUNDATION

DRUP the Drug Rediscovery Protocol

CZ

Zorginstituut Nederland

Norway

InPreD NORGE NASJONAL INFRASTRUKTUR FOR PRESISJONSDIAGNOSTIKK – KREFT

IMPRESS NORWAY

CONNECT

national

Advanced Molecular Diagnostics + Clinical trial with matched therapies +

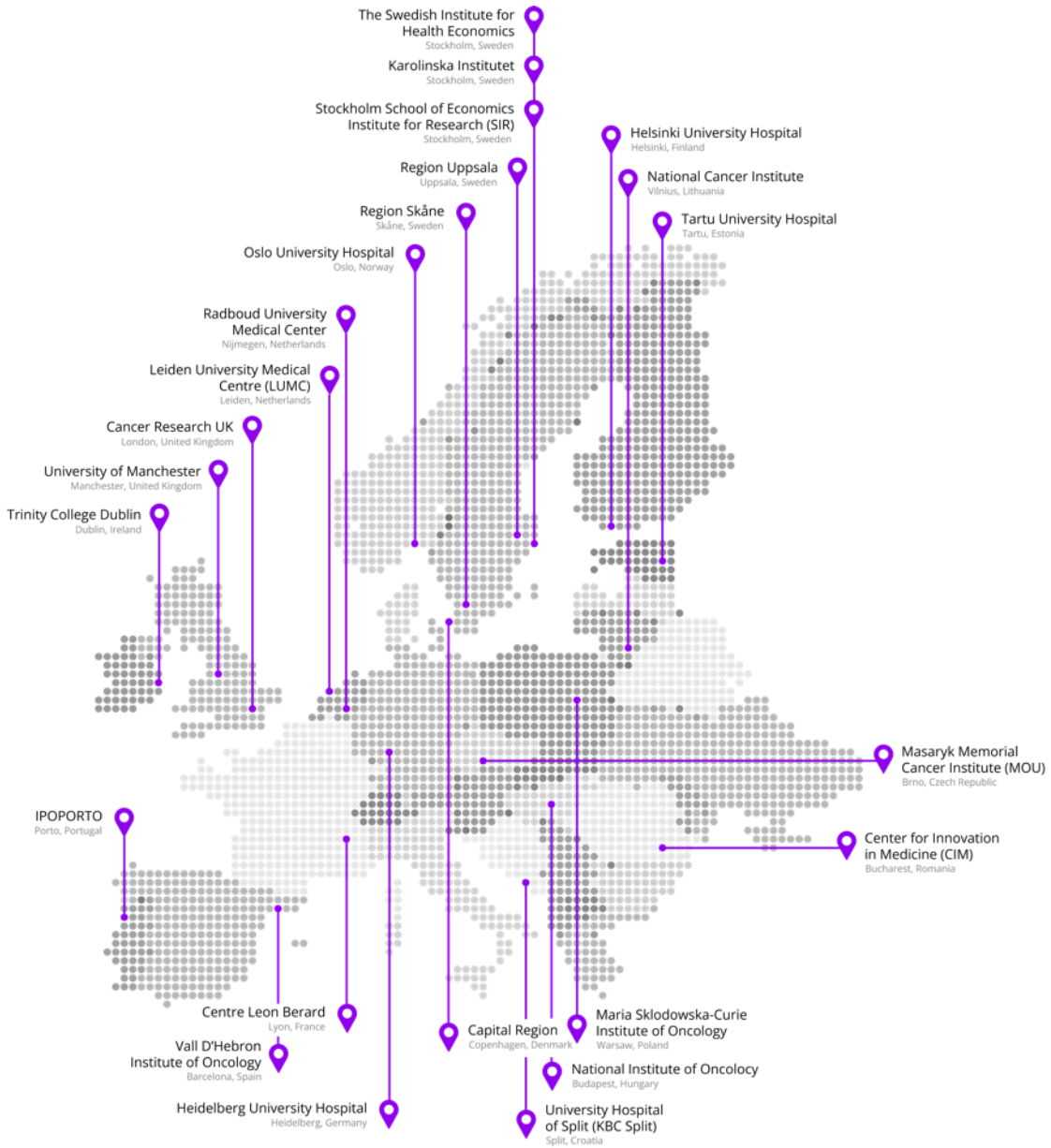
pentahelix ecosystem: formal and informal interaction with national decision-makers-payers, HTA; commercial sector, civil society

Europe

PCM4EU Personalised Cancer Medicine for all EU Citizens

PRIME-ROSE Precision Cancer Medicine Repurposing System Using Pragmatic Clinical Trials

ECHoS Cancer Mission Hubs



Partner Sites

PRIME-ROSE

1. Oslo University Hospital, Oslo, Norway
2. Leiden University Medical Centre (LUMC), Leiden, The Netherlands
3. Stockholm School of Economics Institute for Research (SIR), Stockholm, Sweden
4. Capital Region, Copenhagen, Denmark
5. Helsinki University Hospital, Helsinki, Finland
6. Centre Leon Berard, Lyon, France
7. IPO PORTO, Porto, Portugal
8. Region Uppsala, Uppsala, Sweden
9. The Swedish Institute for Health Economics, Stockholm, Sweden
10. Karolinska Institutet, Stockholm, Sweden
11. Region Skåne, Skåne, Sweden
12. Heidelberg University Hospital, Heidelberg, Germany
13. Maria Sklodowska-Curie Institute of Oncology, Warsaw, Poland
14. University Hospital of Split (KBC Split), Split, Croatia
15. Tartu University Hospital, Tartu, Estonia
16. National Institute of Oncology, Budapest, Hungary
17. Vall D'Hebron Institute of Oncology, Barcelona, Spain
18. Radboud University Medical Center, Nijmegen, The Netherlands
19. National Cancer Institute, Vilnius, Lithuania
20. Cancer Research UK, London, United Kingdom
21. University of Manchester, Manchester, United Kingdom
22. Trinity College Dublin, Dublin, Ireland
23. Masaryk Memorial Cancer Institute (MOU), Brno, Czech Republic
24. Center for Innovation in Medicine (CIM), Bucharest, Romania

PRIME-ROSE
Precision Cancer Medicine Repurposing System Using Pragmatic Clinical Trials

Funding

InPreD NORGE NASJONAL INFRASTRUKTUR FOR PRESISJONSDIAGNOSTIKK – KREFT

HELSE NORD HELSE MIDT-NORGE HELSE SØR-ØST HELSE VEST

IMPRESS NORWAY

KLINBEFORSK
Nasjonalt program for klinisk behandlingsforskning i spesialisthelsetjenesten

KREFTFORENINGEN

RADIUM HOSPITAL FOUNDATION

NordForsk

EU4health

Roche

AstraZeneca

illumina

Incyte

Lilly

NOVARTIS

MATRIX
NORWEGIAN CENTRE FOR CLINICAL CANCER RESEARCH

Forskningsrådet

KREFTFORENINGEN

PCM4EU PRIME-ROSE

Nordic Precision Cancer Medicine

Program Topics Speakers Abstract Practical REGISTRATION

NORDIC PRECISION CANCER MEDICINE

NPCM 2023

MERGING CLINICAL RESEARCH AND STANDARD HEALTHCARE

17 - 19 SEPTEMBER · HOLMENKOLLEN, OSLO, NORWAY

https://www.matrix-fkb.no/en/npcm-symposium/home

Oslo universitetssykehus

acta oncologica

MATRIX

Aktiv mot kreft (AKTIV Against Cancer)

- Founded in 2007 by Grete Waitz & Helle Aanesen
- 3 employees
- Mission:

  “To implement personalized physical exercise as part of standard cancer treatment – in Norway and globally”
- Established fitness centers for cancer patients in 21 Norwegian hospitals
- Educated 750 AKTIV instructors
- Started AKTIV Against Cancer in the US (501c3)
- Proud sponsor of:

Grete Waitz, 9 times NYCM winner

Education of oncologists, oncology nurses and radiotherapists in Ethiopia

A collaboration between
Black Lion Hospital/Addis Ababa University

and

Oslo University Hospital/University of Oslo/Oslo MET

Sponsored by: AKTIV mot kreft

Black Lion Hospital, Addis Ababa

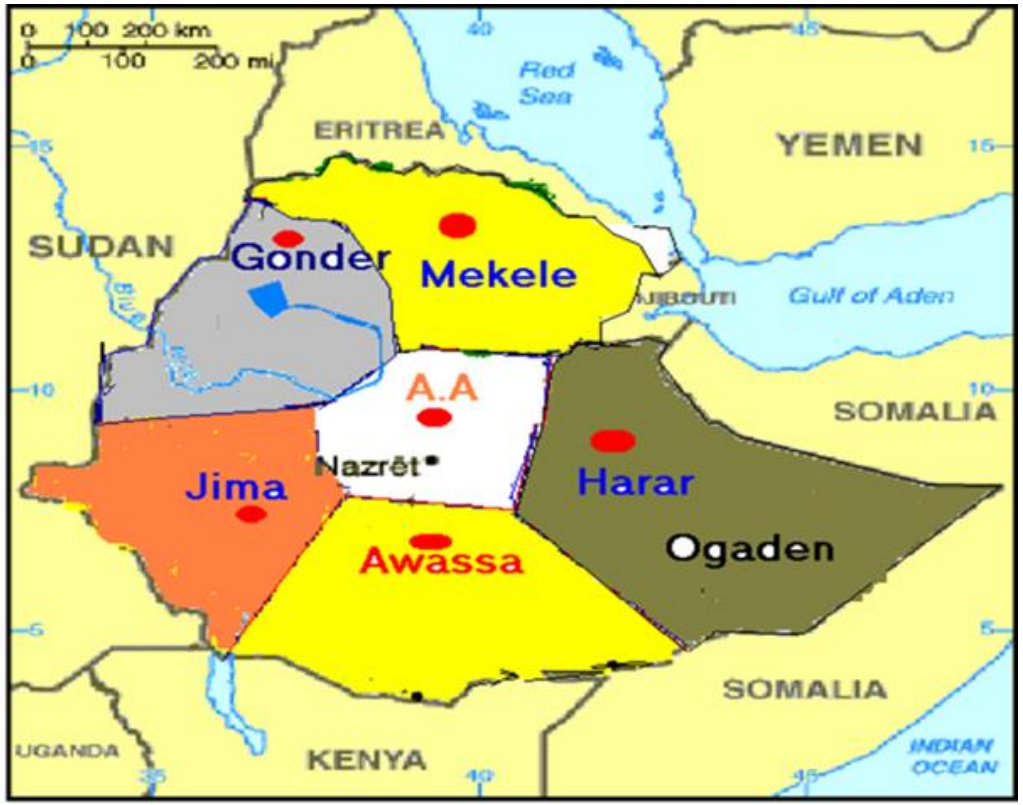
Oslo University Hospital, Oslo

Background

- **Before 2001:**
  One oncologist (educated in Egypt), worked at Black Lion. Retired in 2012.
- **2001-2008:**
  Another **three** oncologists (educated in South-Africa) returned and worked at Black Lion.
- **2010-2013:**
  Collaboration between Oslo University Hospital and Black Lion Hospital
- Curriculum was made and Memorandum of Understanding (MoU) signed.

The Programs

- **Oncology Residency Program – started 2013**
  - 38 have graduated, 40 currently in program
- **Master Oncology Nursing Program – started 2015**
  - 57 have graduated, 30 currently in program
  - Collaboration with Oslo MET and FUG
- **Radiation Therapy Technologist Program – starts 2021**
- **The National Cancer Plan**
  - 6 new centers with radiotherapy:
    - Harar
    - Gonder
    - Mekele
    - Awassa
    - Jimma
    - St. Pauls (Addis Ababa)



The first graduation of new oncologists - 2017

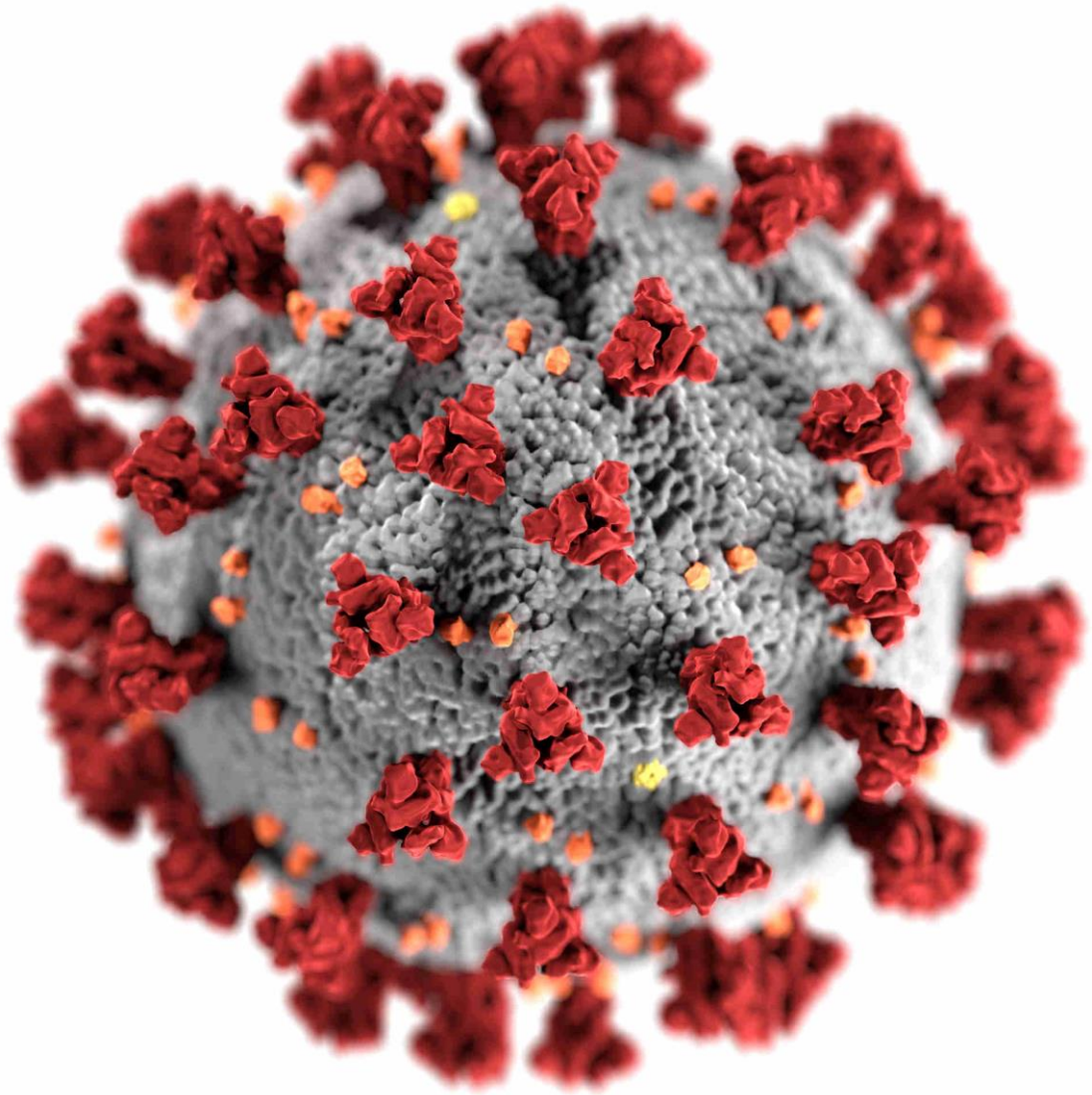
Five oncologists graduated in 2017 – among them the first female oncologist of Ethiopia – **Dr. Edom!**

The President of Ethiopia was present.

The first graduation of oncology nurses - 2017

Then came Covid…

- Non-presence since March 2020.
- Dr. Aynalem, dies of Covid in April 2021.
- The programs suffers under the lack of personal presence from the Norwegian mentors, lecturers and examinators.
- Lack of digital equipment and infrastructure.



…and the idea of a MDT-room!

- Enable teaching & lectures from MDT-rooms in Norway
  (also other hospitals than Oslo University Hospital).
- Patient treatment planning on a regular basis.
- Longer lasting collaboration than originally planned for, enabling plenty of possibilities for both countries.
- Sustainability and reduced resources moving forward (costs, personell, climate).
- Enhance the quality and quantity of the collaboration, as all elements can be offered on a more regular and frequent basis – with the best digital solutions delivered by Cisco.

MDT-room from Cisco – being installed at Black Lion Hospital as we speak!

OSLO CANCER CLUSTER

NCE
Norwegian Centres of Expertise

Building an Ecosystem to Drive innovation

Dedicated to accelerating the development of new cancer treatment

Oslo Cancer cluster

- Leading innovation cluster
  - Centrally positioned and connected to global industry
  - ECEI GOLD Label "Excel in Cluster Excellence“
- Award-winning Incubator
  - > 30 start-ups / companies
  - Successful financing / IPO
  - EU / national program award
- International cooperation
  - EU projects funded / mediated funding
  - Strong US / EU network
- National genetics and precision medicine
  - Connect repurposing project initiator and coordinator

OSLO CANCER CLUSTER - A HISTORY ABOUT PUBLIC PRIVATE PARTNERSHIP

1932 Norwegian Radium Hospital

1952 Norwegian Cancer Registry

1953 Institute for Cancer Research (ICR)

1987 DNR Research Foundation

2006 Oslo Cancer Cluster

2009 New ICR Building

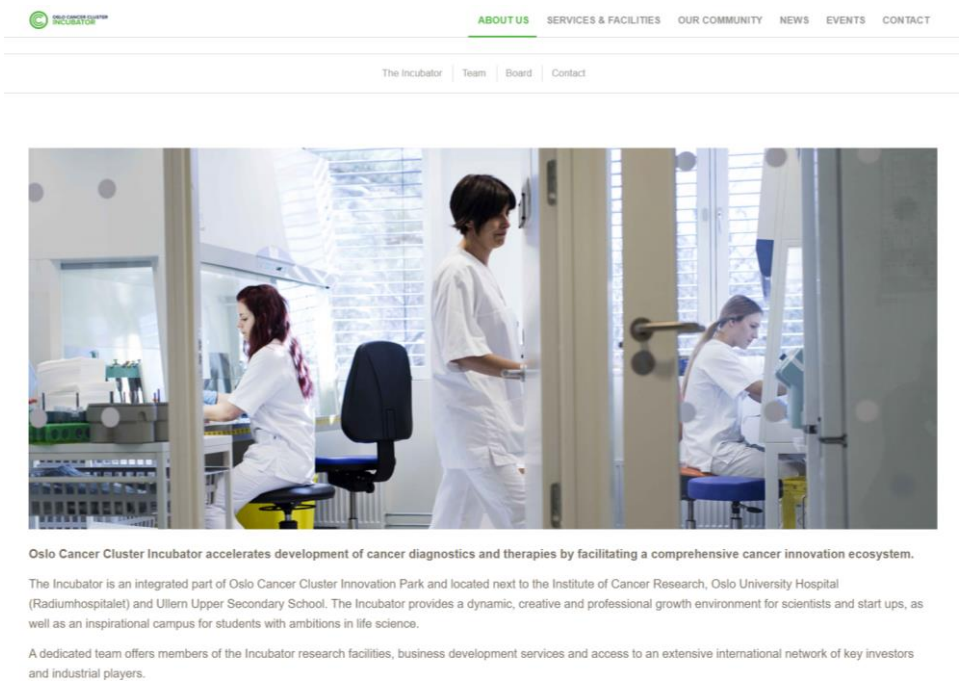
2015 OCC Innovation Park
Diagnostic Laboratories
Cancer Registry, Incubator

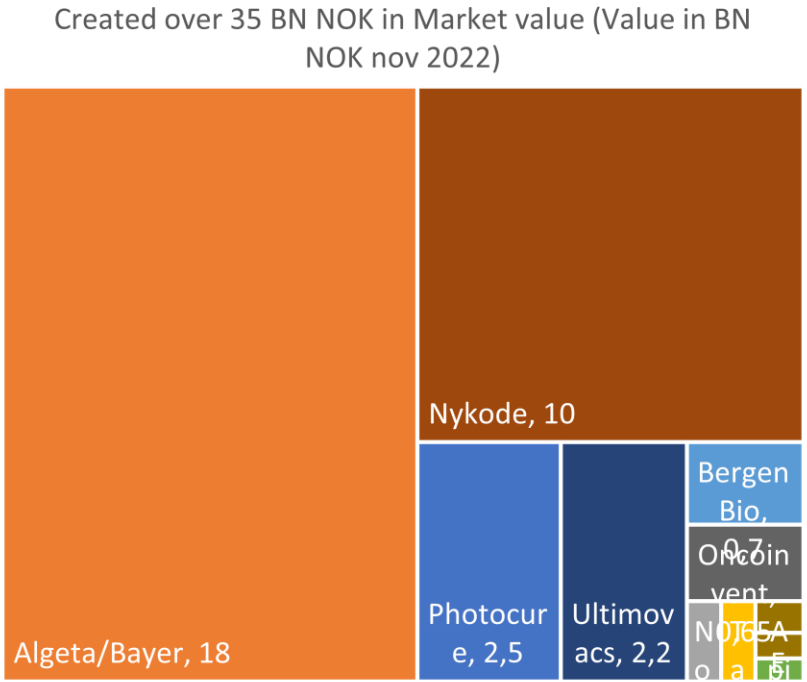
2019 Oslo University Hospital
new Clinic building and Proton
center initiated

OSLO CANCER CLUSTER

NCE Norwegian Centres of Expertise

Created a recognized oncology startup milieu

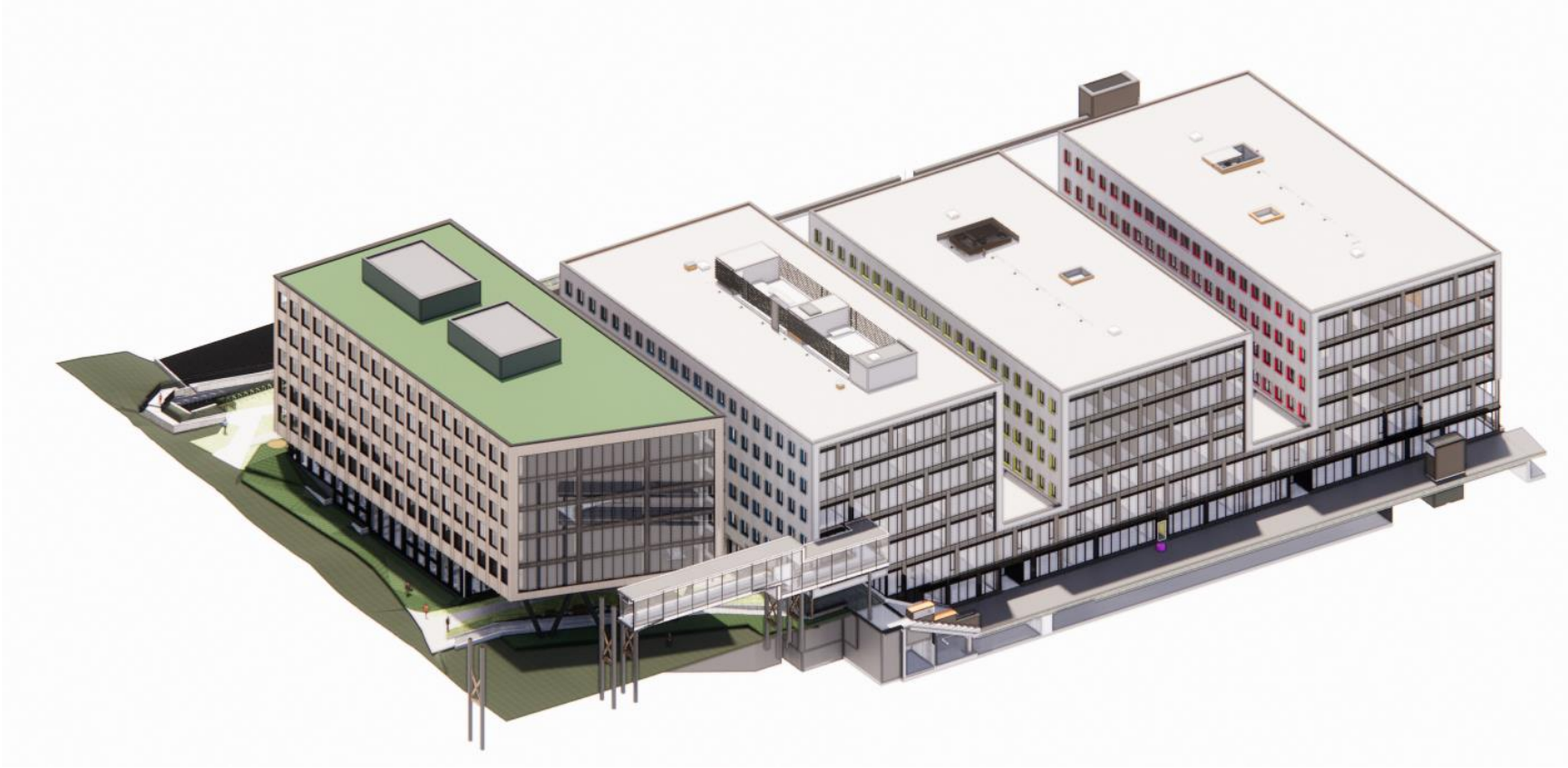




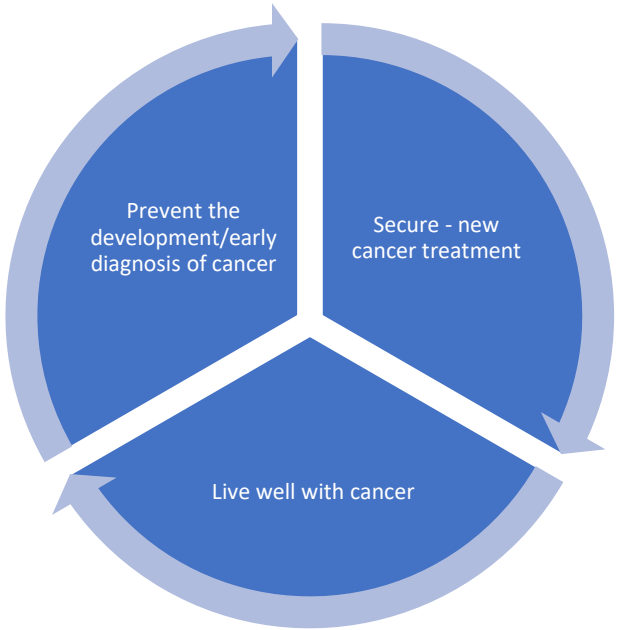
This is no ordinary building site

OSLO CANCER CLUSTER

NCE
Norwegian Centres of Expertise



Cancer – a complex challenge requires cooperation between actors

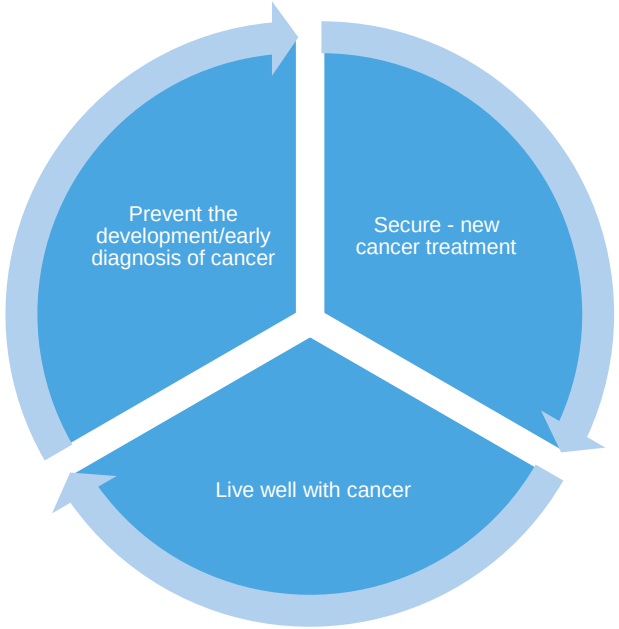


OSLO CANCER CLUSTER

NCE
Norwegian Centres of Expertise

INNOVATION MORE THAN TREATMENT

Prevention/early detection:
- Behavior/Education
- Contraceptive measures (diet, exercise)
- Precision screening incl. (e.g. Circulating Tumor DNA), risk-based
- Preventive vaccines
- Exposure e.g. Dataminig /food/exercise
- Etc…



Implement precision medicine:
- RWD development race
- DNA/phenotype understanding
- Interdisciplinary tumor boards
- Access to innovative medicines (incl. off-label use, Cancer vaccines, Cell therapy)
- Nordic / International cooperation for critical mass)
- New ways of public-private collaboration
- Etc…

Cancer management:
- Patient interaction at home / side effect management
- "Digital medicines"
- Follow-up of long-term survivors Pallative treatment
- Etc…

OSLO CANCER CLUSTER

NCE Norwegian Centres of Expertise

The start of Oslo Science City

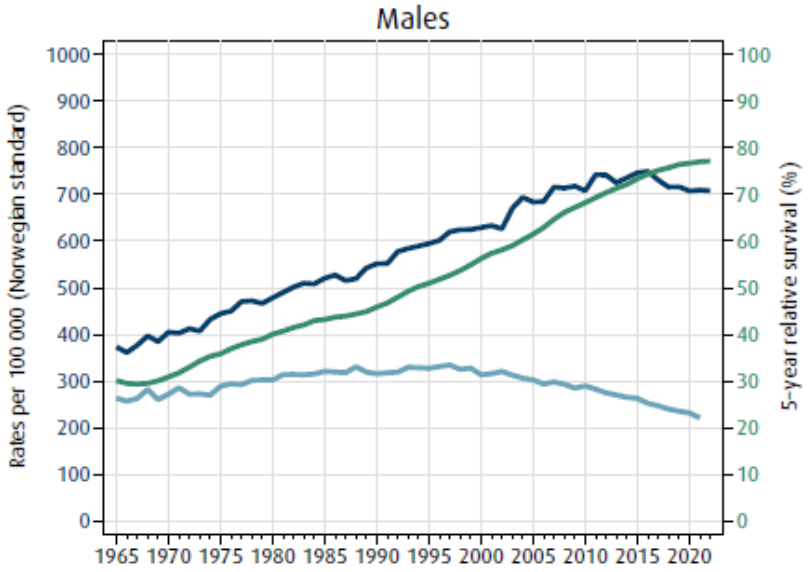
Visit from Australia

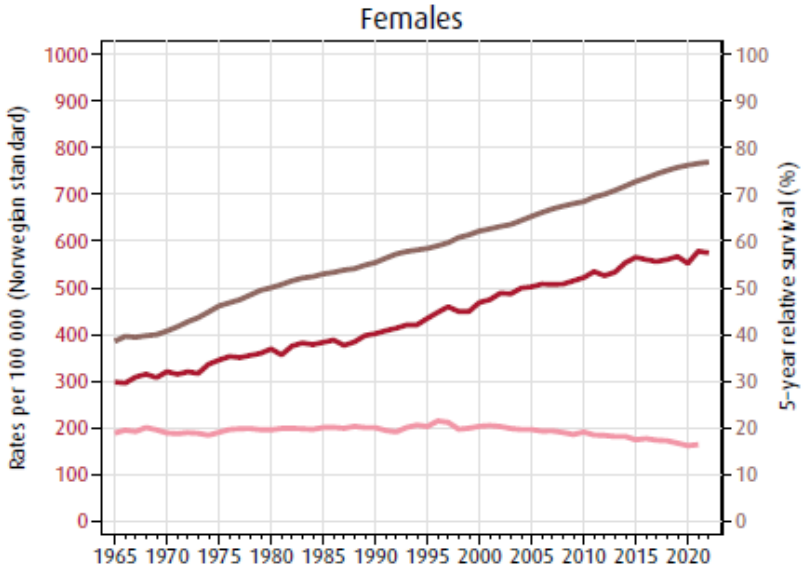
Oslo University Hospital Comprehensive Cancer Center

Prof Sigbjørn Smeland
Head Division of Cancer Medicine and
Chairman of OUS-CCC board
Oslo University Hospital and University of Oslo

Cancer in Norway
Incidence, survival and mortality

2022 Annual report from the Cancer Registry



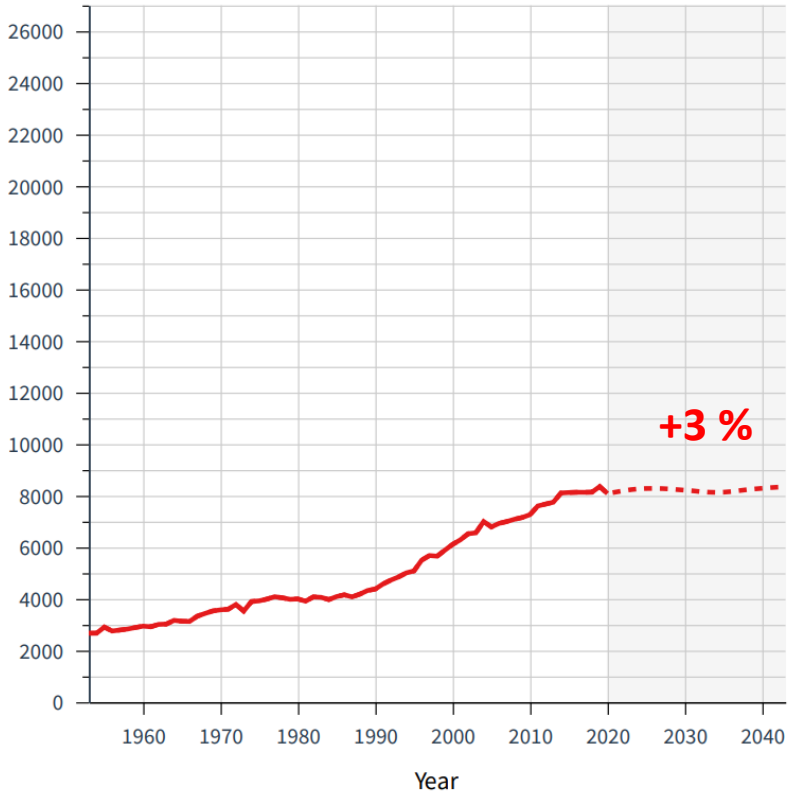


38265 (+1268) incident cases in 2022

11121 (+68) cancer deaths in 2022

5-year survival 77,1 % for men and 76,9 % for women

< 60 year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16000
14000
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10000
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6000
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2000
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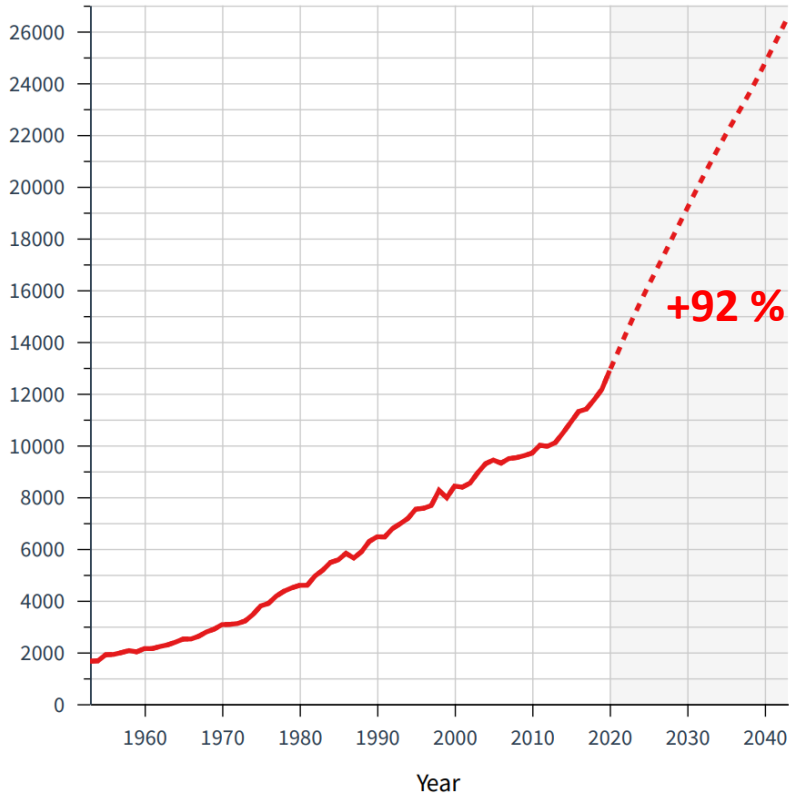
1960
1970
1980
1990
2000
2010
2020
2030
2040
Year
+3 %

75 +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6000
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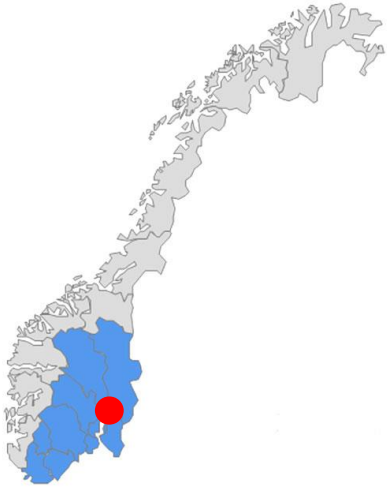
2000
0
1960
1970
1980
1990
2000
2010
2020
2030
2040
Year
+92 %

Oslo University Hospital

Referral hospital for South-East Health region

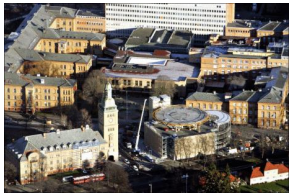
Merger of four University Hospitals in 2009

- Primary hospital
  for districts in Oslo (~300000)
- Referral hospital for
  South-East Health Region
  (3.1 mill – approx 60 % of Norway)
- Selected national functions (5.4 mill, ~5 % of total activity; allo-TX, CAR-T, rare gyn. cancers, transplantation oncology, bone sarcomas)



Aker Hospital
Surgery

Ullevål
Surgery, Radiotherapy, Medical therapy



Radium Hospital
Surgery, Radiotherapy, Medical therapy

Rikshospitalet
Therapy and medical therapy

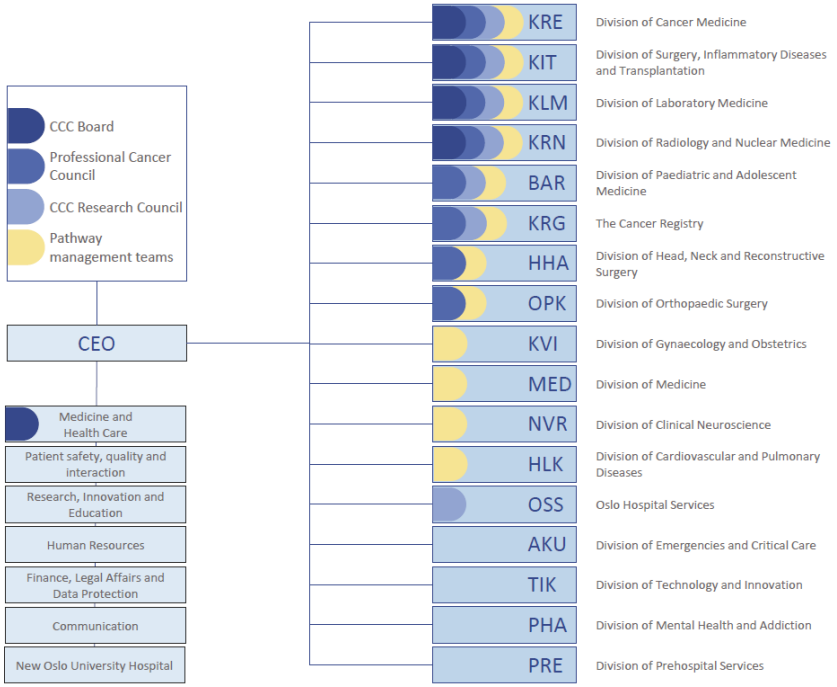
Cancer activity at all sites
Cancer Institute and Cancer Registry
located at Radium Hospital

”Cancer Centre” concept:

OECI
ORGANISATION OF EUROPEAN CANCER INSTITUTES
EUROPEAN ECONOMIC INTEREST GROUPING
Accreditation & Designation Program

- Institutional Strategy
- Governance & Resources
- Coordiation of patient pathways across
- Quality System
- Level & Integration of Research

OUH-CCC
Governance structure



CCC Board

The CCC board contributes to strengthening the line managements' power of action across organisational divides and where activities are located. This is strived for by strengthening the overall ability to coordinate work with operational challenges and the development and implementation of the cancer strategy. The work includes diagnostics, treatment, research, care, and rehabilitation.

Members are appointed ex officio

Head, Division of Cancer Medicine (Chair), Head, Division of Surgery, Inflammatory diseases and Transplantation,

Head of Research, Division of Cancer Medicine, CCC Quality director, Head, Division of Laboratory Medicine, Head, Division of Radiology and Nuclear Medicine, Medical director, Head, Department of Oncology, Head, Department of Gastro- and Paediatric Surgery, Secretary, Division of Cancer Medicine

Cancer Council

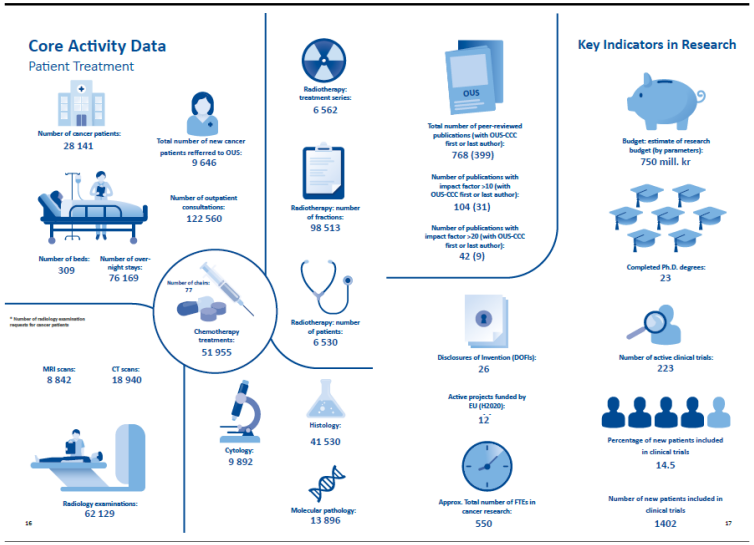
CCC Board + Dept heads, Patient representative, union representatives

Research Council for CCC

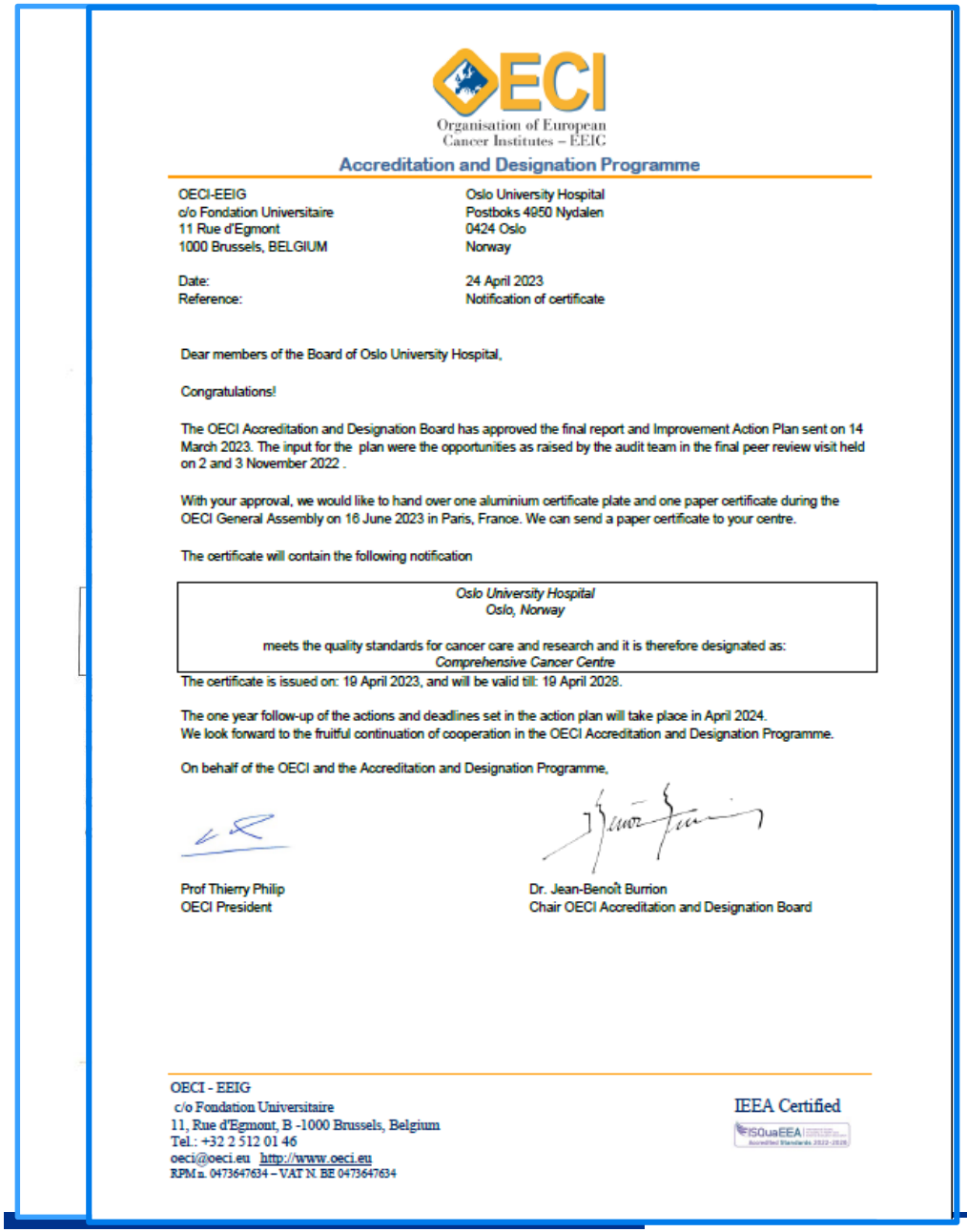
Research directors Div and Dept, Cancer Registry, Univ of Oslo,

Cancer Center Activity

(From data warehouse)



	2019	2020	2021	2022
Antall nyhenviste	12484	11938	12093	12467
Antall pasienter	32313	31935	32080	32766



Organisation of European Cancer Institutes – EEIG

Accreditation and Designation Programme

OECI-EEIG
c/o Fondation Universitaire
11 Rue d'Egmont
1000 Brussels, BELGIUM

Oslo University Hospital
Postboks 4950 Nydalen
0424 Oslo
Norway

Date: 24 April 2023
Reference: Notification of certificate

Dear members of the Board of Oslo University Hospital,

Congratulations!

The OECI Accreditation and Designation Board has approved the final report and Improvement Action Plan sent on 14 March 2023. The input for the plan were the opportunities as raised by the audit team in the final peer review visit held on 2 and 3 November 2022 .

With your approval, we would like to hand over one aluminium certificate plate and one paper certificate during the OECI General Assembly on 16 June 2023 in Paris, France. We can send a paper certificate to your centre.

The certificate will contain the following notification

Oslo University Hospital
Oslo, Norway

meets the quality standards for cancer care and research and it is therefore designated as:
Comprehensive Cancer Centre

The certificate is issued on: 19 April 2023, and will be valid till: 19 April 2028.

The one year follow-up of the actions and deadlines set in the action plan will take place in April 2024.
We look forward to the fruitful continuation of cooperation in the OECI Accreditation and Designation Programme.

On behalf of the OECI and the Accreditation and Designation Programme,

Prof Thierry Philip
OECI President

Dr. Jean-Benoît Burrion
Chair OECI Accreditation and Designation Board

OECI - EEIG
c/o Fondation Universitaire
11, Rue d'Egmont, B -1000 Brussels, Belgium
Tel.: +32 2 512 01 46
oeci@oeci.eu http://www.oeci.eu
RPM n. 0473647634 – VAT N. BE 0473647634

IEEA Certified

Accreditation
The certificate is issued on: 10 April 2017, and will be valid till: 10 April 2022.

Reaccreditation
The certificate is issued on: 19 April 2023, and will be valid till: 19 April 2028

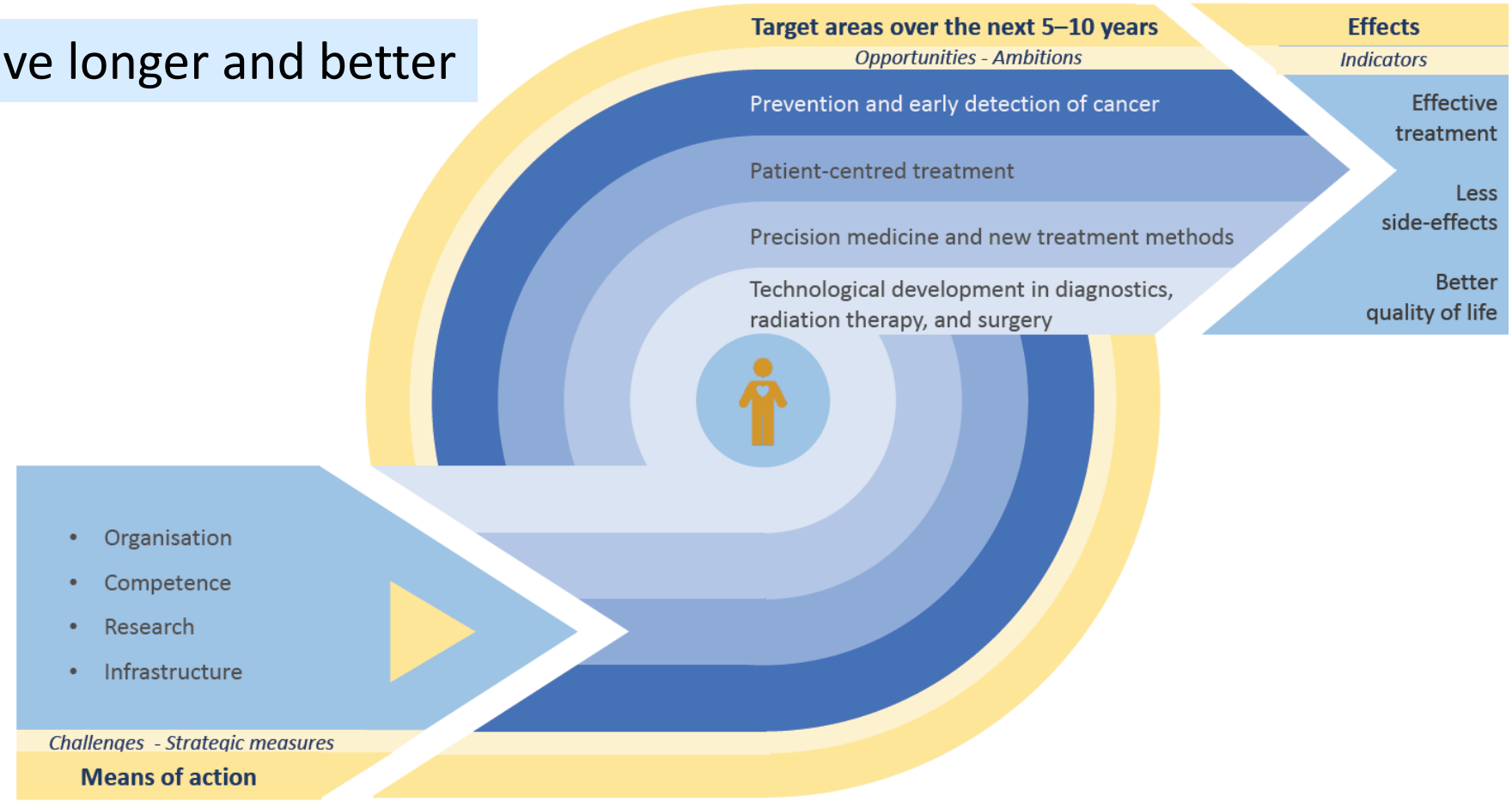
o

Our vision

”Oslo University Hospital shall be a leading European cancer centre”

OUS Cancer strategy 2022-26

Live longer and better



Action plan 2023-24

Opportunity 1	Improving the cancer center governance structure
Opportunity 2	**Improving the quality governance of the CCC**
Opportunity 3	Enhancing the patient influence in cancer care and research
Opportunity 4	Enhance professional impact of nurses in cancer care
Opportunity 5	**Building a Program for cancer survivorship**
Opportunity 6	Spreading excellent praxis of palliative care to cover all relevant departments and pathways
Opportunity 7	**Improving the quality and efficiency of MDT meetings**
Opportunity 8	Broadening the comprehensiveness of clinical and translational research
Opportunity 9	Improving the logistics of pathology related to cancer pathways

Building new hospitals: Big plans for the next 10 years

Radium Hospital 40 000m^2

Aker Hospital 171 000m^2

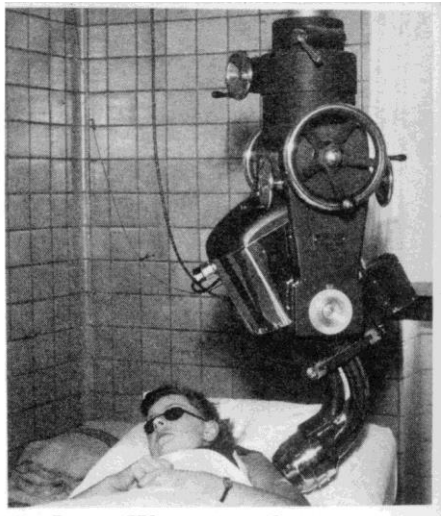
Rikshospitalet 140 552m^2

Life Science building (UiO)

Radium Hospital

Opened May 1932 by the king of Norway (Håkon VII)

Radiotherapy only treatment option before WW2



Radium Hospital

New Clinical building Opens 30.04.2024

Hospital (surgery, radiotherapy, med onc) + (pathology, radiology, nuclear med++), Research Institute, Cancer Registry, Innovation Park

Proton therapy

- Integrated part of comprehensive radiotherapy center
- RFE Sept 15, 2023 (ProBeam 360° from Varian)
- Start patient treatment Dec, 2024
- Two gantries for patient treatment, one for research – Core facility
- Capacity to treat 280 pts pr gantry pr year

Tumor center concept

- Breast Cancer Center, Prostate Cancer Center, Gynecological Cancer Center
- All activity co-localised at the Radium Hospital:

Extending the Comprehensive Cancer center concept to Innovation and Education
Oslo Cancer Cluster

High school

Start-up Companies

- Photocure
- PCI
- DiaGenic
- PubGene
- Algeta
- Nordic Nanovector
- Ultimovax
- Targovax
- Zelluna
- DoDiagnostics
- T-Rx Therapeutics

Alpharadin: alpha-emitter Radium-223
«not the Madam's isotope»

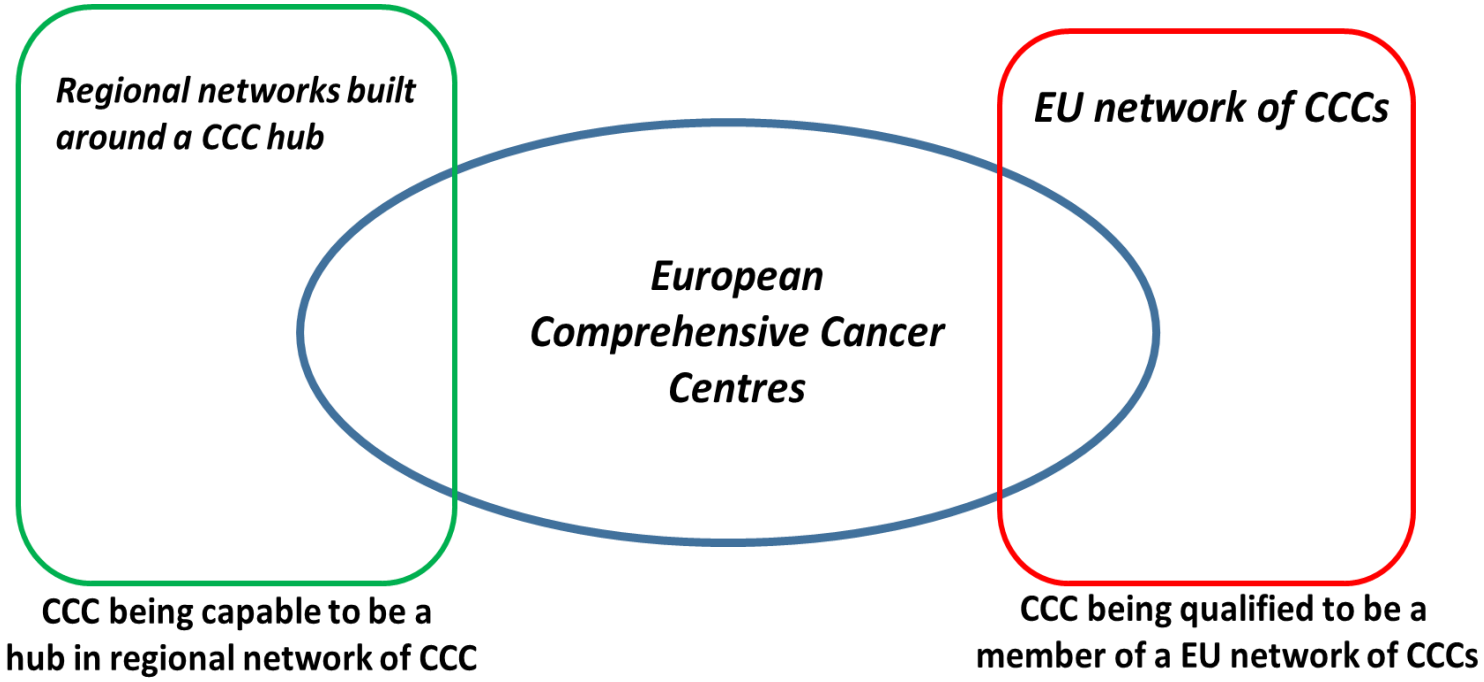
CCC concept – increased attention in Europe

- Cambridge Cancer Centre
- Institute Curie, Paris
- Institute Gustave Roussy, Paris
- Institut Jules Bordet, Brussel
- Instituto Nazionale dei Tumori , Milano
- Vall d'Hebron Barcelona
- Netherlands Cancer Institute, Amsterdam
- Karolinska , Sahlgrenska og Lund i Sverige
- Helsinki, Turku, Tampere, Kuopio, Oulu i Finland

+++

OUS

CCC concept recognized by the EU Commision as an important structure to improve quality and ensure quality improvement in cancer care. Funded by both Cancer Mission og Eu'sBeatingCancer plan



General findings from the OECI audit team, Nov 2022

- Well organized visit
- Motivated, competent and hard-working staff
- Open atmosphere in interviews
- Hospitals well organized, clean and busy
- Coffee available everywhere

LA TROBE UNIVERSITY

Innovation Central Melbourne

A collaboration led by cisco

ENHANCING HEALTHCARE

LA TROBE DIGITAL INNOVATION HUB

CISCO INNOVATION CENTRAL MELBOURNE

VICTORIAN VIRTUAL EMERGENCY DEPARTMENT

HEALTHCARE CHALLENGES

Nurse shortages

Ambulance ramping, bypass

Emergency visits increase

Longer wait times

Aged care

Access to healthcare in rural areas

Healthcare worker shortages

VICTORIAN VIRTUAL EMERGENCY DEPARTMENT
Northern Health

LA TROBE HEALTHCARE EDUCATION AND INNOVATION

DEVELOPING THE FUTURE AND CURRENT WORKFORCE –

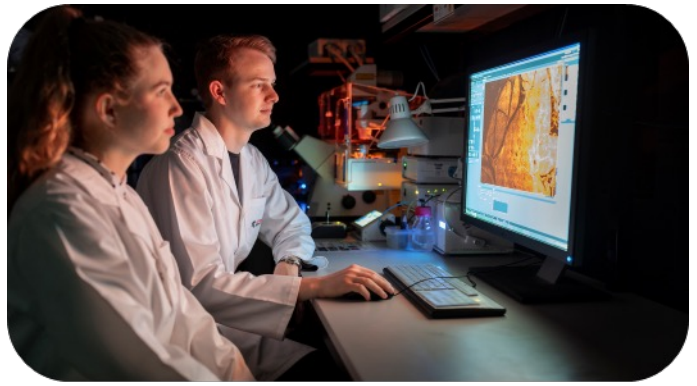
- **UG / PG / SHORT COURSES - NURSING, MIDWIFERY, ALLIED HEALTH, DIGITAL HEALTH, RURAL HEALTH**

RESEARCH FOCUSED ON –

- **HEALTHY PEOPLE, FAMILIES & COMMUNITIES AND**
- **UNDERSTANDING AND PREVENTING DISEASES**

FIRST RESEARCH INSTITUTE FOCUSED ON THE CARE ECONOMY

PARTNER WITH HEALTHCARE PROVIDERS ACROSS METROPOLITAN MELBOURNE AND REGIONAL VICTORIA



LA TROBE DIGITAL INNOVATION HUB

Innovation Central Melbourne
A collaboration led by Cisco

Facilities	State-of-the-art learning and research facilities
Events and Education	Hackathons, education programs, knowledge transfer, corporate strategy days
Research consulting projects	Collaborative research and development projects, testing and validation, prototyping
Industry-led consulting projects	Strategic, business and commercialization advice, market intelligence, incubator projects
Membership program	Membership program and co-working space
Partnership program	Access to La Trobe researchers, students, partners, grants, sponsors, etc.




LA TROBE UNIVERSITY

NIIN
National Industry Innovation Network

Innovation Central
A collaboration led by Cisco

VICTORIAN VIRTUAL EMERGENCY DEPARTMENT
Northern Health

Innovation Central Melbourne
A collaboration led by cisco

La Trobe has collaborated with the Northern Health Virtual Emergency Department and Cisco to study how Augmented Reality (AR) can modernise emergency care models and reduce pressure on Emergency Departments

Our prototype system harnesses Augmented Reality (AR) to connect patients and medical professionals remotely

The technology allows a nurse or paramedic to perform hands-free head-to-toe examinations using the AR device can discuss the patient's condition with multiple doctors who can see the patient, observe their vital signs in real time and maintain a collaborative 5G connection from any location, at any time.

Project expanding into applications within Residential Aged Care Facilities.

LA TROBE UNIVERSITY

NIIN
National Industry Innovation Network

Innovation Central
A collaboration led by cisco

LA TROBE DIGITAL INNOVATION HUB

Innovation Central Melbourne
A collaboration led by cisco

ABC News May 19, 2023

HTTPS://WWW.YOUTUBE.COM/WATCH?V=8JEGXYC03NY

VICTORIAN VIRTUAL EMERGENCY DEPARTMENT
Northern Health

HOLOGRAM TECHNOLOGY

Innovation Central Melbourne
A collaboration led by cisco

To expand the VVED project, La Trobe have established a centre for Webex hologram use cases

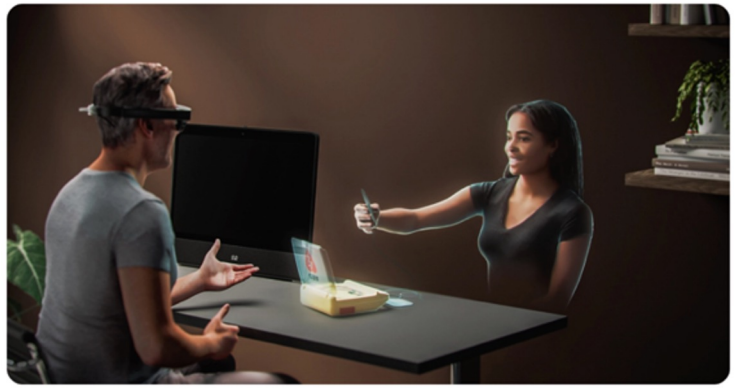
Examine use cases for the Webex Hologram in Healthcare

NIIN project plan

Provide feedback to the Hologram team

Research applications

Demonstration centre.



LA TROBE UNIVERSITY

VICTORIAN VIRTUAL EMERGENCY DEPARTMENT
Northern Health

Innovation Central
A collaboration led by cisco

LA TROBE DIGITAL INNOVATION HUB

Innovation Central Melbourne
A collaboration led by cisco

La Trobe University Partners with Cisco - Cisco

LA TROBE UNIVERSITY

THANK YOU

latrobe.edu.au

La Trobe University
CRICOS Provider Code Number 00115M

DTU SKYLAB

MIKKEL SØRENSEN, DIRECTOR

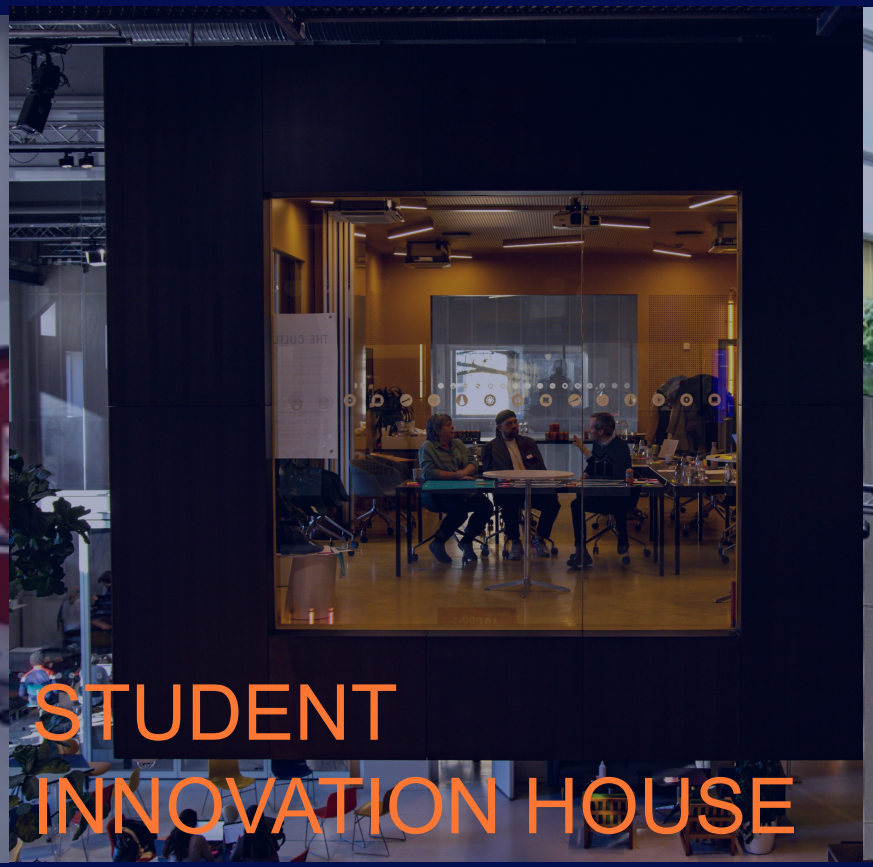
DTU MISSION

”DTU will develop and create value using the natural sciences and the technical sciences to benefit of society”

H.C. Ørsted, Founder of DTU

AN ENTREPRENEURIAL JOURNEY

PROTOTYPE



STUDENT
INNOVATION HOUSE

LEADING
INNOVATION HUB

APPROACH

OUTREACH		ACTIVITIES
100’s	IMPACT	the dedicated core, start-ups, funding, innovation partnerships, incubation
1,000’s	COMPETENCIES	community, coaching, engagement, learning, courses, early-stage programmes
10,000’s	CULTURE	broader eco-system, outreach, events, inspirational activities

PROGRAMMES

START-UP SUPPORT

COMPANY COLLABORATION

EDUCATIONAL ACTIVITIES

FACILITIES

DTU SKYLAB (LYNGBY)

5.500m2 of innovation space including:
labs, auditoriums, co-working space,
projects rooms, café & more…

DTU LINK (RISØ)

startup incubator, office space
& workshops

2022 in numbers

COMMUNITY ENGAGEMENT

12.041 night owls from 10pm-6am

171.861 visitors

123 delegations

127 events

26 virtual

101 physical

we reached 264k through

ACADEMIA

2057 students

2.796 lectured hours

30 courses from

10 departments

COMPANY COLLABORATION

75 companies/ organizations in larger collaborations

STARTUP SUPPORT

our pre-startups and startups are within:

365 coached and/or mentored startups from DTU Skylab

68 female co-founders

331 male co-founders

113 unique teams in startup programmes

LABS & WORKSHOPS

571 prototypes

10.696 users

1.196 unique users *from*

67 study lines

WELCOME!

THIS PLACE IS YOURS

10+ YEARS OF FOCUS ON BUILDING AN ECO-SYSTEM

DTU Departments
Talent, technology, ideas

DTU Entrepreneurship
Education and research

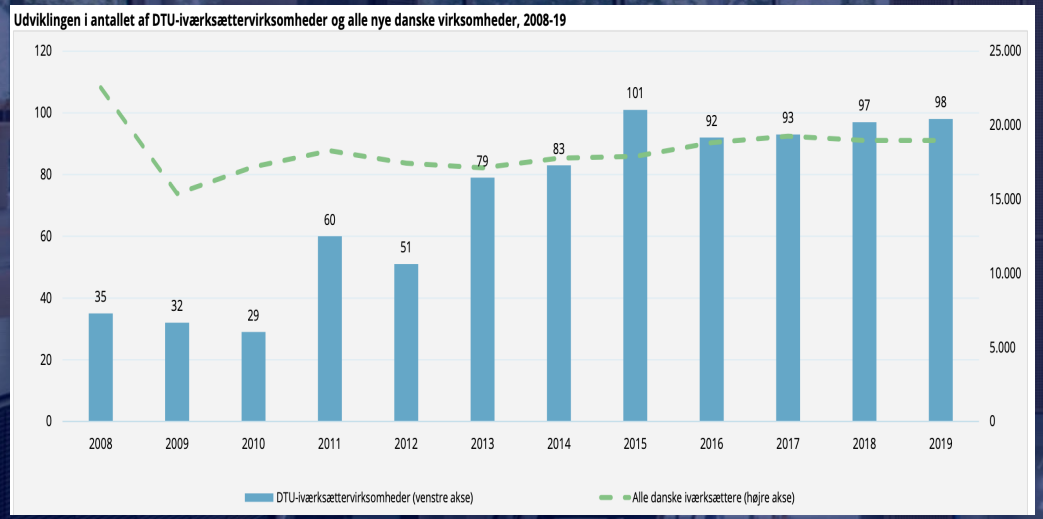
AFRI
IPR, license, corporate partnerships

DTU Skylab
Innovation programmes & community

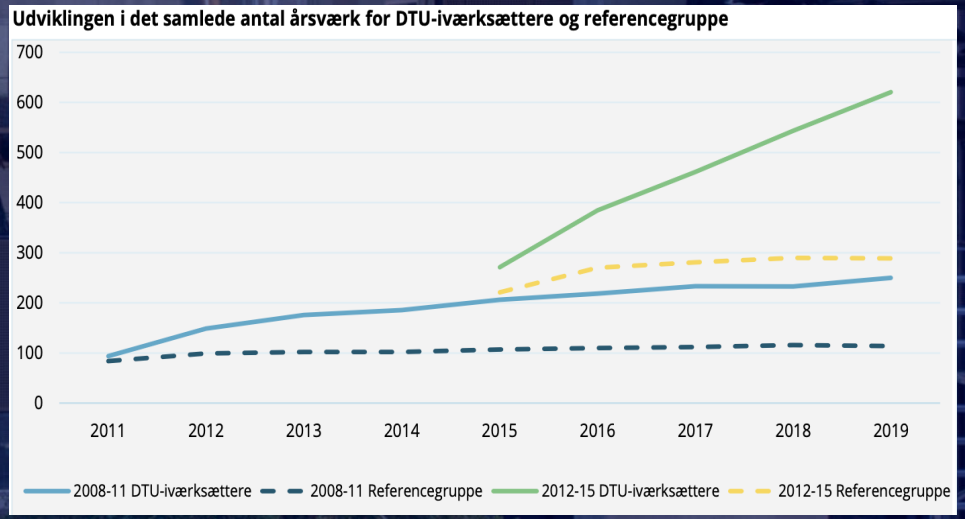
DTU Science Park
Housing, acceleration

PreSeed Ventures
Early Stage VC

INVESTING IN THE ECO-SYSTEM PAYS OFF



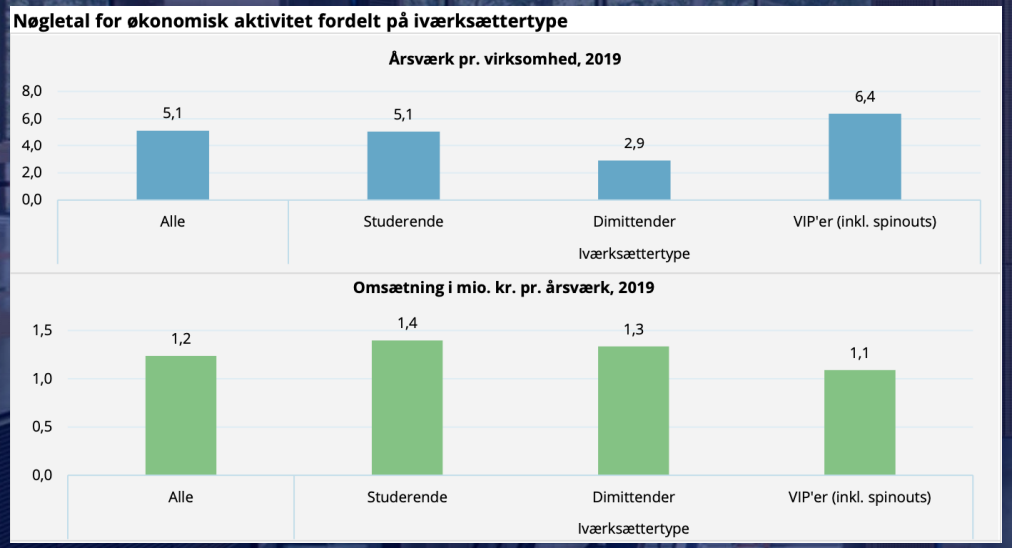
Significant growth in number of newly established "real" DTU companies (main occupation for min. 1 person)



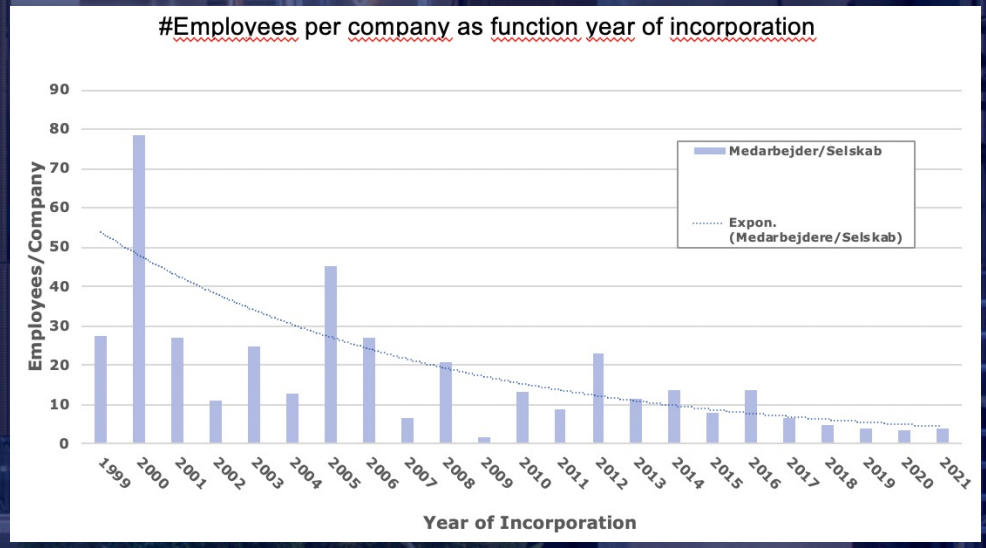
DTU startups est. 2012-15 had in the years 2015-19 a job growth of 129% (31% in comparable DK startups)

Source: IRIS Group

REAL VALUE, BUT IT TAKES TIME TO SCALE



In 2019 the research-based startups (est. >´08) had an average of 6.4 FTE's and a revenue of DKK 1.1 M/FTE. Student startups had an average of 5.1 FTE's and a revenue of DKK 1.4 mill/FTE



It takes 10+ years to scale university deep tech startups

Source: IRIS Group (2022) and internal analysis

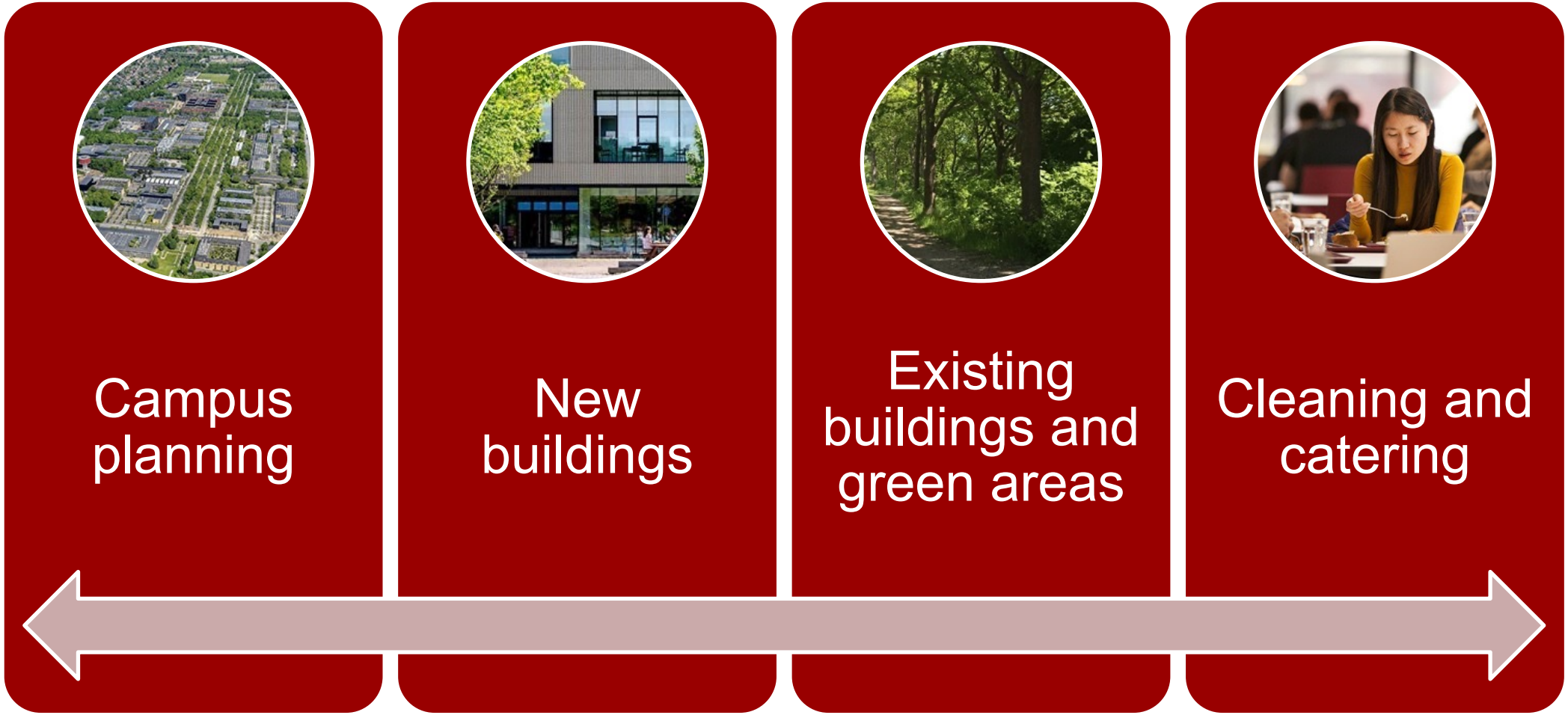

DTU

By / Anders B. Møller, Director of Real Estate and Facilities

Sustainability & Living lab. DTU campuses

Campus Service has worked with sustainability since 2012

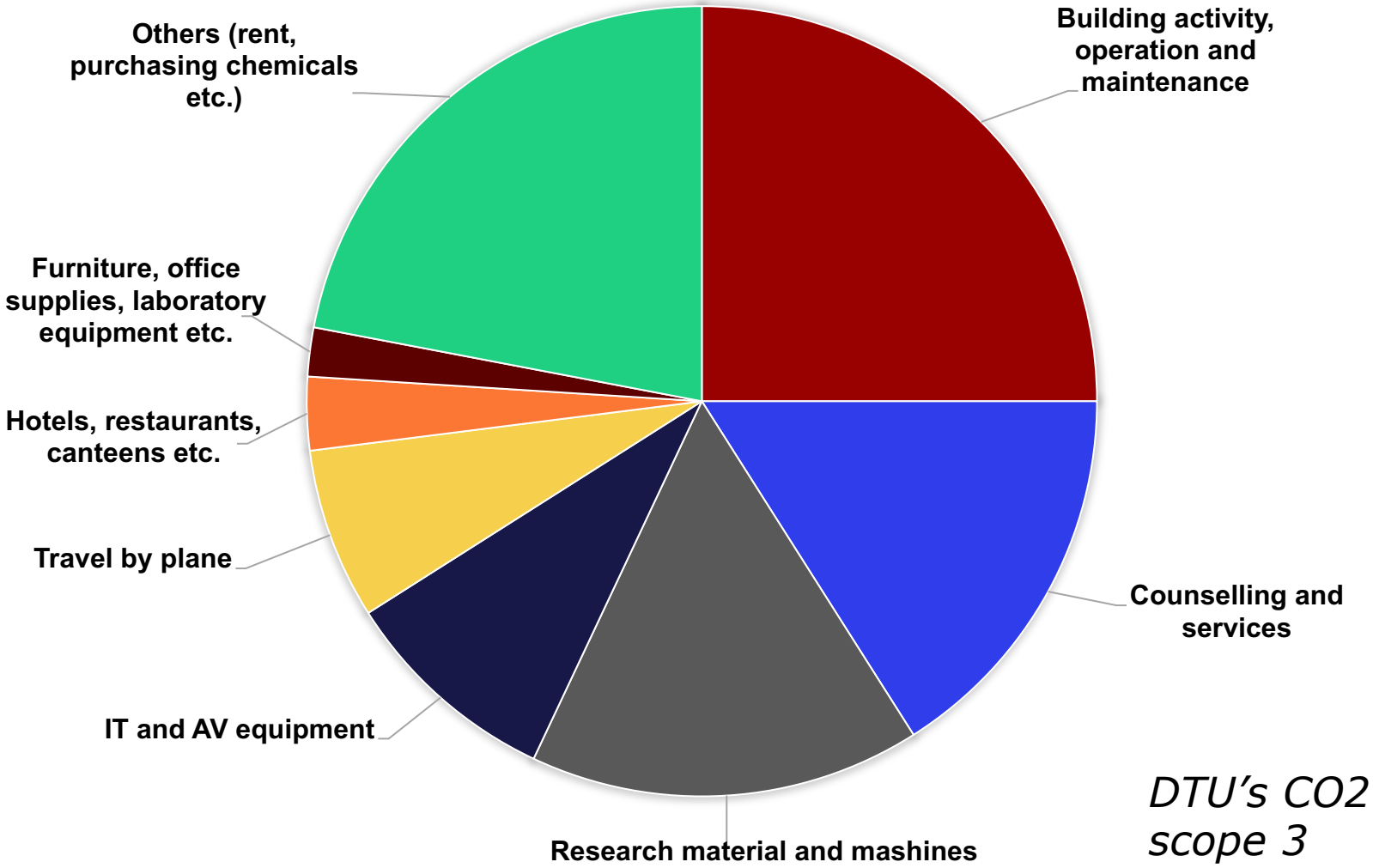
Holistic perspective on sustainability within CAS

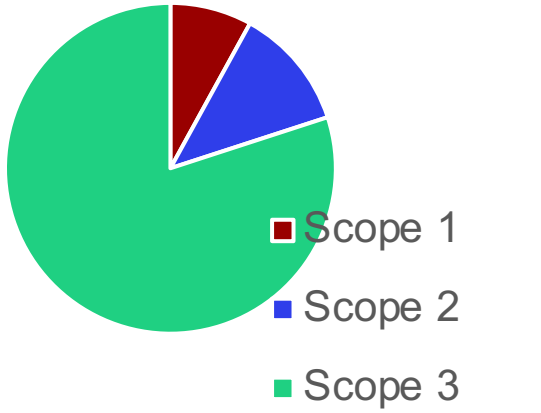


Sustainability in campus planning and buildings

Sustainability in the built environment guided by DGNB

DTU's CO2-emmissions



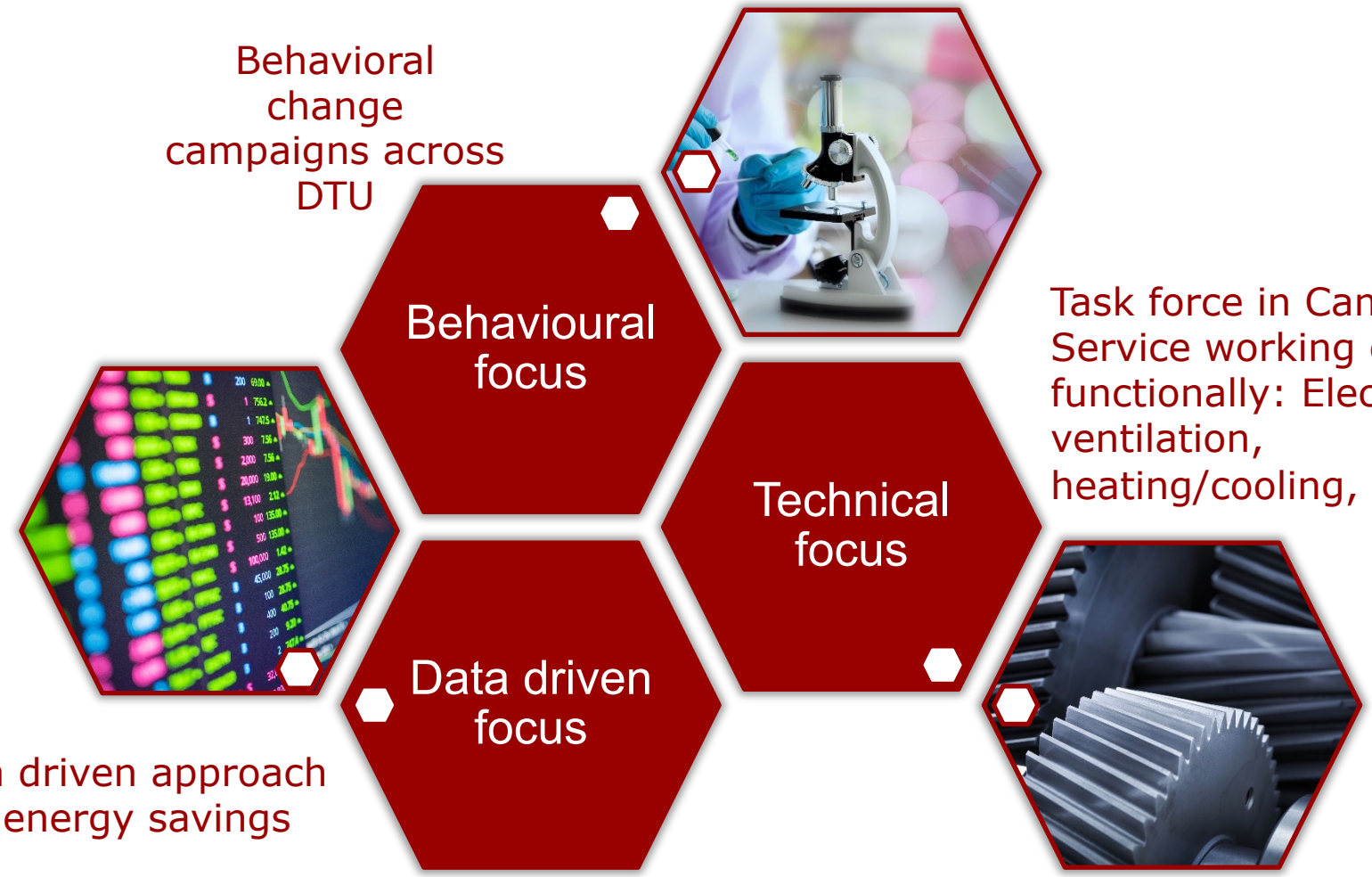


DTU's CO2 emmissions

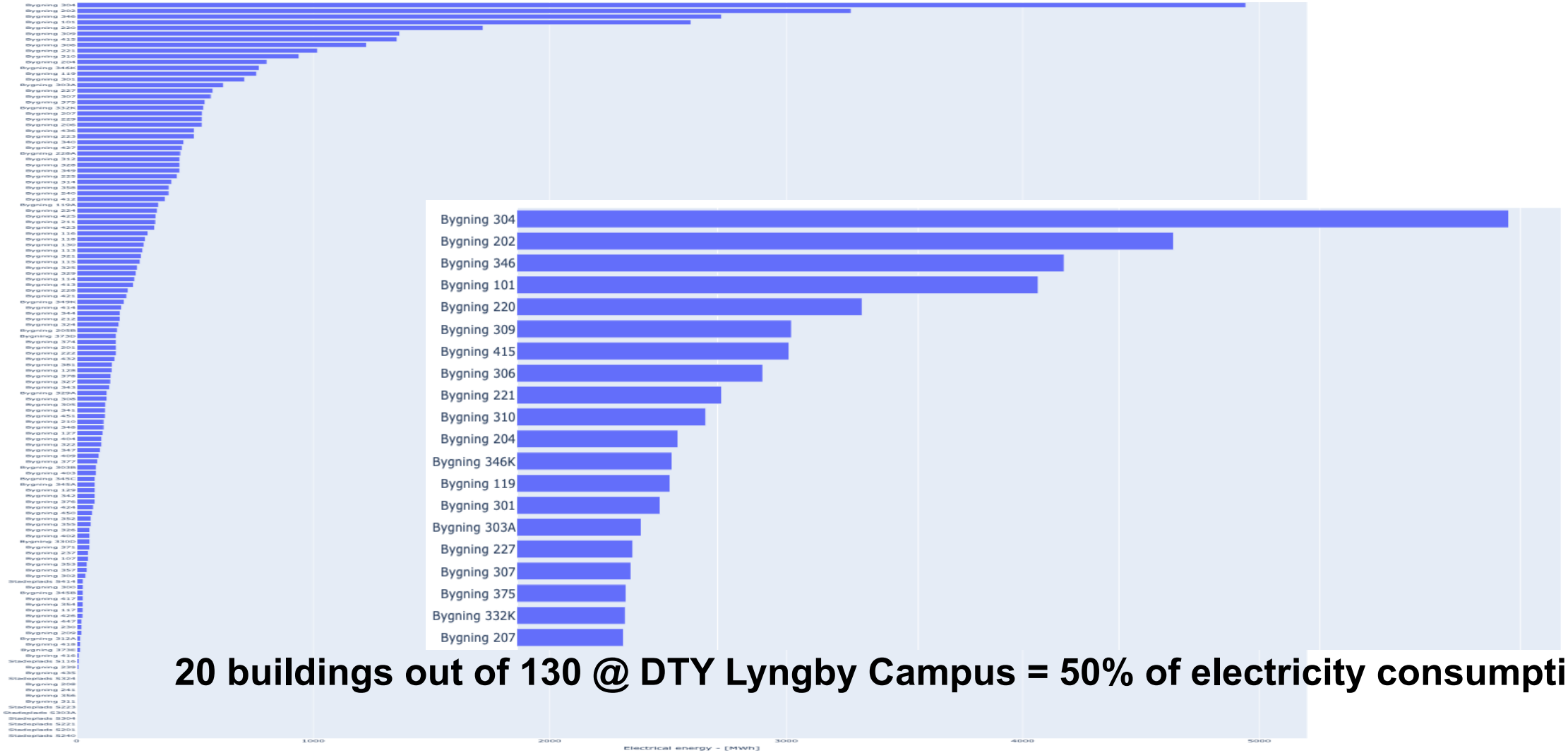
DTU's CO2 emmissions scope 3

Focus on energy savings at DTU

- CAS has worked ambitiously with energy savings since 2012 in order to reduce CO2-emmissions.
- Increasing focus on energy savings from 2022 due to European energy crisis.

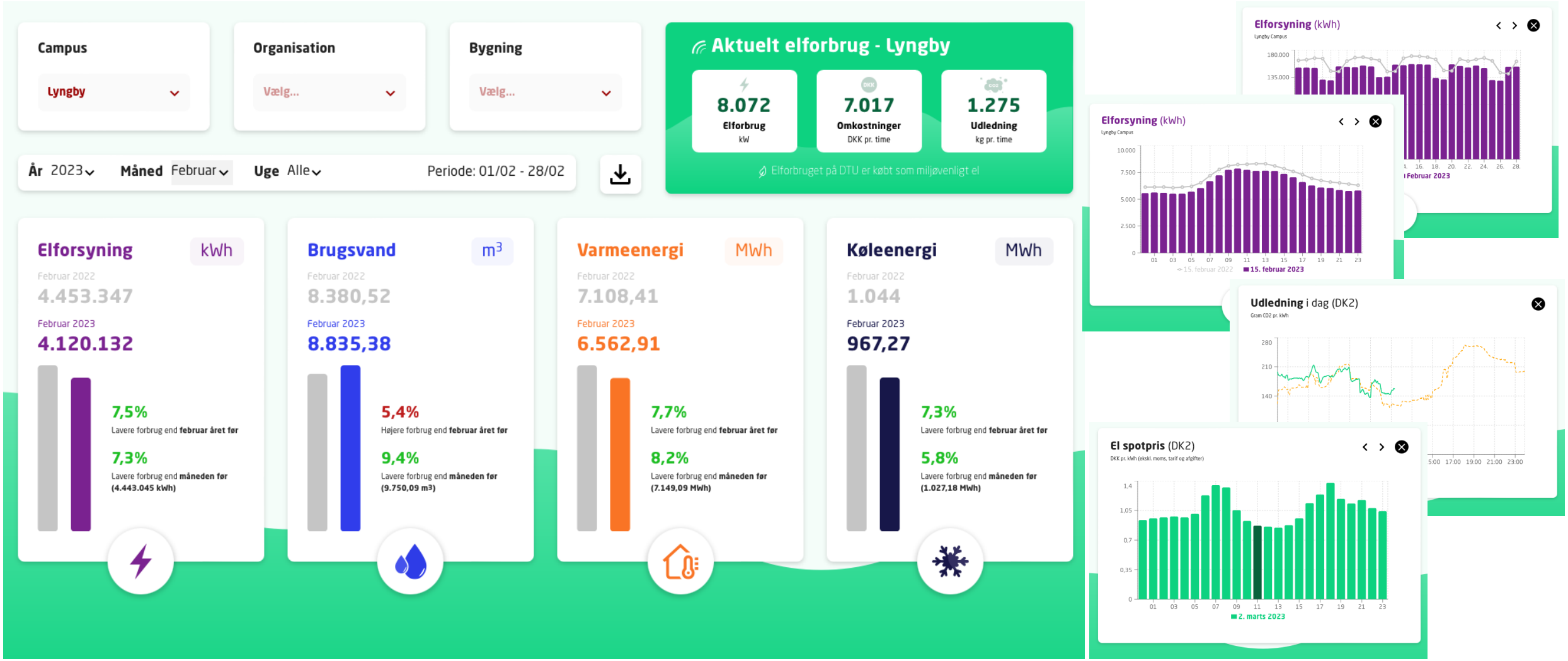


Data driven approach to energy-reductions



20 buildings out of 130 @ DTY Lyngby Campus = 50% of electricity consumption

Data driven approach to energy-reductions



DTU energy online

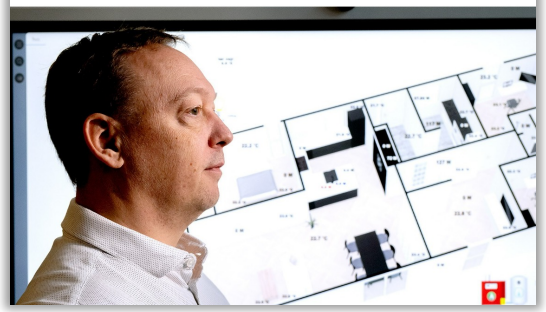
- https://dashboard.cas.dtu.dk/?campus=28643&year=2023

Communications to stimulate behavioural changes

ENERGY SAVINGS

Dashboard promotes good energy habits

Bo Carlsen is on a mission to eliminate unnecessary energy consumption both at work, where he helps run DTU's Campus Service, and at home, where he monitors his own and his family's energy consumption.



ENERGY

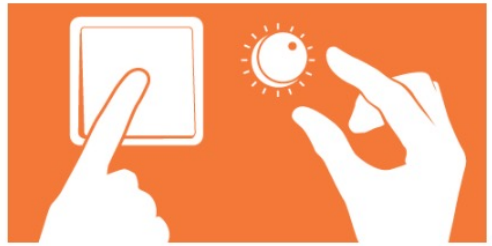
Heat from supercomputers recycled at DTU

A project at DTU Risø Campus shows that heat recovery is the most sustainable and economical choice—even at a time of rising electricity prices.

ENERGY SAVINGS

"We have a social responsibility to find ways to save on energy"

DTU can reduce its energy consumption by between 5 and 10 per cent by changing behaviour, according to the Director of Facilities.



Help save energy

DTU has a high energy consumption and a social responsibility for finding energy savings. Some of DTU's energy consumption is conditioned by good habits.

DTU is continuously working to find energy savings in its operations and development. But not all consumption can be adjusted centrally. Part of DTU's energy consumption depends on how we act when we are on the University's premises. This concerns our habits and our agreements with each other about who switches what on and off in communal areas.

Both experience from the Danish Energy Agency and a pilot project at Lyngby Campus show that you can reduce electricity consumption by approx. 10 per cent simply by introducing good energy habits in everyday life.

Save on electricity

- Conduct a dialogue locally on how you can save energy on your premises—also in communal areas
- Where possible, switch off instruments, computers, AV equipment, lights, screens, process equipment, etc. when they are not in use or when leaving a room
- Be aware of stand-by consumption from equipment, height-adjustable desks, etc. Use, for example, a conductor rail with a switch for PC, docking station, monitors, lamps, tables, etc., so they can easily be switched off outside working hours
- Close fume cupboard hatches and switch off point suction and other ventilation suction if they are not necessary for safety reasons
- Replace old freezers and optimize the space in them; this applies especially to freezers with minus 80 degrees.

Save on heating

- Set thermostats at approx. 2.5—this gives an even temperature of approx. 19 degrees, which is the temperature DTU has decided should apply to all offices and classrooms
- Air out rooms briefly after meetings, but do not turn up the heating, it will stabilize quickly.
- Remember to close doors and windows.
- Report it if you find rooms that are too hot or cold

Updated by Signe Bjerke Termansen on 28 October 2022
Responsible unit: DTU (Employee)

Consumption in Lyngby (Danish only)

Report an error in DaluxFM HelpDesk

Download the frees app for android or iOS or report an error via the browser through this link.

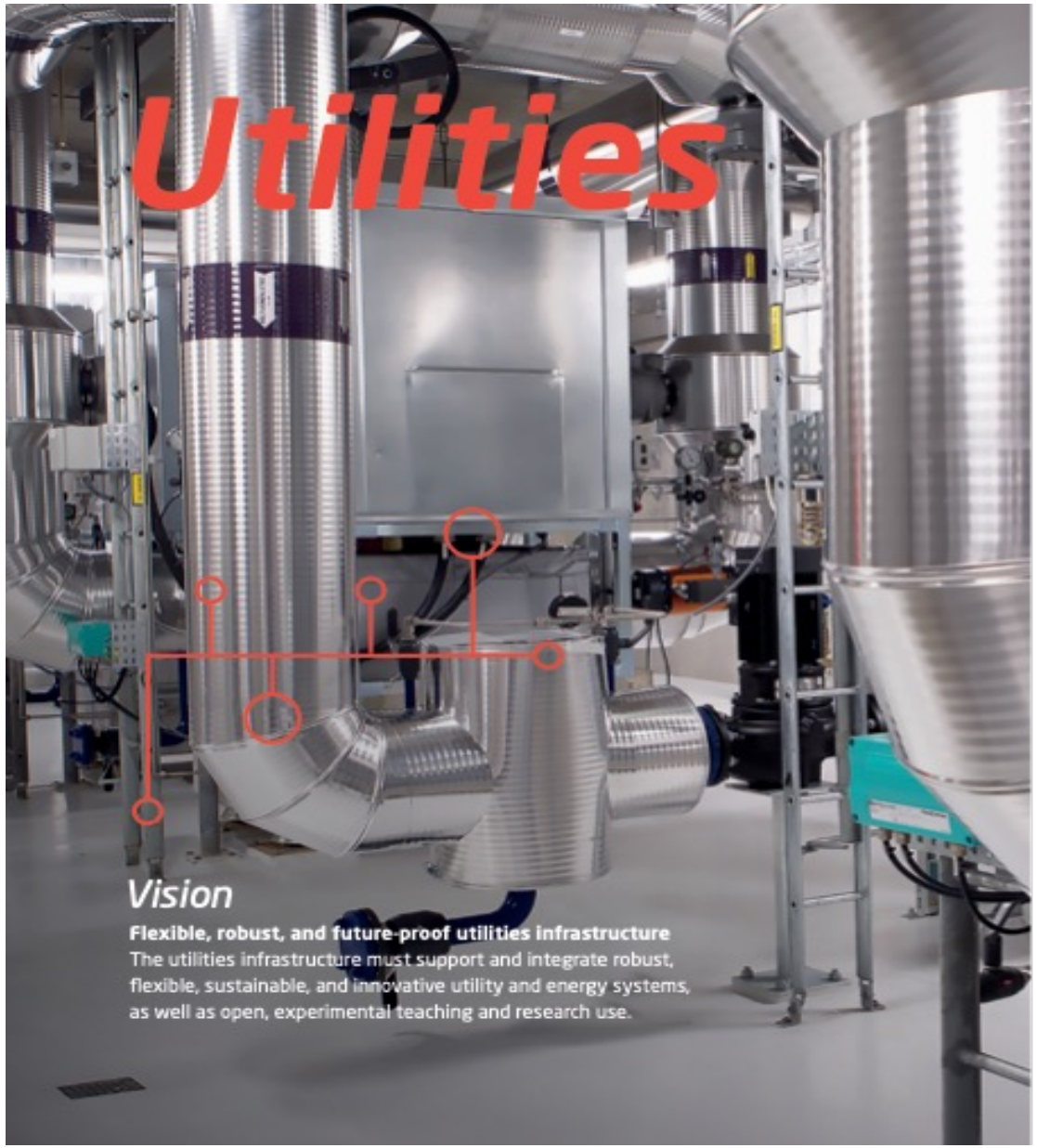
- DTUfm-Helpdesk-StepByStep

ENERGY NEWS

- Colder days ahead
- No Christmas lights
- Keep the temperature down
- Heat recovery at Risø
- Interview: Director of Facilities
- How Campus Service saves energy
- Energy savings: Spotlight on DTU's lighting

Energy research at DTU

More than a thousand DTU researchers are working with energy. Read more about energy research at DTU.



Flexible, robust, and future-proof utilities infrastructure

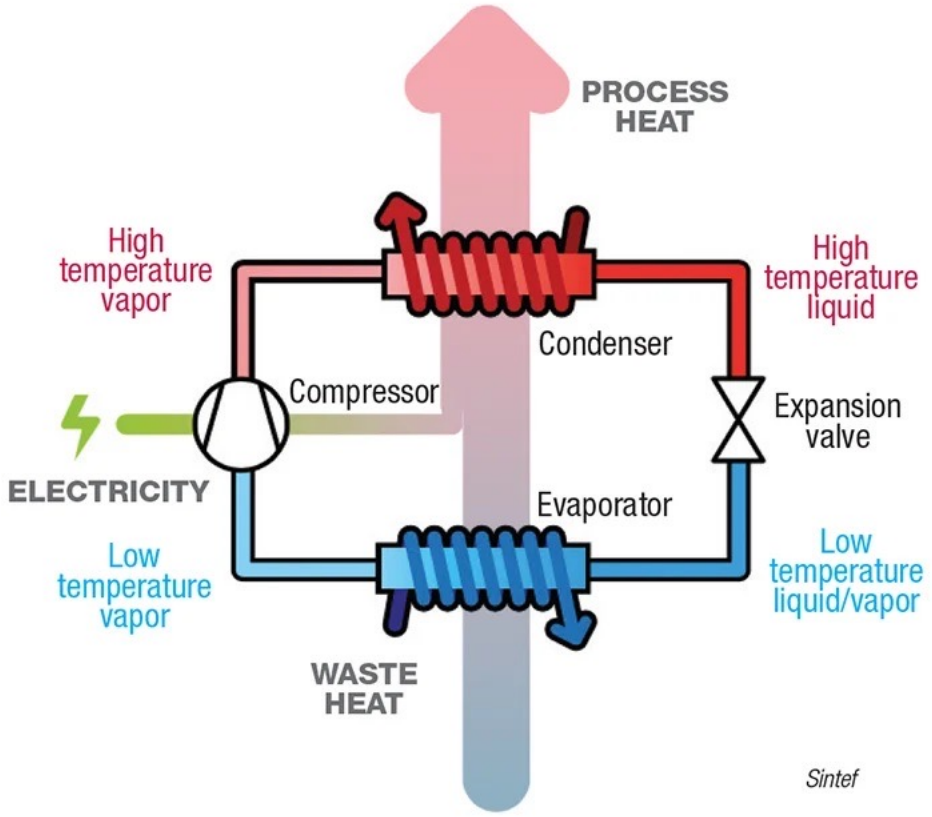
DTU has a unique tunnel system which connects and supplies the entire campus, through systems and technical networks for electricity, heating, and cooling. During the development and densification of the campus, it must be ensured that utility systems can interplay with the public infrastructure through intelligent control, so that the environmental impact on society is minimized.

DTU is already at the forefront of living lab and smart campus integration. In the future development of the campus there will be new initiatives in this area, where smart energy systems integrate solutions that support wind and solar energy.

39

How can the new & old buildings work together ?

Reuse of heat from the new buildings to feed in the old buildings.
Result = 30% reduction in heat delivery from district heating Company



Smart Parking Solutions

Sensors register magnetic field in the parking area, send information via Lora Wan, for data processing in a cloud solution s

Self-Driving Shuttles

07.56 99

lincproject.dk

17. MAY 2021

DTU students contribute to a self-driving future

It is now possible for students and employees at DTU in Lyngby to take a self-driving shuttle when they need to get from A to B on campus. In exchange for the ride, they share their experiences in the shuttle with the project team, so that we can ensure the best...

19. MARCH 2021

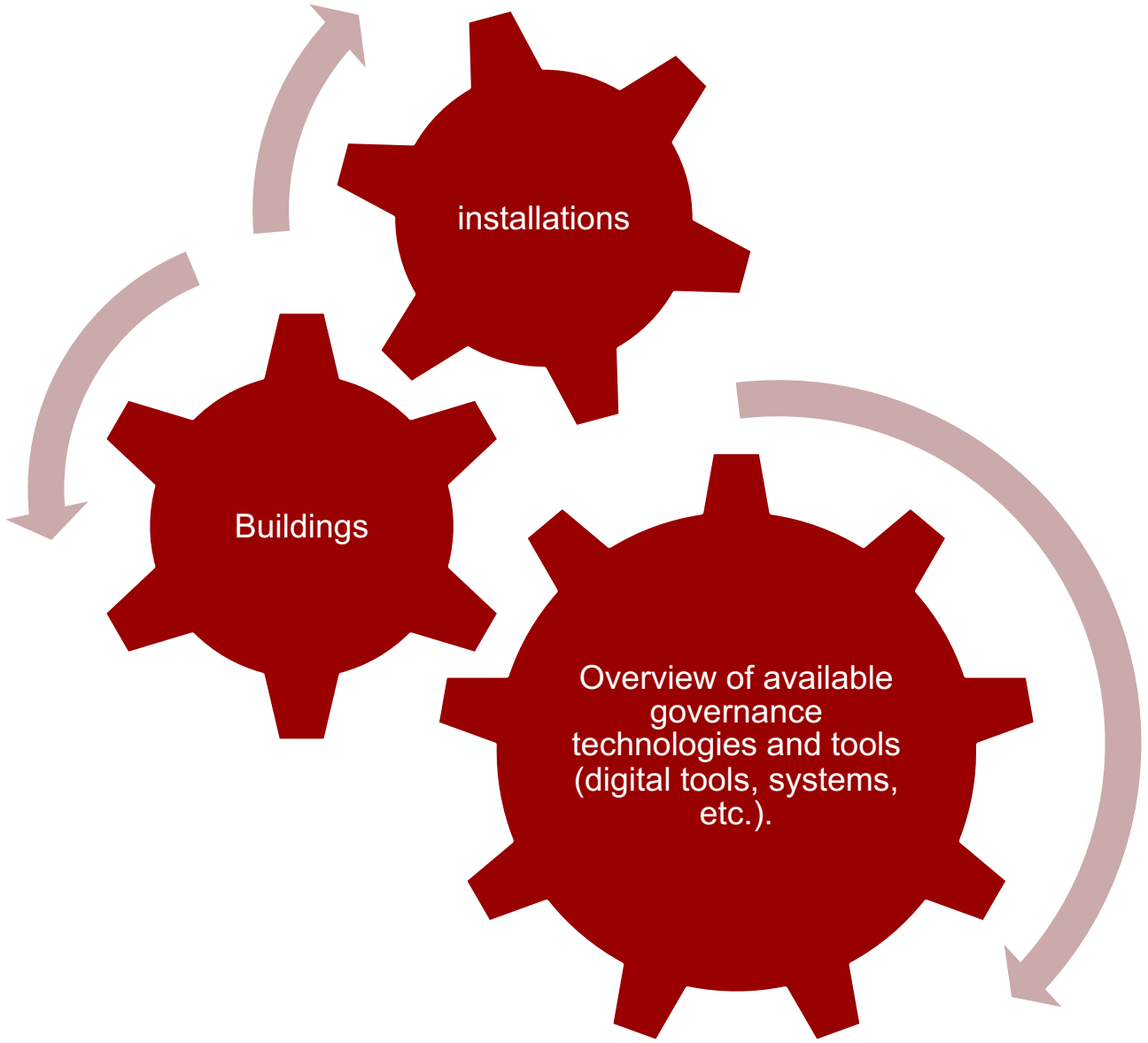
Self-driving shuttles approved for test-drives on Technical University of Denmark

The Danish Minister of Transport has now signed the approval for the LINC project, which will test self-driving shuttles at DTU Campus Lyngby. Students and staff can try out the shuttles from April 2021. A long-awaited approval from the Danish Road Directorate has...

Final reflection

if you want to be able to decide and change installations in your infrastructure,

you have to own your buildings and installations.



DOLL Living Lab – Digital City Model

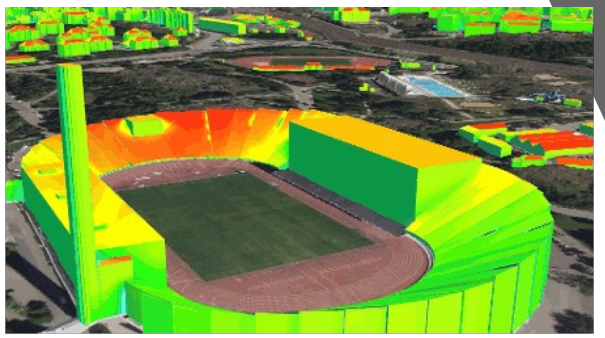
Cisco Inspiration Tour

June 2023

DOLL
Lighting the future
of Smart Cities

WE
BUILD
DENMARK

DOLL Digital City Model



- GOAL
- Build a digital model of DOLL that allows testing and demonstrating of Smart City technologies
- Build a fundament that allows for others to build applications on our data
- Act as an example best/next-practices case for Municipal Smart City deployment
- Build new partnerships and relations around digital SC development

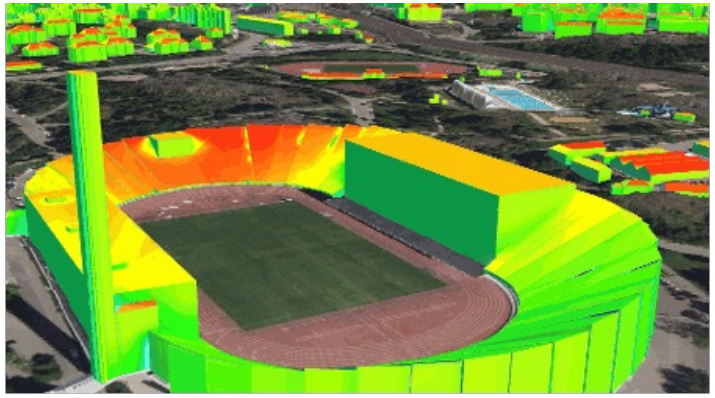
- PARTNERS
- KMD – development of base environment
- Key DOLL companies – Data delivery, initial use-case testing
- Ministry of Education, Danish Business Authority – funding
- Alexandra Institute – Simulation/Compute
- ??? – Visualisation, application development

DOLL DBM – Digital City Model

DOLL

AGGREGATED PARTNER DATA

CITIES, UTILITIES, OPEN DATA

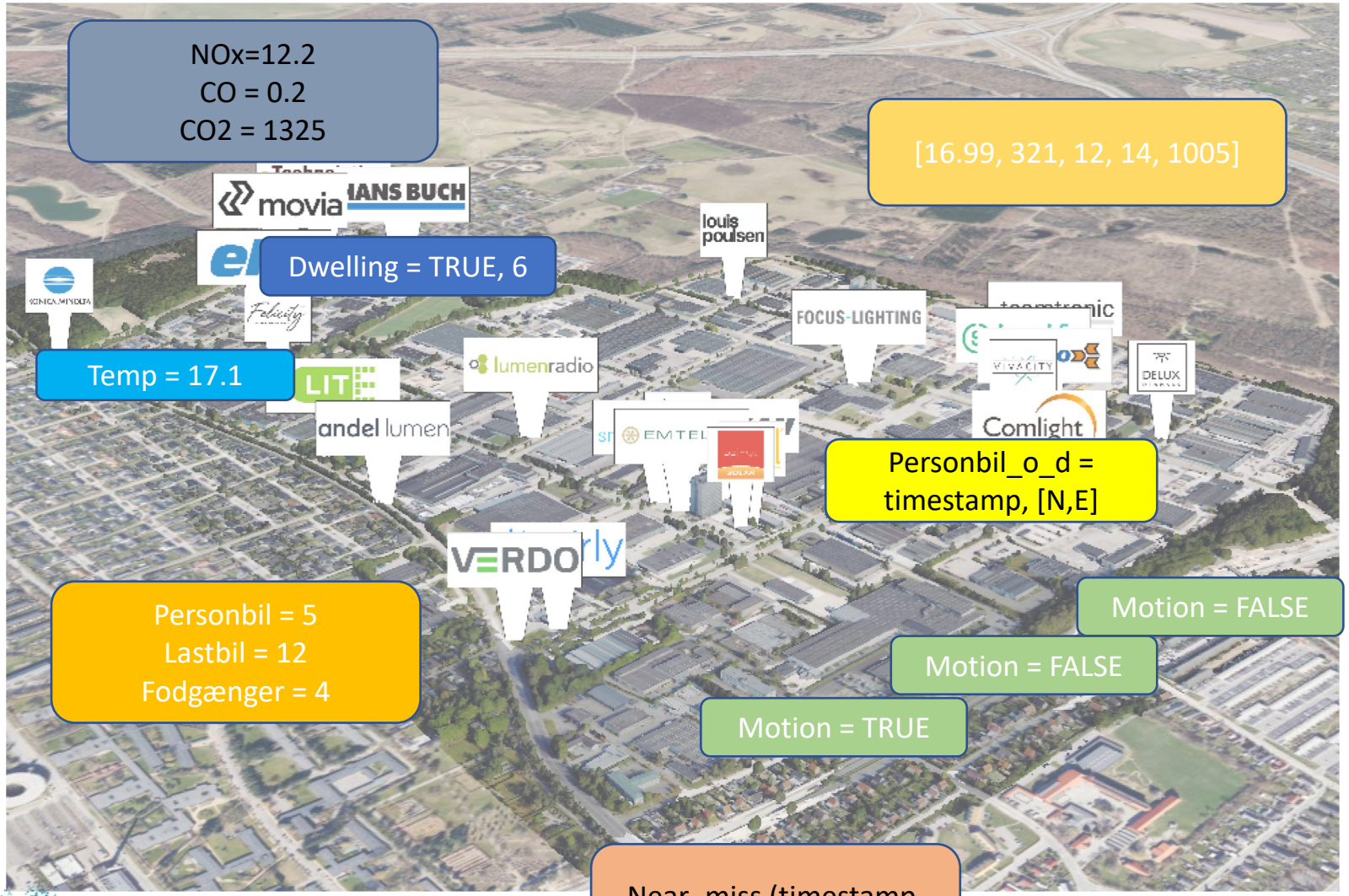


Physical Layer	Observed Data Layer	Infrastructural Data Layer
Fixed infrastructure Rapidly-changing environment Highly-localised environment Most complex Context-rich	Rapidly-changing measurements (Highly)-localised observations Middle complexity Context-poor	Slowly-changing Continuously distributed Lowest complexity Context-establishing

DOLL
Lighting the future of smart cities

PART OF WE BUILD DENMARK

DOLL Data Landscape



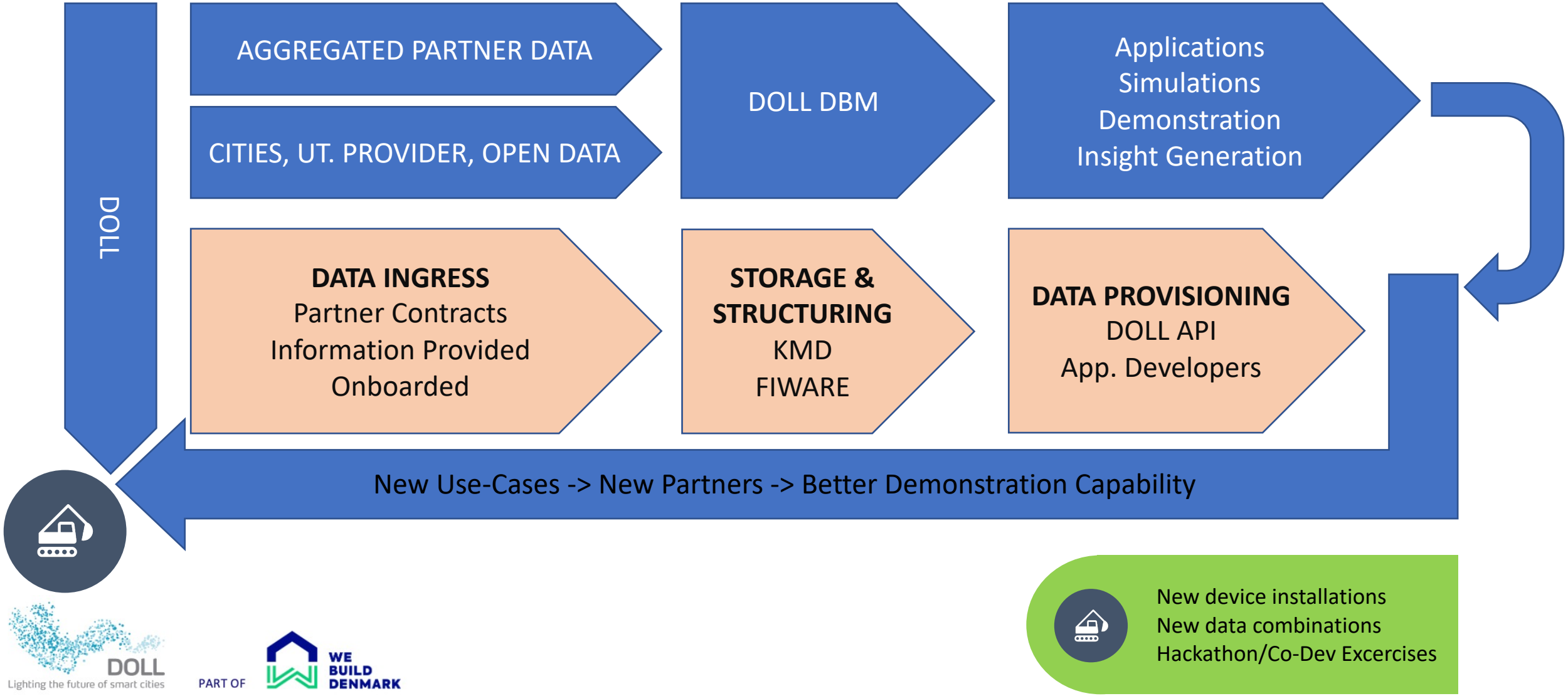
- **Traffic**
  - Vehicle Types
  - Speed, heading
  - Dwelling at X's
  - Make + model
  - Origin-Destination, Routes
- **Environment**
  - Gasses, Particles
  - Air and Road Temperature
  - Humidity, pressure
- **Lighting**
  - Power consumption
  - Colour, intensity
  - Local motion detection
- **Operational Parameters**
  - Power, net, state etc.

- No standard models
- Mixed-space of rich+poor data
- Varying update frequency

DOLL
Lighting the future of smart cities

PART OF WE BUILD DENMARK

DBM Co-Creation Pipeline



DOLL
Lighting the future of smart cities

PART OF WE BUILD DENMARK

DOLL Digital City Model – How?

DOLL PHYSICAL LAYER

- 13km roads and cycle paths
- 100+ buildings
- 6 regulated intersections
- School, nursery, college
- Industrial production, logistics, service providers
- Industrial – Urban – Suburban

SENSOR DATA (PARTNERS)

- Gasses and particles
- Temperature, humidity, pressure etc.
- Vehicle type, make, model, position, speed + dir
- Routes, Origin-Destination
- Pedestrian counts, dwelling-time
- Operational parmaters, power, network etc.

3rd PARTY DATA

- GIS – roads, addresses, buildings etc.
- BIM
- Utilities – power, net, heating, water
- Traffic- and street- light status
- Weather, environment
- Parking infrastructure and status

DATA INGRESS

- Identify relevant 3rd party data
- Onboarding of Partner
- Technical integration
- Automated ingress
- Event-driven pushing of data

STORAGE & STRUCTURING

- Choose suitable Smart Data Model
- Develop new SDM
- Transforming/Mapping
- Store in timeseries DB

DATA PROVISIONING

- DOLL API for developers
- Historical datasets for R&D
- Access for DOLL partners – integrate into own CMS

Applications
Simulations
AI Training + Test
Demonstration
Insight Generation

DOLL Digital City Model – Example Integration with Hans Buch A/S

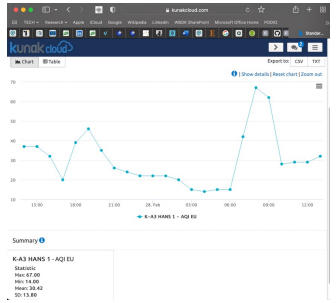
Kunack AirPro2 – high-end environmental station
Rich data – also composite dimensions (AQI, dew point etc.)
Mature, well documented API

Cooperative partner - willingness
Technical and strategic input

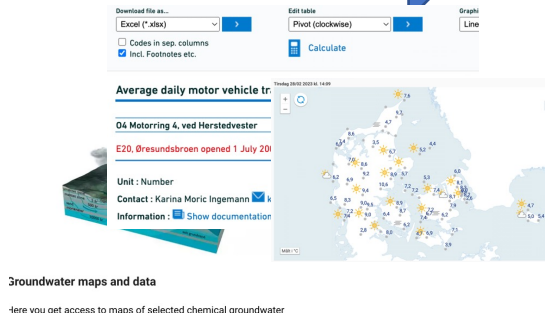
Integration Process (6-12 hours)

Key person at partner company

Onboarding document



Web Interface



3rd Party Data

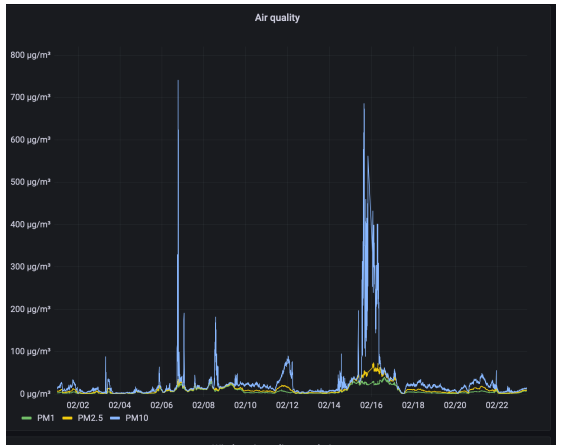
DOLL
Lighting the future of smart cities

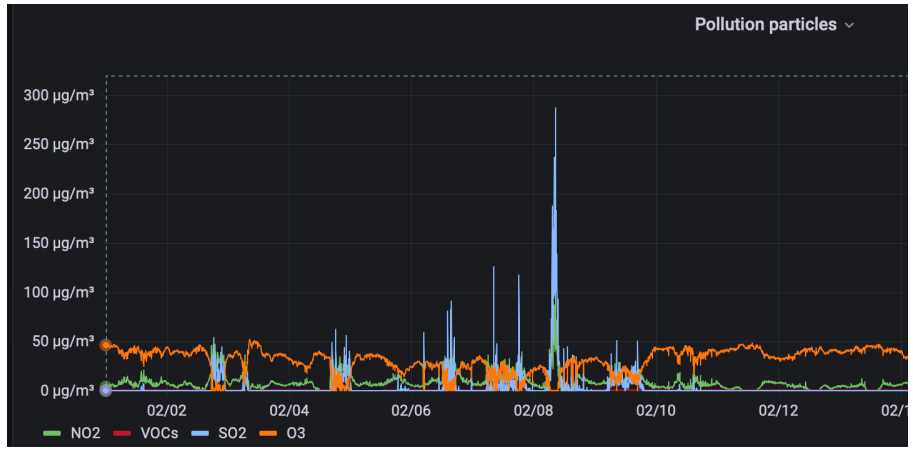
PART OF WE BUILD DENMARK

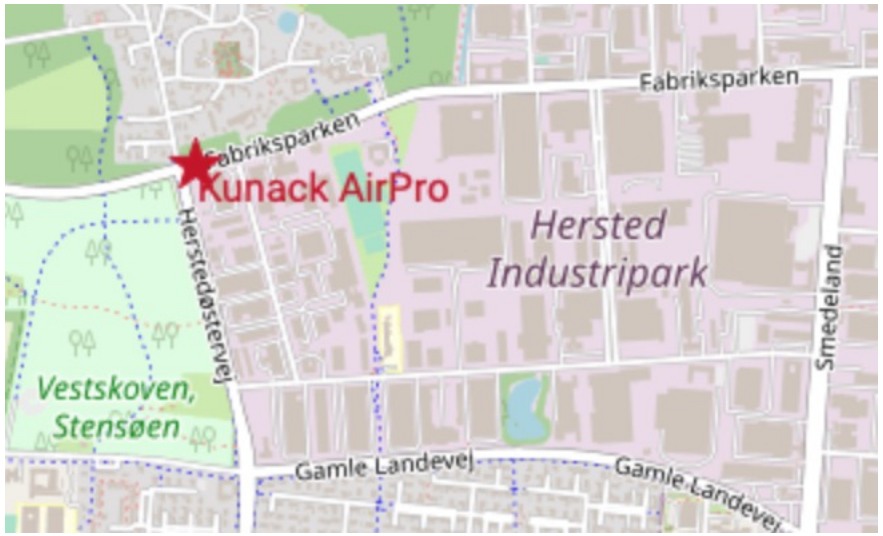
DOLL Digital City Model – Data Visualisation in Grafana

Standard timeseries visualisations
"Recreation" of vendor CMS graphs
UI – Zoom, filtering, colour, export

All data is retrieved from the device/API (including UoM, dimension names etc.)







Standard map-based visualisation
"Recreation" of vendor CMS interactive map
UI – Zoom, pan/dolly, filtering, a la Google Maps/GIS

All data (incl. location, name etc) from device
Map data from Open Street Maps

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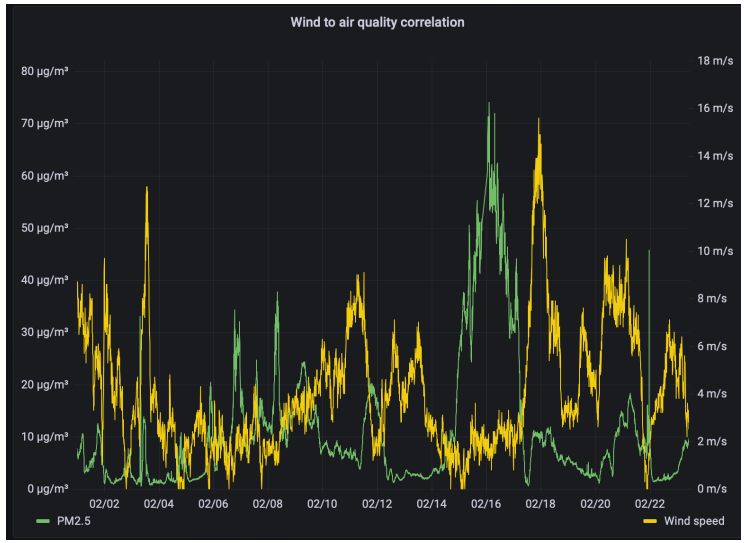
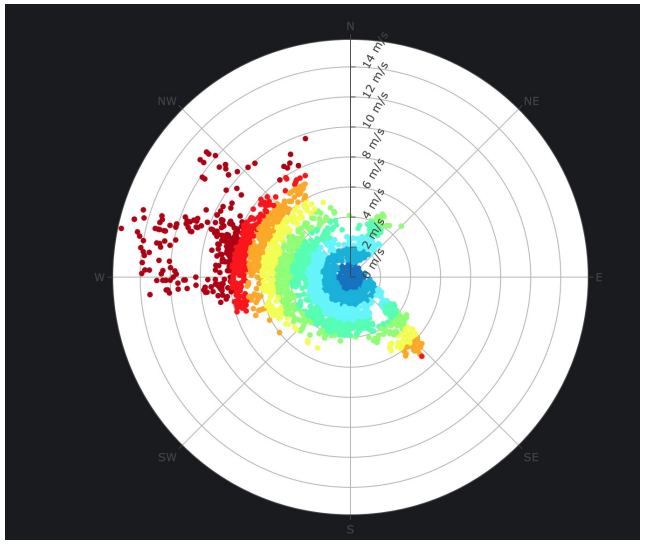
DOLL Digital City Model – Data Visualisation in Grafana

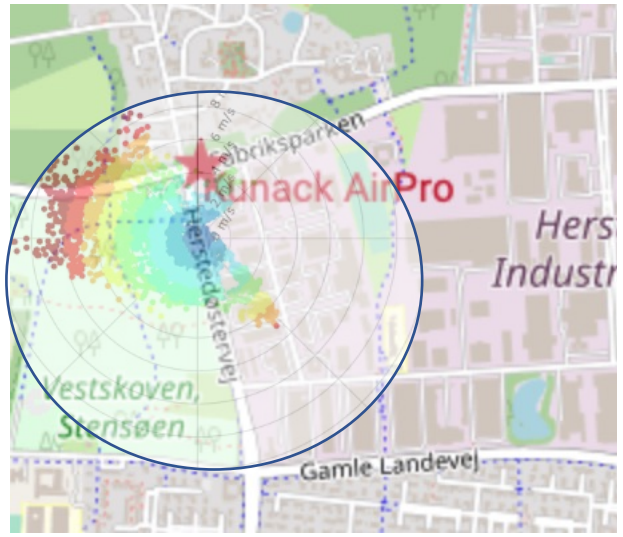
Enriched 1-D timeseries graphs
Wind Speed from DMI
PM2.5 from device



Enriched 2-D graph
Wind Speed + Direction from DMI
PM2.5 from device



Enriched map visualisation
Overlay on OSM map



Where is the pollution coming from? Calculate origin of (PM2.5*wind speed+dir) vector, triangulate between measurement points. What type of factories/production units are around the origin (AK data)?
Where is the pollution headed? Calculate dispersion (concentration) of particles from origin – is it dangerous within X meters?
What actions to take? Issue fine to factory owner, establish dynamic exclusion zone in school time, redirect specific vehicle type

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Application – Road Condition

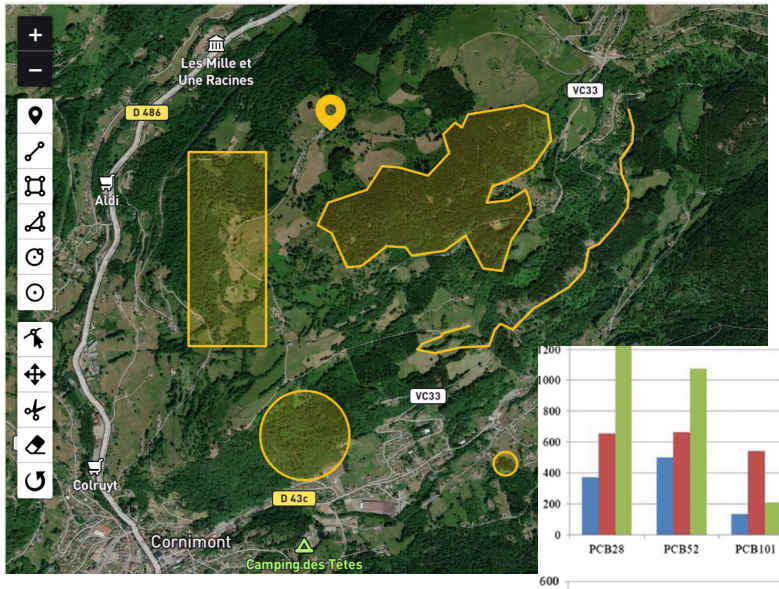
- Maintenance of road infrastructure
  - **Today [Digitalise]**
    - Log defects and organise by type and severity
    - Organise tasks to optimise man-hours
    - Optimise trave-time between sites
    - Recuse false-positive observations
    - Propose Smart Data Model to FIWARE
  - **In 6 months [Statistics]**
    - Know ***exactly*** the maintenance cost of XYZ
    - Evaluate current processes manually against ground-truth
    - ***Prove*** a carbon-offset
  - **In a year [AI/ML]**
    - Predictive maintenance
    - Optimise effort
    - Reduced costs
    - Reduce hard manual work
    - Damage mitigation?

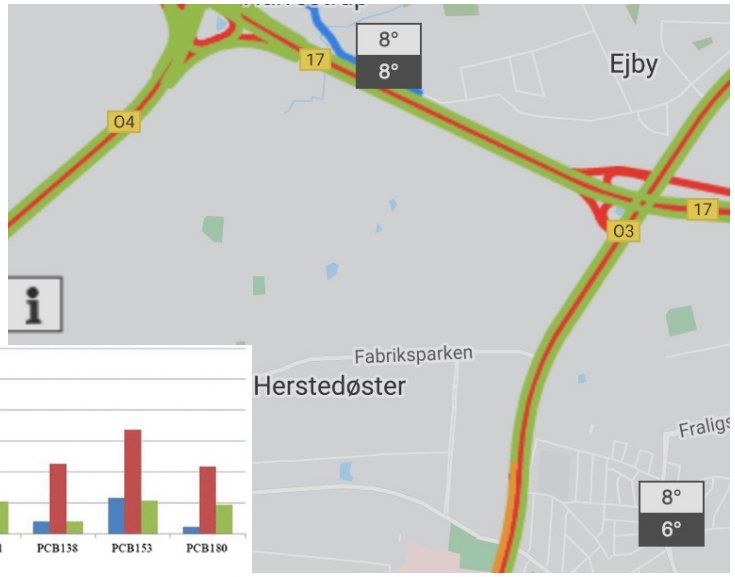
Partner Constellation

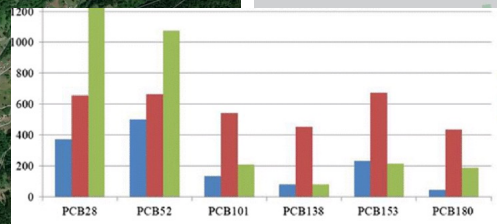
Social Tech Projects: Domain Knowledge, Scanning + Processing
Alexandra Institute: Calculations, AI Predictions
K**MD:** Data modelling, integration with DBM
DOLL + Municipality: Domain Knowledge, Use-Case Development
DMI, COWI, DOLL partners: Supporting data
??? – Additional road data

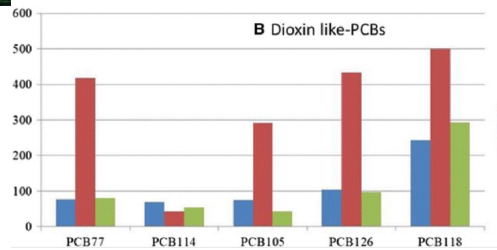
Applications

- City Performance Indicator App
  - **Today [Summarise]**
    - Better environmental measurements
    - Compare areas
    - Prcise traffic measurements
    - Combine local and 3rd-party data
  - **In 6 months [Correlate]**
    - Area X is polluted because:
    - Intersection X is a bottleneck on road Y
    - We don't have enough measurements in area Y
  - **In a year [AI/ML]**
    - Redirect traffic from HERE to THERE
    - Establish a green wave HERE
    - Buy X amount of devices to achieve Y
    - WHERE to put effort
    - WHAT will that achieve?









End-users:

- Municipal employees seeking information
- Procurement, looking to optimise ROI
- City DM wishes to qualify their choices
- Coucil Department X evaluating performance
- Planning dept. want to make informed decisions

The Application Layer – Municipalities of Tommorrow

Our experience today	Our hope for the future
Cities don't have a budget for data exploration	Standardised models negate the data cleaning and preprocessing stages thereby reducing costs significantly
Municipal systems are numerous (350+ in DK) and often not interoperable	Automated middleware components that can translate between formats, models, systems.
Employees lack domain knowledge – domain experts do not have "boots on the ground" experience with the city's challenges	Domain-specific knowledge not required to integrate. Ease-of-use in toolset allows employees to generate insights based on their own practical knowledge.
Scaling from one region to another is very difficult due to varying infrastructure, expertise, "target applications"and tech stacks	Well-documented compliance strategies freely availible, good examples can be examined before spending
Difficult to explain new concepts verbally/statically	We can quickly assemble a PoC to demonstrate a concept for decision-makers
Hard to predict cost/efforts for smart city tech deployment	Metadata layer can be used to calculate ROI and CapEx/OpEx in simulated environment

The Digital City Model – Main Challenges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{
    "id": "vehiclemodel:econic",
    "type": "VehicleModel",
    "name": "MBenz-Econic2014",
    "brandName": "Mercedes Benz",
    "modelName": "Econic",
    "manufacturerName": "Daimler",
    "vehicleType": "lorry",
    "cargoVolume": 1000,
    "fuelType": "diesel"
}
```

- Mapping of data to standard models
- Enriching data from sensor A with sensor B – same car, different dimensions
- Reidentification of vehicles across sensors
- Make, model - classifying with cheap/free ANPR/CV

- Deriving speed from a mix of vectors, points, aggregated dwelling
- Modelling acceleration curve from sparse speed/location points

- Access to third party data – power usage, driving activity, logistics, consumption
- “Filling in the gaps” with additional physical sensing points
- Ensuring GDPR compliance going forward
- How do we PROVIDE data? Legal, technical.