UiO : Department of Informatics
University of Oslo

Ethics and Artificial Intelligence in Healthcare (Etikk og kunstig intelligens innen helse og omsorg)

Jim Tørresen

Research group Robotics and Intelligent Systems (ROBIN)

University of Oslo, Norway

Artificial Intelligence in Healthcare Conference
June 18-19, 2019, Bodø

UiO : Department of Informatics
University of Oslo

Robotics and Intelligent Systems (ROBIN)

http://www.mn.uio.no/ifi/english/research/groups/robin

Jim Tørresen
Professor, Group leader

Mats Høvin
Assoc. Prof.

Kyrre Glette
Assoc. Prof.

Kristian Nymoen
Assoc. Prof.
(shared with music dep)

Yngve Hafting
Ass. Prof.

Vegard D Søyseth
Principal Engineer

Postdocs:

Charles Martin (20%)

Kazi SN. Ripon

Kai Olav Ellefsen

Md. Zia Uddin

Weria Khaksar

PhD students:

Eivind Samuelsen
Farzan Noori
Flavia Dias Casagrande (HIOA)
Julian Fuhrer
Justinas Miseikis
Jørgen Nordmoen
Sondre Engebråten (FFI)
Tønnes Nygaard
Benedikte Wallace

Adjunct positions (20%):

Alexander Wold (assoc.prof.)
Ole Jakob Elle (Prof.)
Roar Skogstrøm (lecturer)
Ståle Skogstad (assoc.prof.)

Students Bachelor ~180; Master: ~45
Robotics and Intelligent Systems program

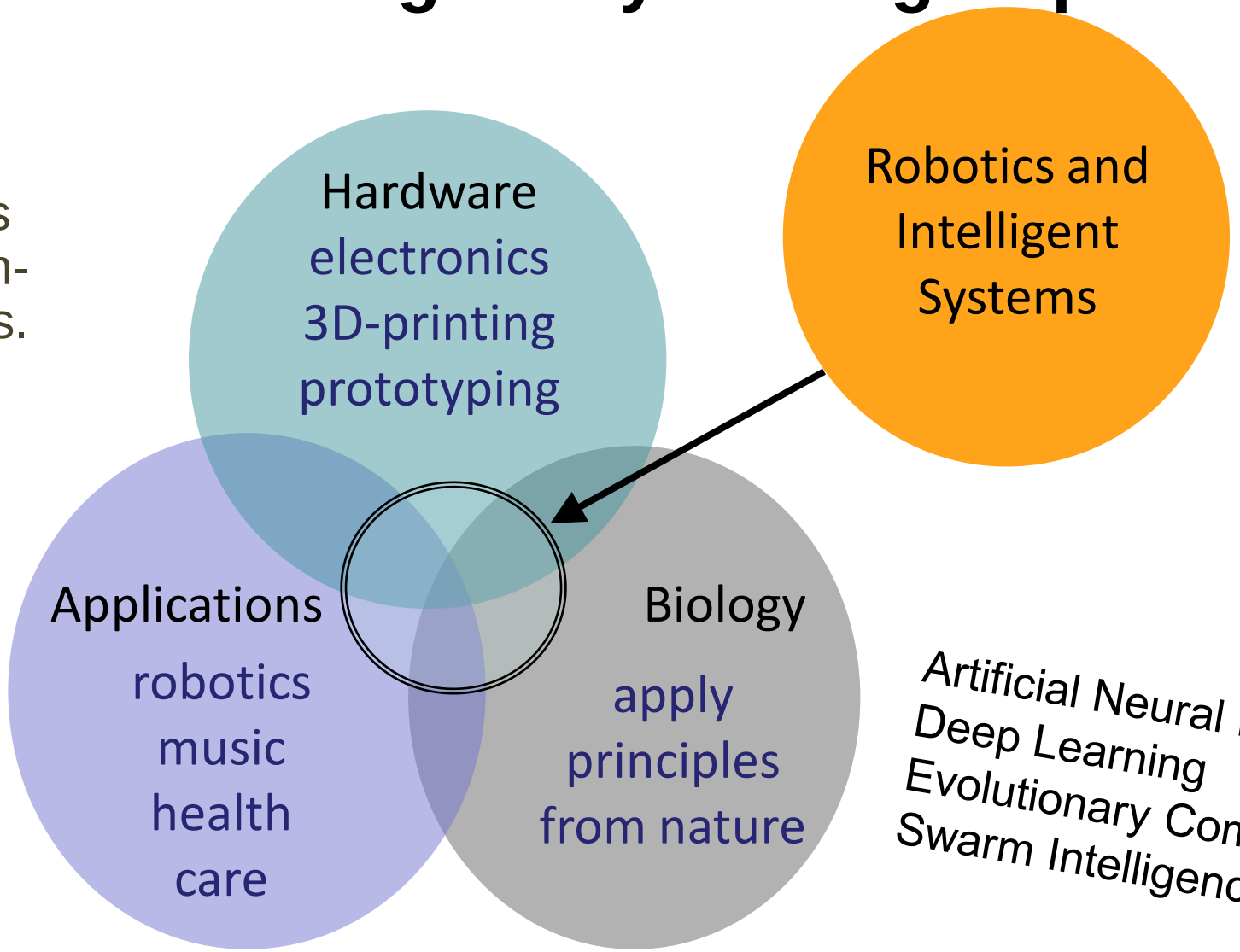
Students hired on hourly basis

Visiting researchers

UiO : Department of Informatics
University of Oslo

Robotics and Intelligent Systems group
ROBIN

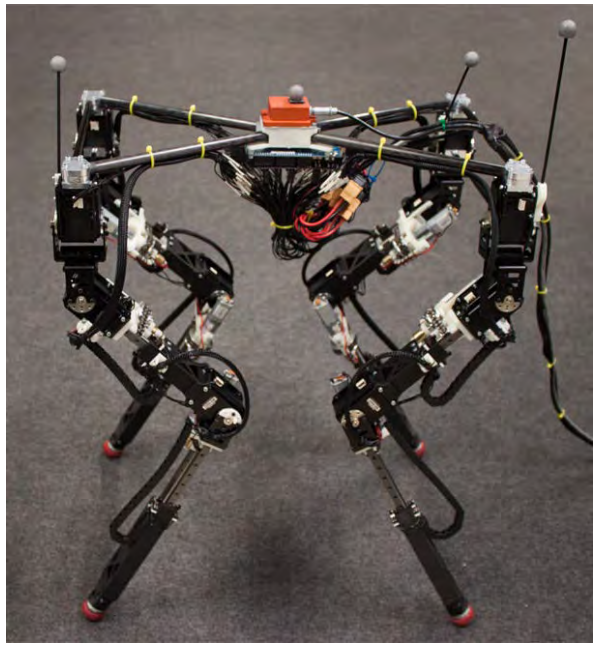
Creating systems for demanding run-time environments.

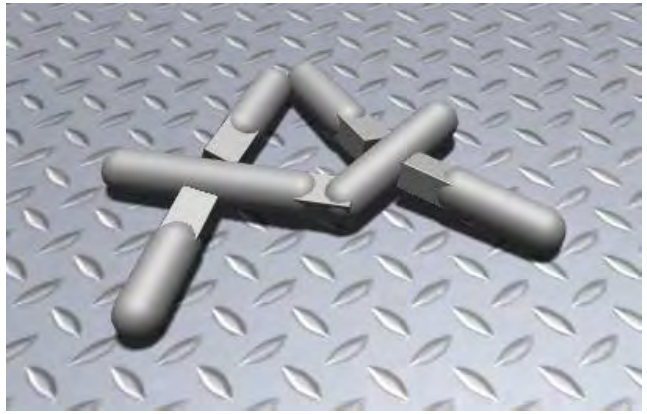


Artificial Neural Networks
Deep Learning
Evolutionary Computation
Swarm Intelligence

Web page: Google for ”ROBIN IFI”

Robotics and Intelligent Systems research





ROBIN Research Projects and Centre Funded by the Research Council of Norway

- **Prediction and Coordination for Robots and Interactive Music** (EPEC, 2015-2019, FRIPRO)
- **Multi-sensor Elderly Care Systems/Robots** (MECS, 2015–2019, IKTPLUSS)
- **INtroducing personalized TReatment Of Mental health problems using Adaptive Technology** (INTROMAT, 2016-2021, LightHouse project)
- **Vulnerability in the Robot Society** (VIROS, 2019-2023, IKTPLUSS)
- **Centre of Excellence for Interdisciplinary Studies in Rhythm, Time and Motion** (RITMO, 2017-2027, CoE)

The Research Council of Norway

UiO : Department of Informatics
University of Oslo

INTROMAT: INtroducing personalized TReatment Of Mental health problems using Adaptive Technology (2016-2021)

Research Council of Norway grant 259293

Goal: Increase access to **mental health** services for common mental health problems by developing **smartphone technology** which can **guide patients**.

http://intromat.no

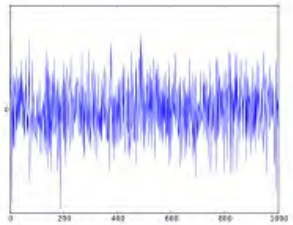
Project Manager:
Haukeland Univ. Hospital, Bergen

Funding: *IKTPLUSS Lighthouse, Research Council of Norway*

The Research Council of Norway

Mental health monitoring (INTROMAT)

- Analysis of sensor and behavioral data with machine learning.
- Mental states prediction for bipolar, anxiety and attention-deficit/hyperactivity disorders.
- Use of smartphones, wristwatches and virtual reality devices to monitor users´ behavior.
- Adapt clinical follow up and activate automatic treatments when needed.



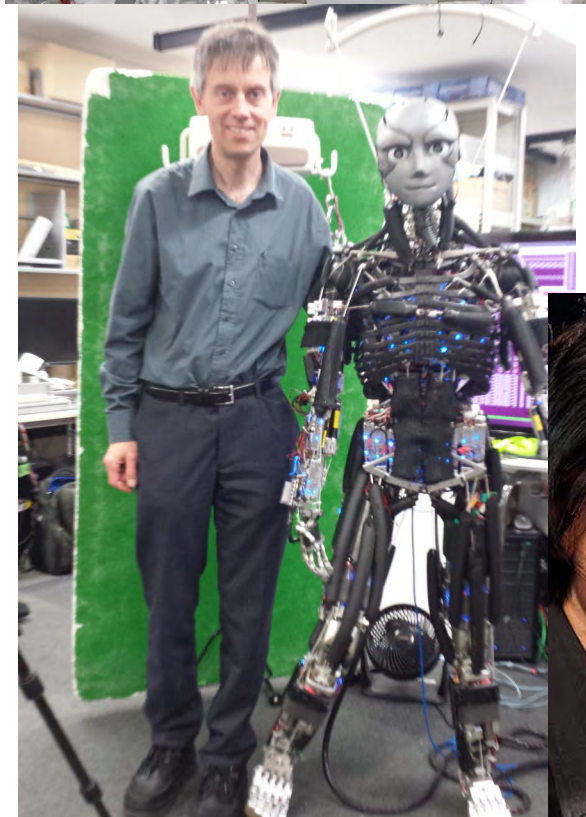
Speech, motion, heartbeat, phone usage etc

Machine learning

Mental state

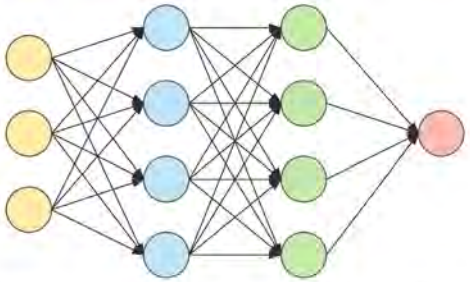
Robots (earlier)

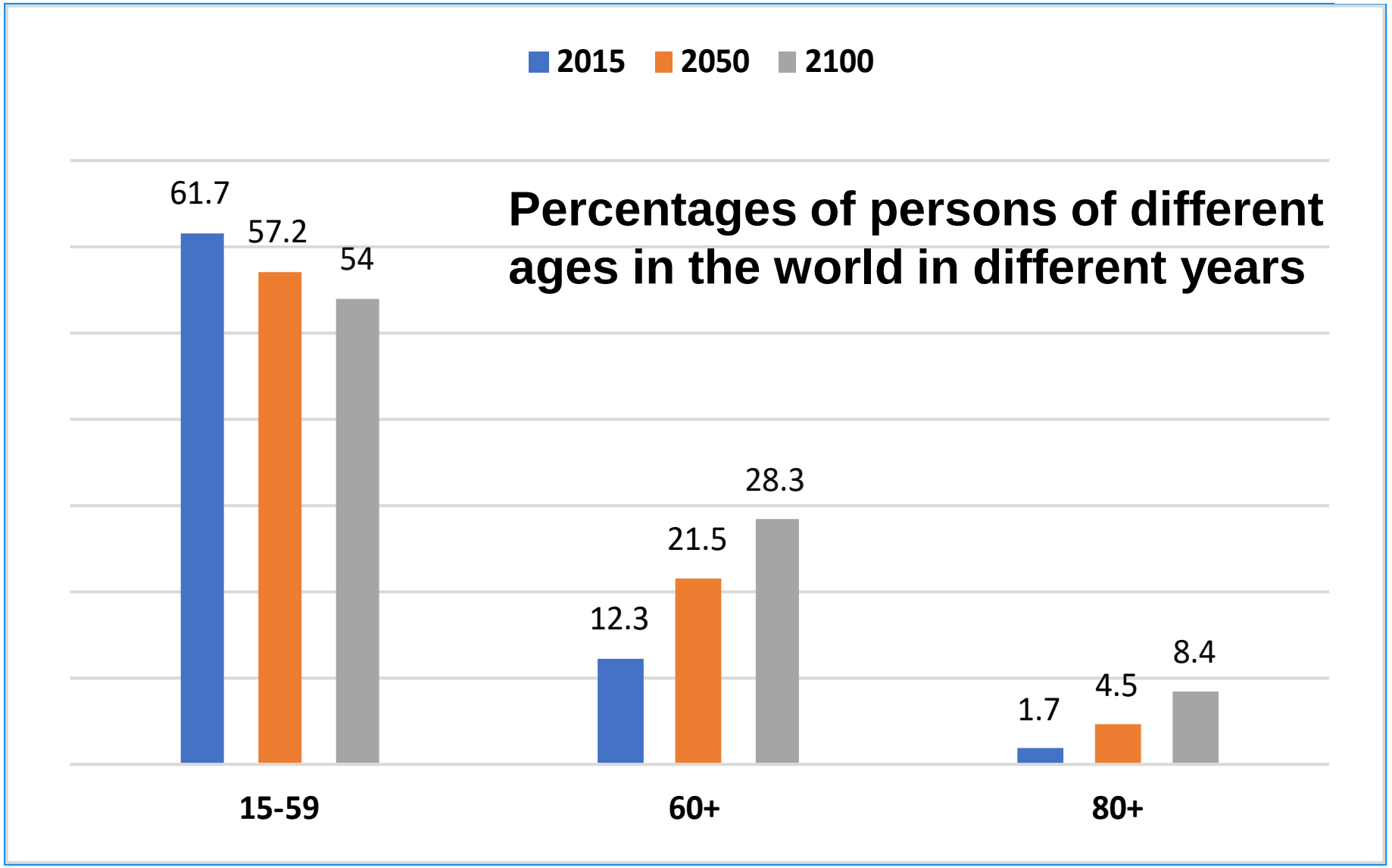
Robots (now)



What is a Robot?

ROBOT = Sense → Sensors | Think → Artificial Intelligence | Act → Motors + Mechanics





United Nations (2015) World population ageing. United Nations, New York.

Would we like to be surrounded by robots rather than humans?

Would we like – with some help from robots – **to be independent with regards to our key needs like personal care, eating and transportation?**

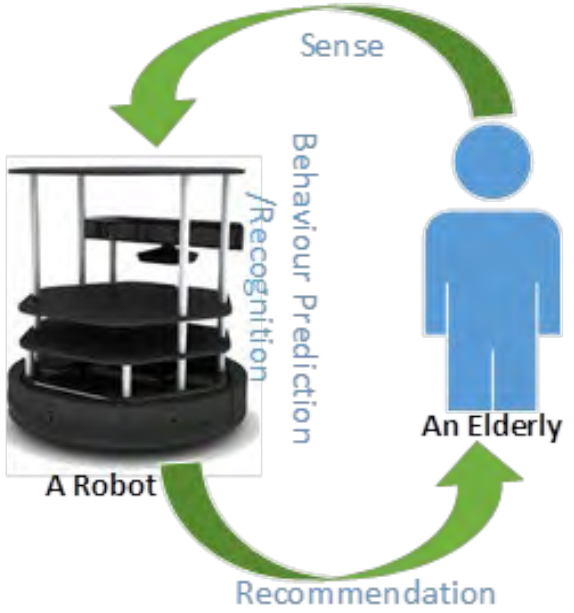
UiO : Department of Informatics
University of Oslo

MECS
Multimodal Elderly Care Systems

MECS: Multi-sensor Elderly Care Systems

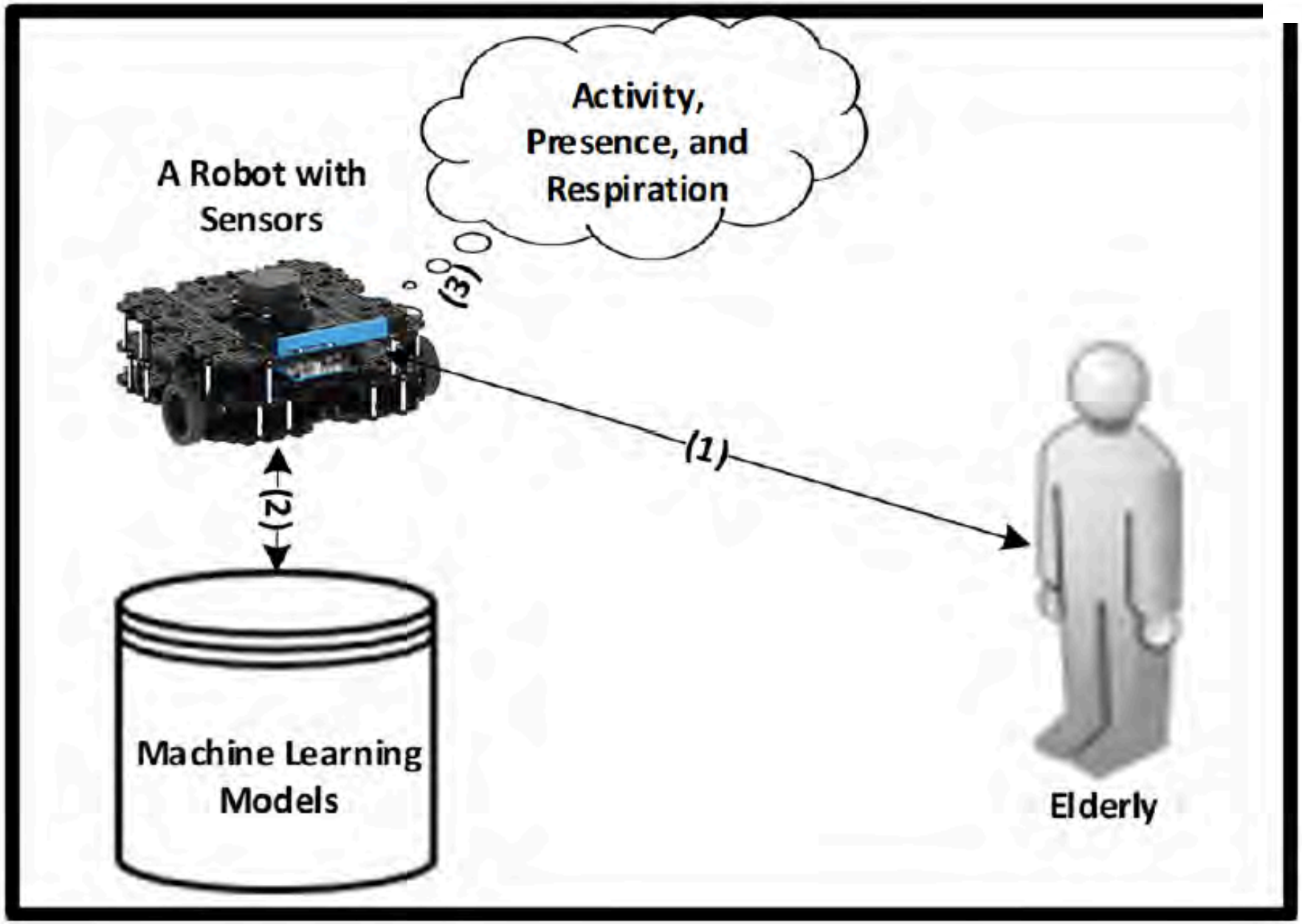
Research Council of Norway grant 247697

Goal: Create and evaluate multimodal mobile **human supportive systems** that are able to **sense, learn and predict future events**.



Funding: *FRINATEK*
Research Council of Norway

The Research Council of Norway


Activity,
Presence, and
Respiration
A Robot with
Sensors
(3)
(1)
(2)
Machine Learning
Models
Elderly

Elderly Care with Robot Companion

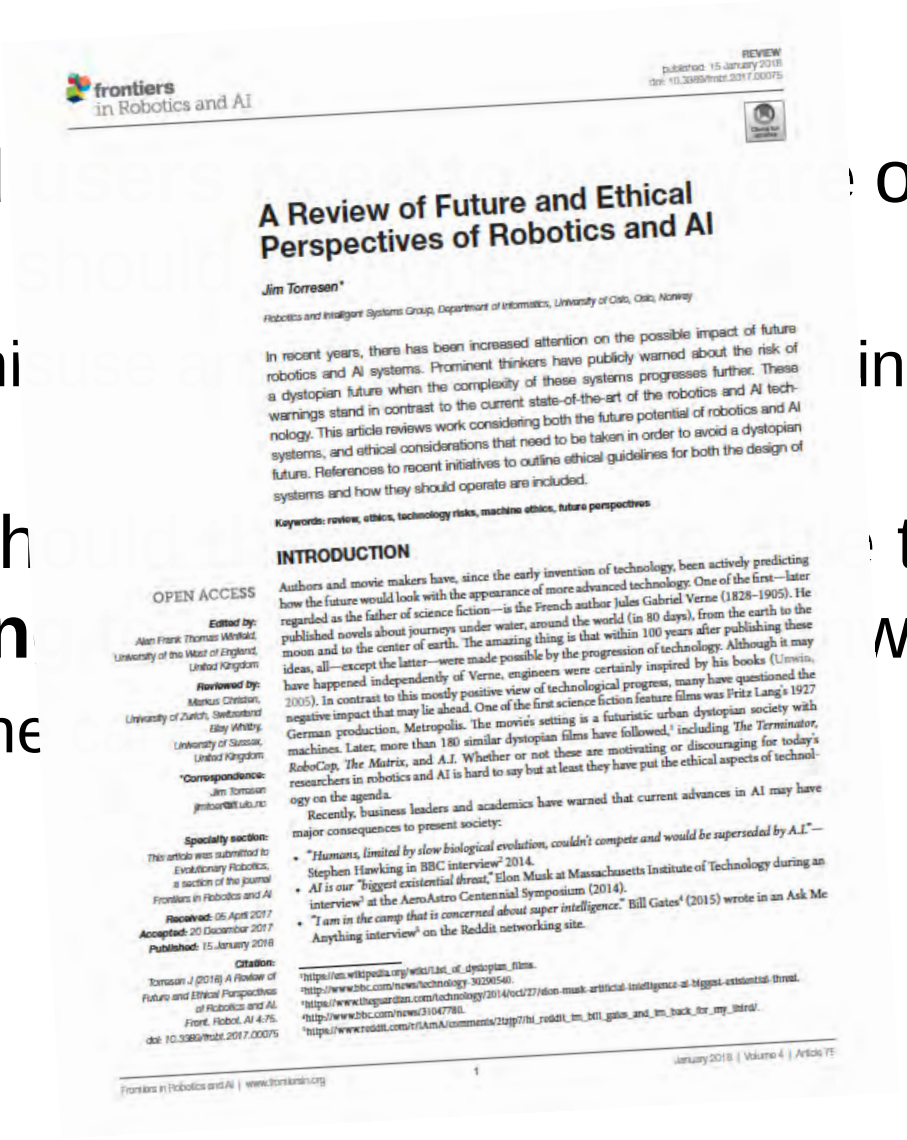
- Move from permanent and fixed room surveillance to **flexible and adaptive**
  - Increased privacy
  - Increased accuracy
- Active testing involving **real environments**
- **Detect and predict** falls and other non-normal situations to **notify caregiver**.
  - In emergency situations, the **robot –** rather than the elderly – **activates the safety alarm**.

Ethical Concerns

1. privacy
2. security
3. safety
4. potential lack of contact with other humans

Ethical Countermeasures

- **Designers and** of possible ethical challenges that
  - e.g. avoiding mi inspection of the functionality
- The **systems** sh to **do ethical decision makin** wanted behavior
  - Decide when the



frontiers in Robotics and AI

REVIEW
published: 15 January 2018
doi: 10.3389/frobt.2017.00075

A Review of Future and Ethical Perspectives of Robotics and AI

*Jim Torresen**

Robotics and Intelligent Systems Group, Department of Informatics, University of Oslo, Oslo, Norway

In recent years, there has been increased attention on the possible impact of future robotics and AI systems. Prominent thinkers have publicly warned about the risk of a dystopian future when the complexity of these systems progresses further. These warnings stand in contrast to the current state-of-the-art of the robotics and AI technology. This article reviews work considering both the future potential of robotics and AI systems, and ethical considerations that need to be taken in order to avoid a dystopian future. References to recent initiatives to outline ethical guidelines for both the design of systems and how they should operate are included.

Keywords: review, ethics, technology risks, machine ethics, future perspectives

INTRODUCTION

Authors and movie makers have, since the early invention of technology, been actively predicting how the future would look with the appearance of more advanced technology. One of the first—later regarded as the father of science fiction—is the French author Jules Gabriel Verne (1828–1905). He published novels about journeys under water, around the world (in 80 days), from the earth to the moon and to the center of earth. The amazing thing is that within 100 years after publishing these ideas, all—except the latter—were made possible by the progression of technology. Although it may have happened independently of Verne, engineers were certainly inspired by his books (Unwin, 2005). In contrast to this mostly positive view of technological progress, many have questioned the negative impact that may lie ahead. One of the first science fiction feature films was Fritz Lang's 1927 German production, Metropolis. The movie's setting is a futuristic urban dystopian society with machines. Later, more than 180 similar dystopian films have followed,[1] including *The Terminator*, *RoboCop*, *The Matrix*, and *A.I.* Whether or not these are motivating or discouraging for today's researchers in robotics and AI is hard to say but at least they have put the ethical aspects of technology on the agenda.

Recently, business leaders and academics have warned that current advances in AI may have major consequences to present society:

- *"Humans, limited by slow biological evolution, couldn't compete and would be superseded by A.I."*—Stephen Hawking in BBC interview[2] 2014.
- *AI is our "biggest existential threat,"* Elon Musk at Massachusetts Institute of Technology during an interview[3] at the AeroAstro Centennial Symposium (2014).
- *"I am in the camp that is concerned about super intelligence."* Bill Gates[4] (2015) wrote in an Ask Me Anything interview[5] on the Reddit networking site.

OPEN ACCESS

Edited by: Alan Frank Thomas Winfield, University of the West of England, United Kingdom

Reviewed by: Markus Christen, University of Zurich, Switzerland; Eleay Whitby, University of Sussex, United Kingdom

***Correspondence:** Jim Torresen jimtoer@ifi.uio.no

Specialty section: This article was submitted to Evolutionary Robotics, a section of the journal Frontiers in Robotics and AI

Received: 05 April 2017
Accepted: 20 December 2017
Published: 15 January 2018

Citation: Torresen J (2018) A Review of Future and Ethical Perspectives of Robotics and AI. *Front. Robot. AI* 4:75. doi: 10.3389/frobt.2017.00075

[1] https://en.wikipedia.org/wiki/List_of_dystopian_films.
[2] http://www.bbc.com/news/technology-30290540.
[3] https://www.theguardian.com/technology/2014/oct/27/elon-musk-artificial-intelligence-ai-biggest-existential-threat.
[4] http://www.bbc.com/news/31047780.
[5] https://www.reddit.com/r/IAmA/comments/2tpp7/hi_reddit_im_bill_gates_and_im_back_for_my_third/.

International Work on Ethics and AI

- IEEE Standards Association
  - Prioritizing Human Wellbeing with Artificial Intelligence and Autonomous Systems
- ISO/IEC JTC 1/SC 42 Artificial intelligence
  - Standardization in the area of Artificial Intelligence
- EU High-Level Expert Group on Artificial Intelligence
  - 52 experts on Artificial Intelligence, comprising representatives from academia, civil society, as well as industry.
  - support the implementation of the European strategy on Artificial Intelligence.
  - recommendations on future-related policy development and on ethical, legal and societal issues related to AI, including socio-economic challenges.

Regjeringen.no

Regjeringen vil ha nasjonal strategi for kunstig intelligens

Pressemelding | Dato: 08.02.2019

Strategien skal være ferdig i løpet av 2019.

– Kunstig intelligens er en teknologi som kan få stor betydning for samfunnsutviklingen. Kunstig intelligens kan gi oss helt nye verktøy for å løse samfunnsutfordringer, forbedre offentlig tjenester og bidra til økt verdiskaping i næringslivet. Men teknologien innebærer også utfordringer, særlig knyttet til etikk og personvern. Regjeringen vil derfor utarbeide en helhetlig strategi på dette viktige feltet, sier digitaliseringsminister Nikolai Astrup.

Forskningsetisk betenkning om kunstig intelligens

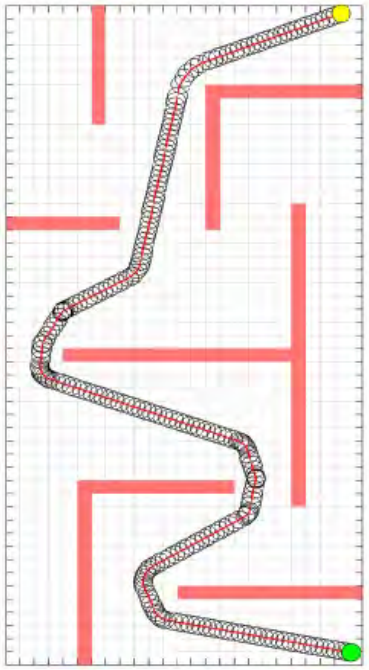
første versjon under ferdiggjøring

- **NENT - Den nasjonale forskningsetiske komité for naturvitenskap og teknologi**
- **Kunstig intelligens arbeidsgruppe** som skriver en rapport om:
  - **identifisere** og **beskrive** de mest presserende **forskningsetiske spørsmålene** som oppstår med kunstig intelligens forskning i dag.
  - Bidra til **økt bevissthet, veiledning** og **diskusjon** om disse spørsmålene.
- Baseres seg på internasjonalt arbeid og kommunikasjon med KI-forskningsmiljøer i Norge

MECS
Multimodal Elderly Care Systems

MECS Research

Diana Saplacan
Rebekka Soma
Trenton Schulz



User needs and preferences

+ Master students

Robot sensing

Robot control

Apply sensors that provides non/less-intrusive sensing

Navigation without a map

Md. Zia Uddin

Weria Khaksar

User Centered Design – Participatory Design

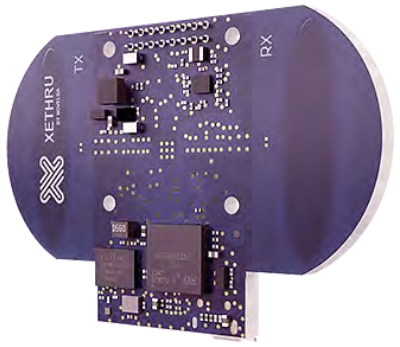
- involve real users in **actual use contexts** (home of elderly)
- focus on behavior and **satisfying the needs** and desires of the users
- achieve improvements through **iterative testing and improvement**

- Oslo municipality elderly care facility: **Kampen Omsorg +**

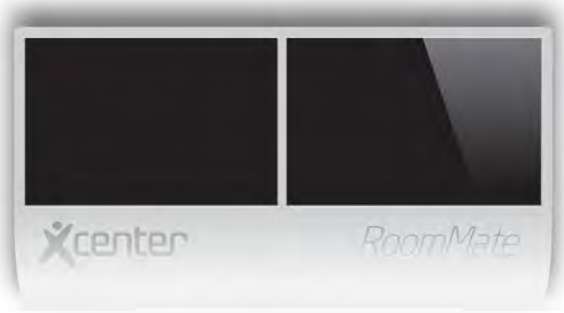
Ethical Concerns: 1. Privacy

- Challenge 1: Balance the **privacy of the elderly** against the **needs for data** collection for having an efficiently functioning elderly care systems.
- Challenge 2: Protection of sensitive data to **avoid unwanted distribution and misuse** of such data.
- Mitigation:
  - **Sensor type:** Use sensors collecting less privacy related information
  - **Sensor data processing**: Process data locally rather than sending sensor data over Internet

MECS project explores a number of novel non/less-intrusive sensors



Novelda XeThru



RoomMate

Non/less-Intrusive Sensing (thermal camera)

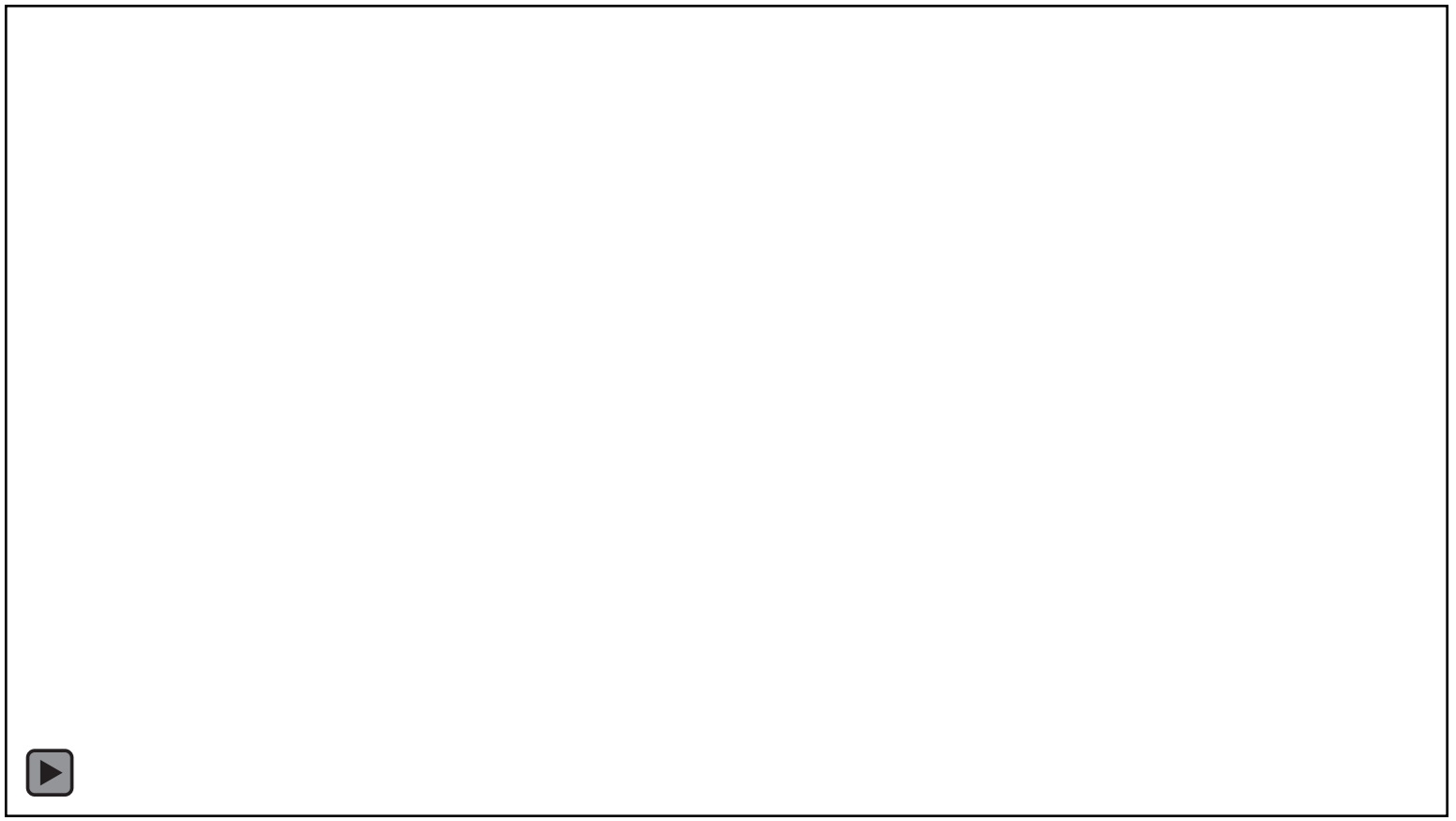
Ethical Concerns: 2. Security

- Concern 1: **Sensing** – possible theft and unwanted distribution of sensor data from a robot.
- Concern 2: **Control** – risk of misbehaviour of the robot in similar ways as computers can be attacked with malware.
- **Mitigation** 1: Regular security measures with **passwords and authentication**
- **Mitigation** 2: Add an **external user assessment** module that can consider the current context (ref. ethical reasoning engine)

Ethical Concerns: 3. Safety

- Challenge: Robots getting **physically much closer to humans** than what we are used to. => Can hit us unintentionally or hurt us through un-authorized access
- Trade-off between robot size, performance and safety
- Mitigation:
  - Equip robots with **soft material**
  - Provide a self-aware adaptable system that can **learn about the user´s daily activities** and preferences

Sampling based Navigation System



Ethical Concerns: 4. Potential lack of contact with other humans

- Care givers can make **robots take care of the manual work** in a home to free time to talk and interact rather than doing practical work.
- **Politicians and society to decide**, including on the staffing within elderly care.
- People in a family may, in general, have **more free time** (robots take over jobs), including time to spend together with elderly family members.

UiO : Department of Informatics
University of Oslo

Centre of Excellence for Interdisciplinary Studies in Rhythm, Time and Motion

grant 262762

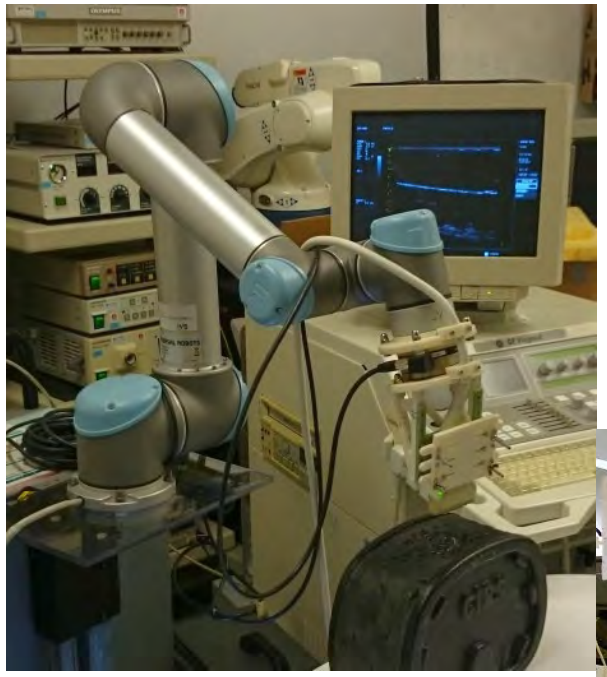
- The center will study the **perceptual** and **cognitive mechanisms** underlying our ability to experience the rhythm and act rhythmically.
- Interdisciplinary **collaboration** between **musicology, psychology** and **informatics.**
- Machine learning and robotics to be applied

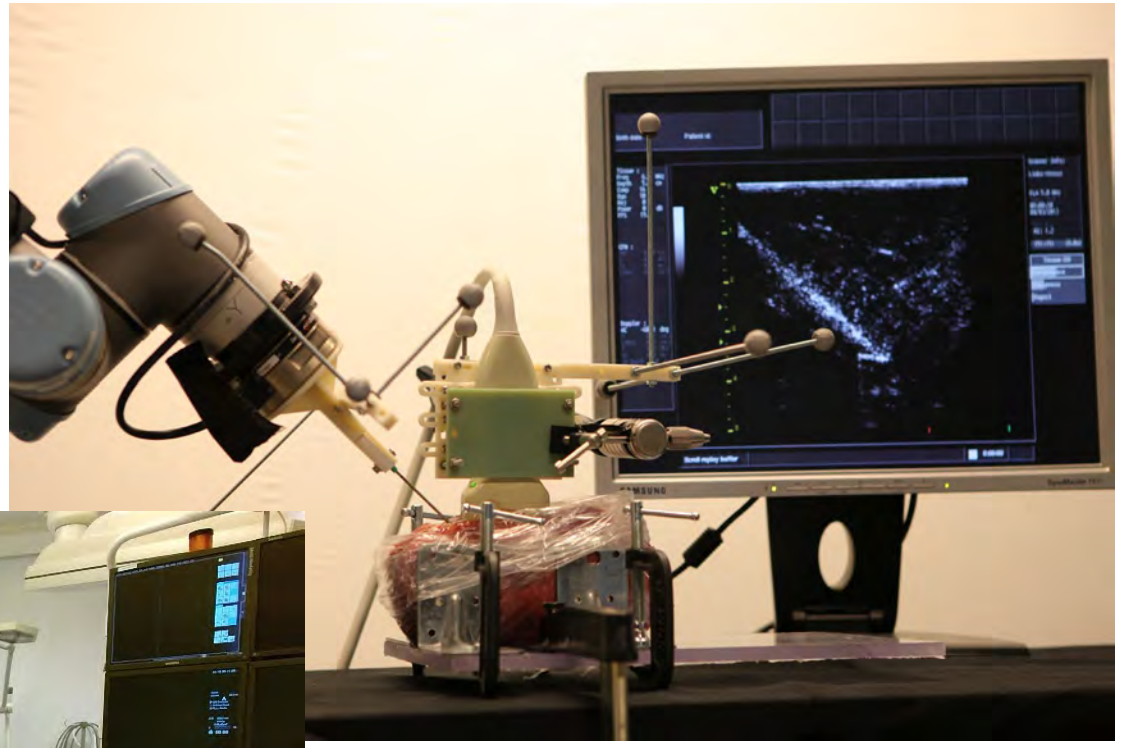
The Research Council of Norway

Norwegian Centre of Excellence

The Research Council of Norway

Robot Supported Surgery – Oslo Universitets-sykehus (OUS) – Ole Jakob Elle (prof. II ROBIN)

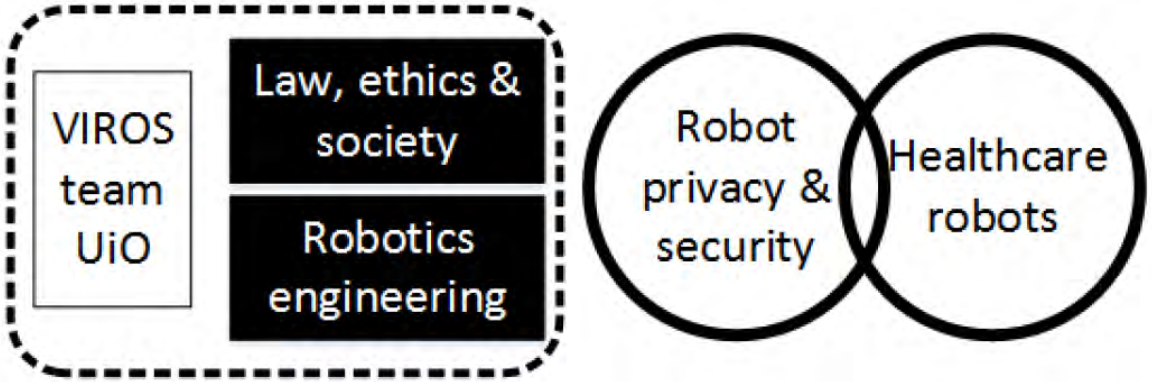




UiO : Department of Informatics
University of Oslo

VIROS: Vulnerability in the Robot Society (2019-2023)

Research Council of Norway grant 288285



Dep. of Private Law + Dep. of Informatics and other depts/partners

Goal:

Develop technology and proposals for **regulatory measures** to reduce vulnerabilities regarding robotics. **Focus on privacy, security and safety**, particularly in healthcare contexts.

Vacancies
1 PhD + 1 Postdoc
Contact:
jimtoer@ifi.uio.no

Funding: *IKTPLUSS, Research Council of Norway*

The Research Council of Norway

https://www.jus.uio.no/ifp/english/research/projects/nrccl/viros/index.html

Les mer om kunstig intelligens: hva er KUNSTIG INTELLIGENS

Innhold:

- Kunstig intelligens og intelligente systemer
- Problemløsning med kunstig intelligens
- Evolusjon, utvikling og læring
- Sansing og oppfatning
- Bevegelse og robotikk
- Hvor intelligente kan og bør maskiner bli?

UiO : Department of Informatics
University of Oslo

ICDL-EPIROB 2019 Oslo, Norway

9th Joint IEEE International Conference on Development and Learning and on Epigenetic Robotics
19-22 August 2019, Oslo, Norway
Web page: https://icdlepirob2019.wordpress.com

We should focus as least as much on improved quality of life as reducing the cost of healthcare equipment and services

Questions?

Make contact: jimtoer@ifi.uio.no