

Virtual visit of Ingrid and Stephan

4 December 2020

Robotics and Intelligent Systems group



Robotics and Intelligent Systems (ROBIN)



Jim Tørresen
Professor, Group leader



Mats Høvin
Assoc. Prof.



Kyrre Glette
Assoc. Prof.



Kai Olav Ellefsen
Assoc. Prof.



Yngve Hafting
Ass. Prof.



Vegard D Søyseth
Principal Engineer

Postdocs:
Frank Veenstra (IFI)



Michael Joseph
Krzyzaniak (RITMO)



Ulysse Côté-Allard
(INTROMAT)



Hoang Minh Pham
(INTROMAT)



NN in VIROS project

Adjunct positions (20%):

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

PhD students (ROBIN main superv.):

Adel Baselizadeh
Benedikte Wallace (RITMO)
Bjørn Ivar Teigen (DOMOS)
Eivind Samuelsen
Emma H Stensby
Farzan M. Noori
Julian Fuhrer (RITMO)
Jørgen Nordmoen
Mojtaba Karbasi (RITMO)
Sondre Engebråten (FFI)
Tom Frode Hansen (NGI)

Students: Bachelor ~200; Master: ~50
Robotics and Intelligent Systems program

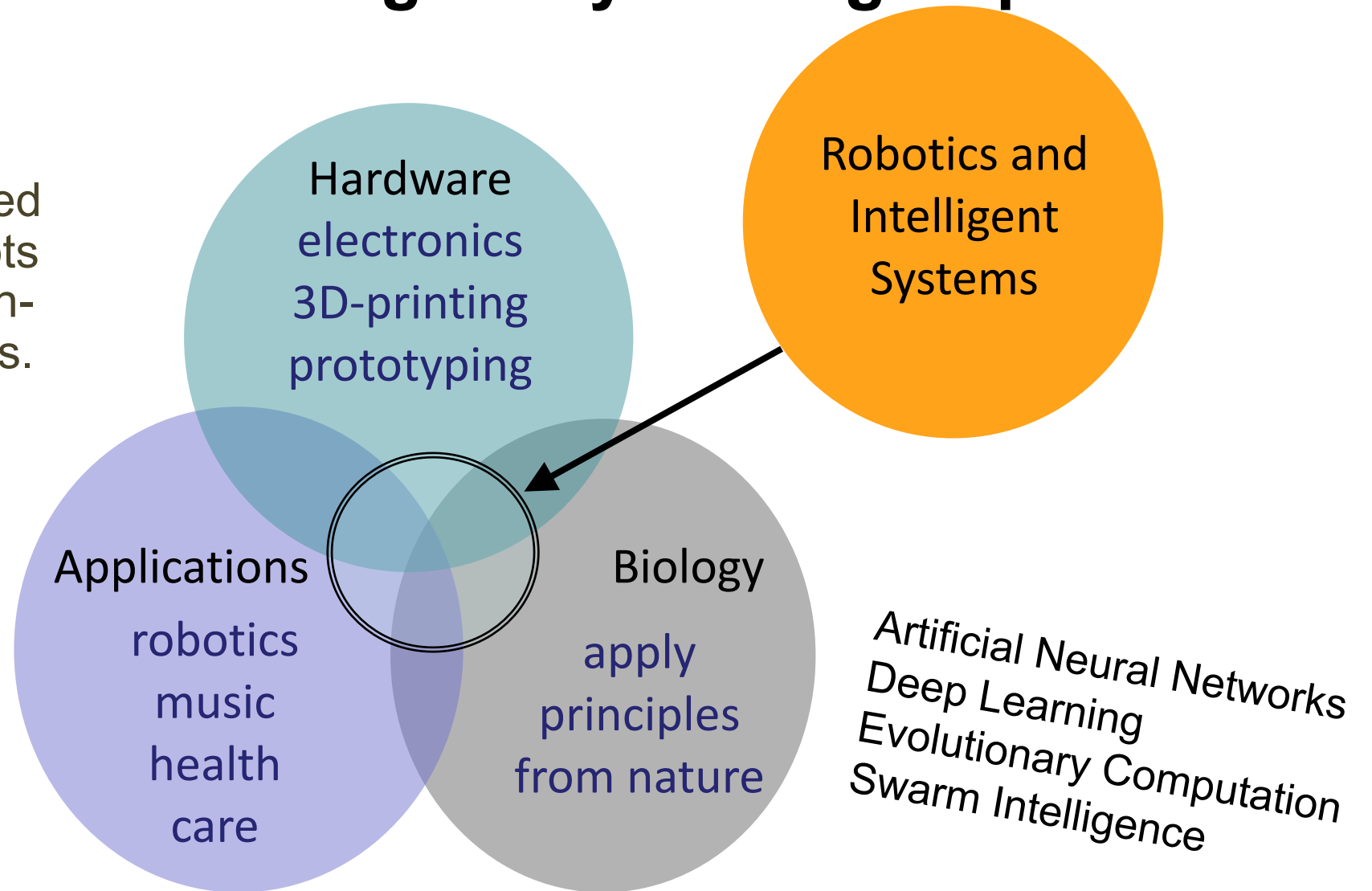
Students hired on hourly basis
(Sebastian og Abbas)

Visiting researchers

Robotics and Intelligent Systems group

ROBIN

Creating embedded systems and robots for demanding run-time environments.



Motion Capture Facilities (ROBIN)

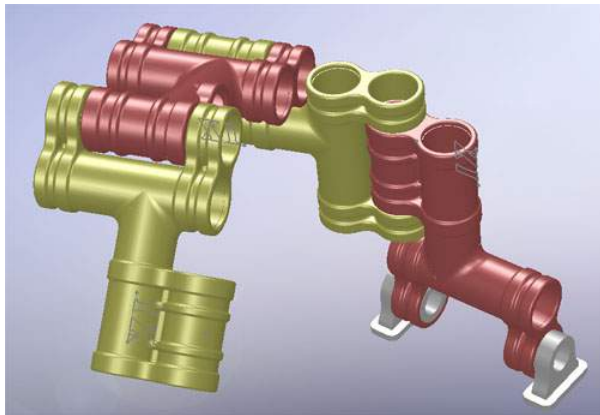
- Allows precise tracking of human and robot motion
- Camera-based and on-body motion capture



Rapid Prototyping Facilities (ROBIN)



- 3D printers and milling machines
- Large potential for developing innovative robot systems.



Rapid Prototyping Facilities

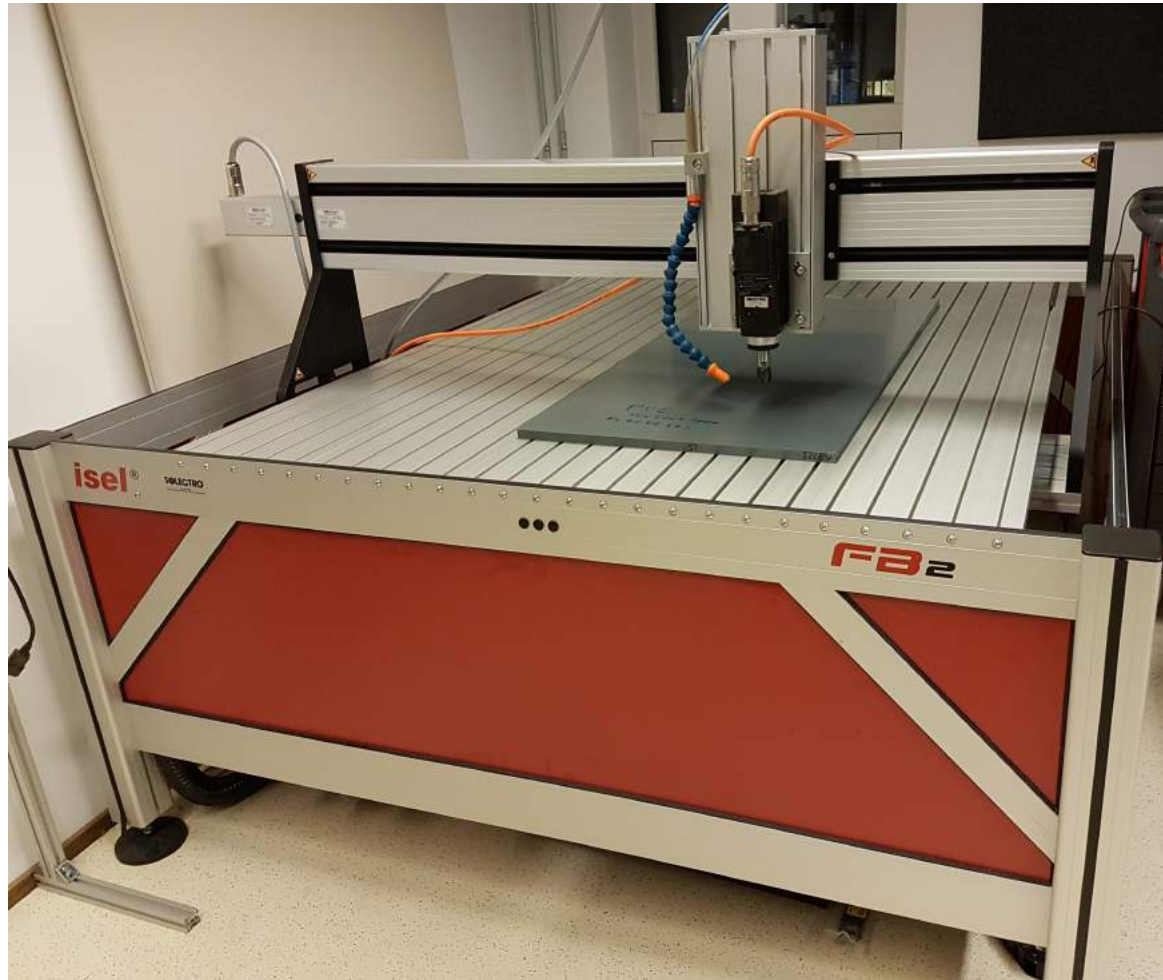
3D-printers (ROBIN)



Markforged Mark X
(carbon fiber 3D printer)

Rapid Prototyping Facilities

Milling Machines (ROBIN)



Robotics and Intelligent Systems (ROBIN) research group

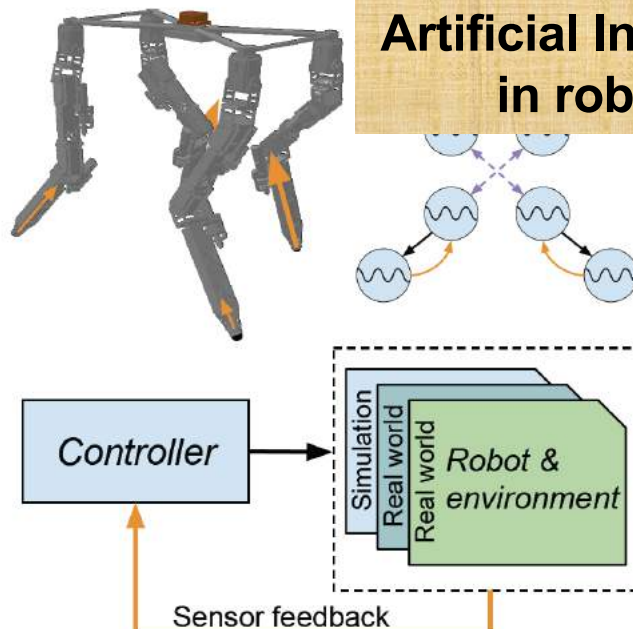
Artificial Intelligence
in smartphones

Interactive music

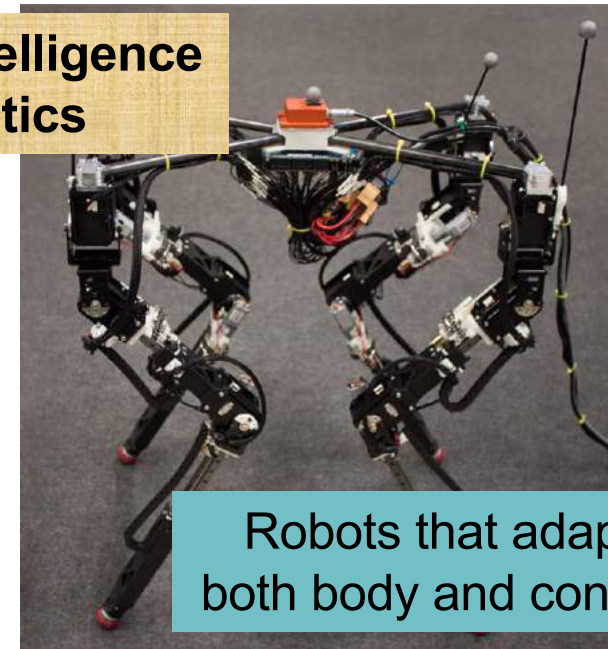
Adaptive and autonomous
mental health treatment



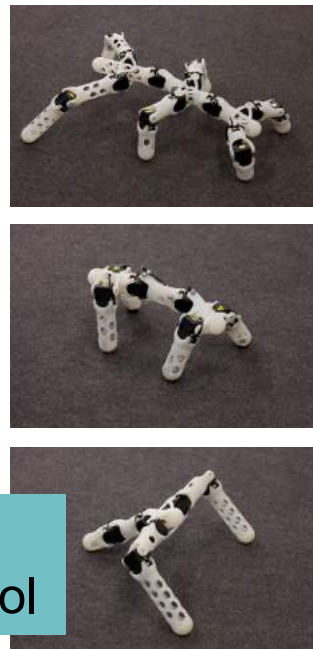
Robots that look after older
single people living at home



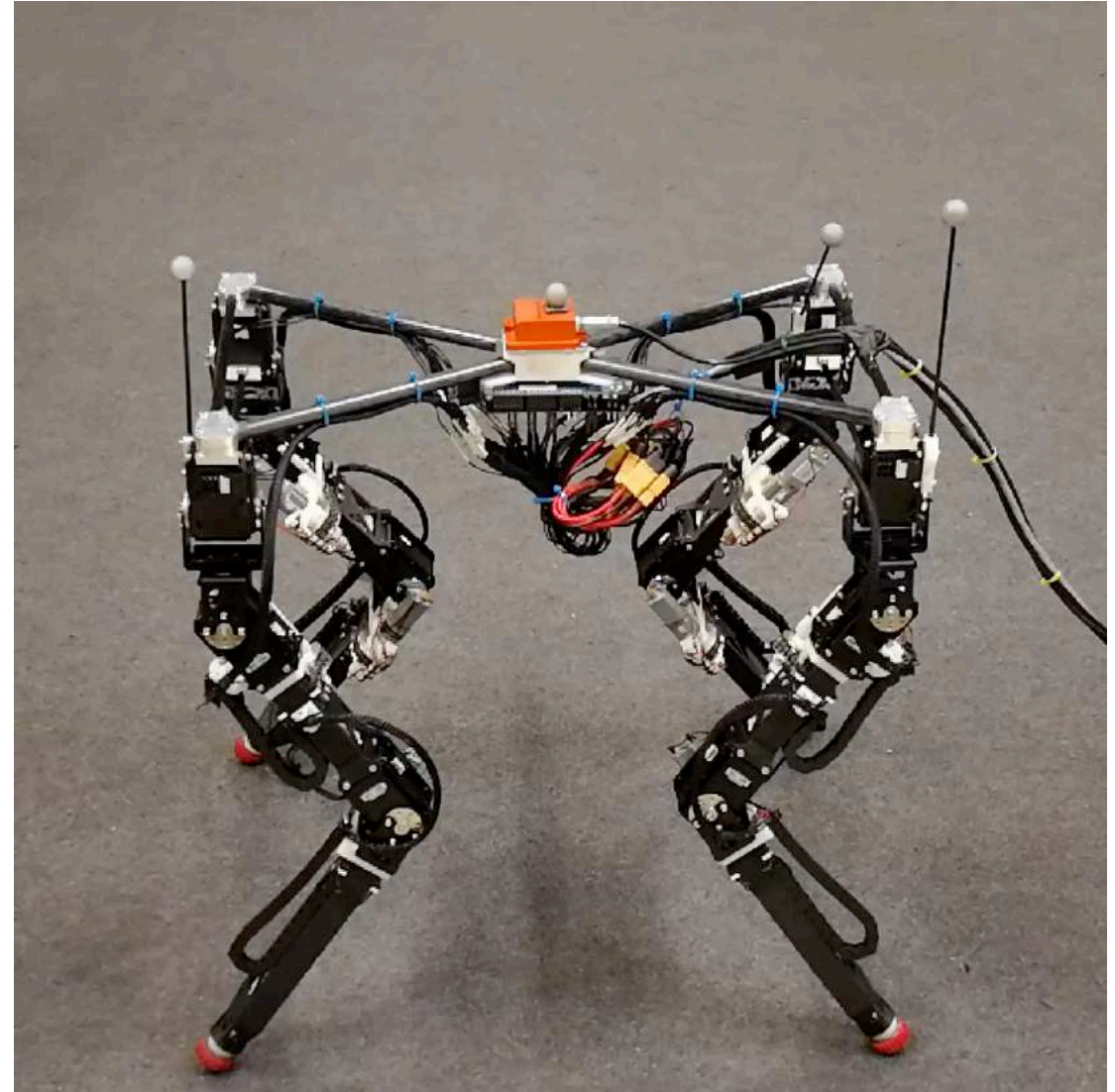
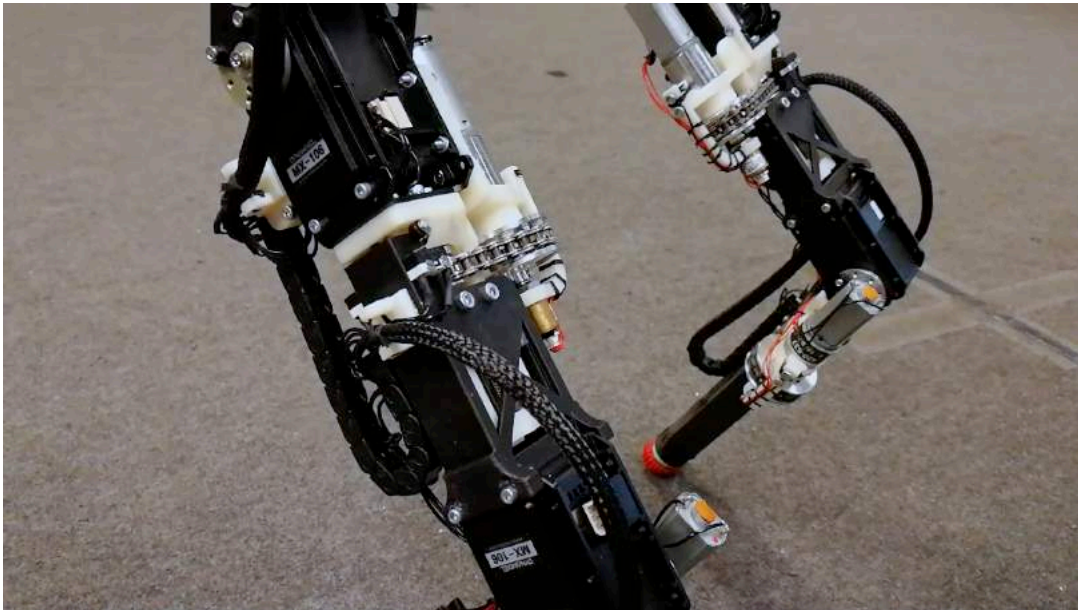
Artificial Intelligence
in robotics



Robots that adapt
both body and control



Real-World Adaptive Robot: Dynamic Robot for Embodied Testing (DyRET) (Norwegian for "the animal") PhD student Tønnes Nygaard



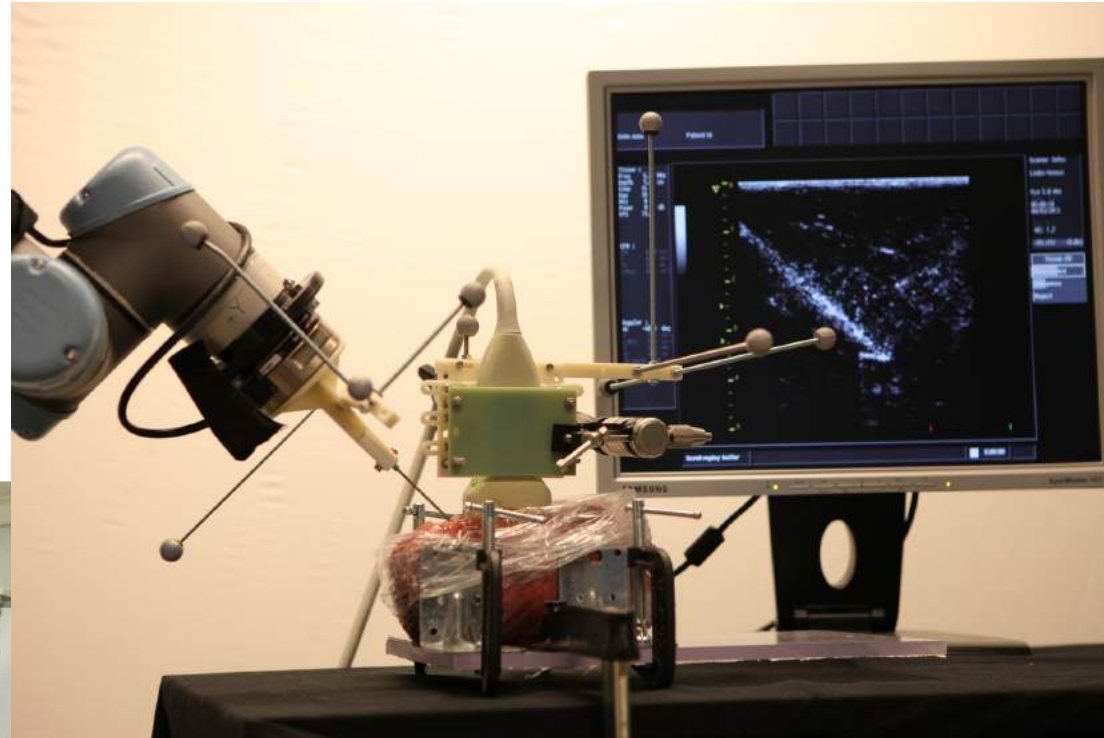
Generative Design

- **Automatic shape generation** of printed parts optimized against external/internal goals.
- At the ROBIN group we are using generative design for **automatic optimization of physical shapes** for 3D printing and CNC machining.
- Any goal or combination of goals (multi-objective) can be used as long as they can be measured or calculated.
Examples: strength/weight, momentum, moment of inertia, resonance frequency, temperature conductivity/expansion, aesthetics, specific shape etc.



Robot Surgery (National University Hospital)

Ole Jakob Elle (adjunct position in ROBIN)



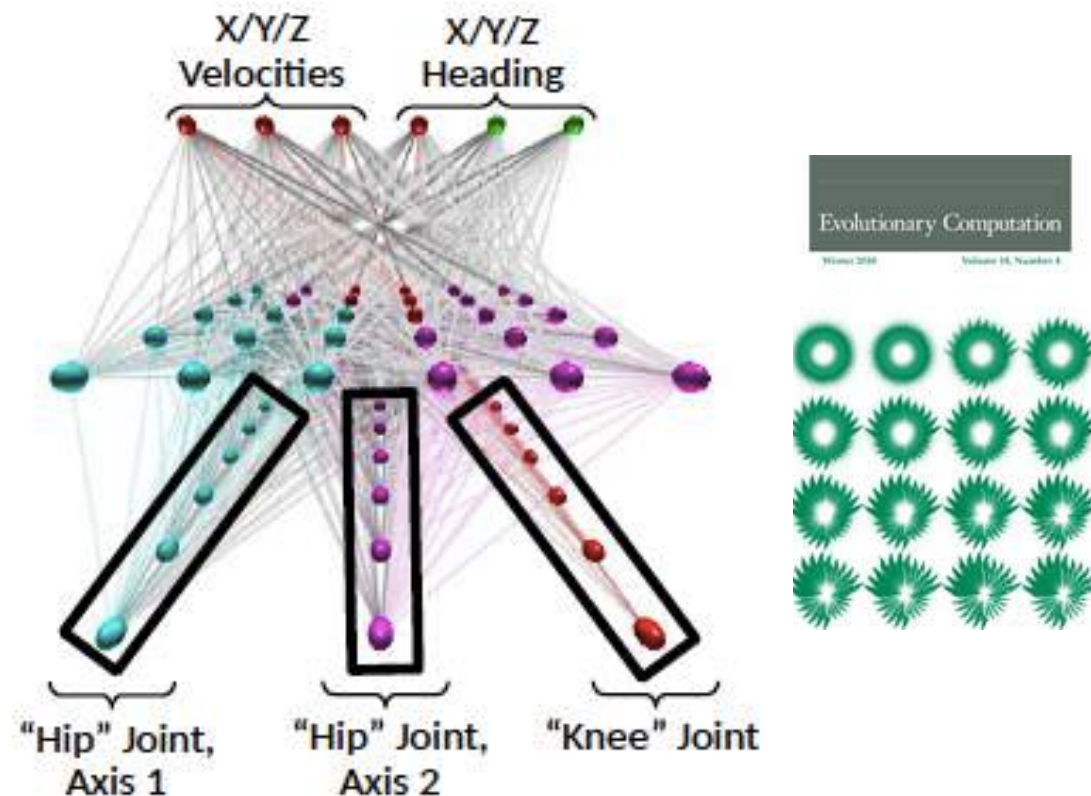
ROBIN group: AI and Machine Learning Techniques

- Feature Extraction (PCA variants, OpenPose, ++)
- Deep learning
 - Classification: CNN
 - Forecasting: RNN
- Deep reinforcement learning (robot control)
- Evolutionary computation (robot design and control, neuroevolution)
- Neuro-fuzzy systems (robot control)
- Transfer learning/user adaptive models
- Training with sparse data (oversampling)

Guiding Neuroevolution with Structural Objectives

- New ways of training neural networks

- Introduce new ways of controlling the structure of a network
- Neuroevolution trains networks using two new objectives:
 - user-recommended de-composition
 - a high diversity in de-compositions



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, 2015–2021, IKTPLUS)
- **Introducing personalized Treatment Of Mental health problems using Adaptive Technology** (INTROMAT, 2016-2021, LightHouse project)
- **Vulnerability in the Robot Society** (VIROS, 2019-2023, IKTPLUS)
- **Predictive and Intuitive Robot Companion** (PIRC, 2020-2025, IKTPLUS)
- **Centre of Excellence for Interdisciplinary Studies in Rhythm, Time and Motion** (RITMO, 2017-2027, CoE)



RITMO Centre of Excellence for Interdisciplinary Studies in Rhythm, Time and Motion grant 262762 (2017-2027)

- The center will study the **perceptual, cognitive** and **acting mechanisms** underlying our ability to experience rhythm and act rhythmically.
- Interdisciplinary **collaboration** between **musicology, psychology, computer science** and **robotics** (10 PIs and 2 leaders)
- Machine learning and robotics to be applied (Kyrre and Jim PIs)

<https://www.uio.no/ritmo/english>

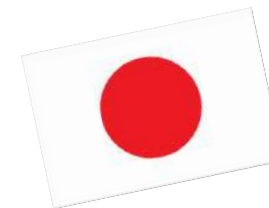


The Research Council
of Norway



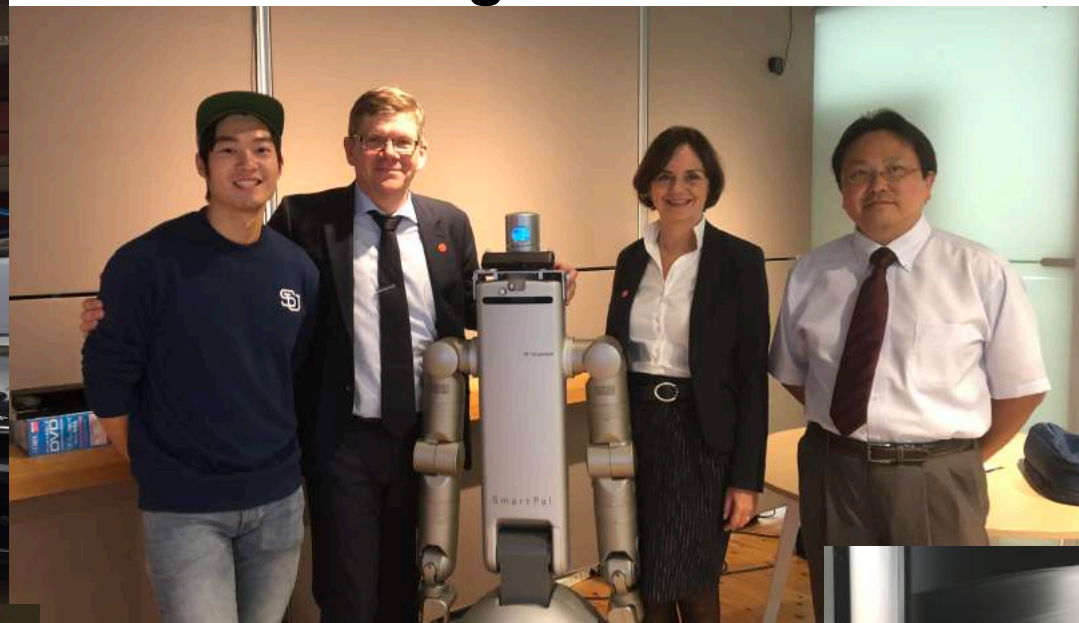


DR. SQUIGGLES



International Collaboration

COINMAC grant 261645



Collaboration on Intelligent Machines

Norway ↔ US, Brazil and Japan

Project manager: Jim Torresen, grant 261645



- Short term mobility stay for meetings
- Sharing and development of curriculum and teaching material for courses
- Long term mobility stay (students)
- Intensive course/student workshop
- Workshop/conference org. activities
- New collaborations/guest lectures



The Research Council
of Norway

Funding: INTPART 2017-2023



Norwegian Agency for
International Cooperation
and Quality Enhancement
in Higher Education

9th Joint IEEE Int. Conference of Developmental Learning and Epigenetic Robotics

19-22 August 2019 in Oslo, Norway



ROBIN/RITMO Lab Tour



Social Events

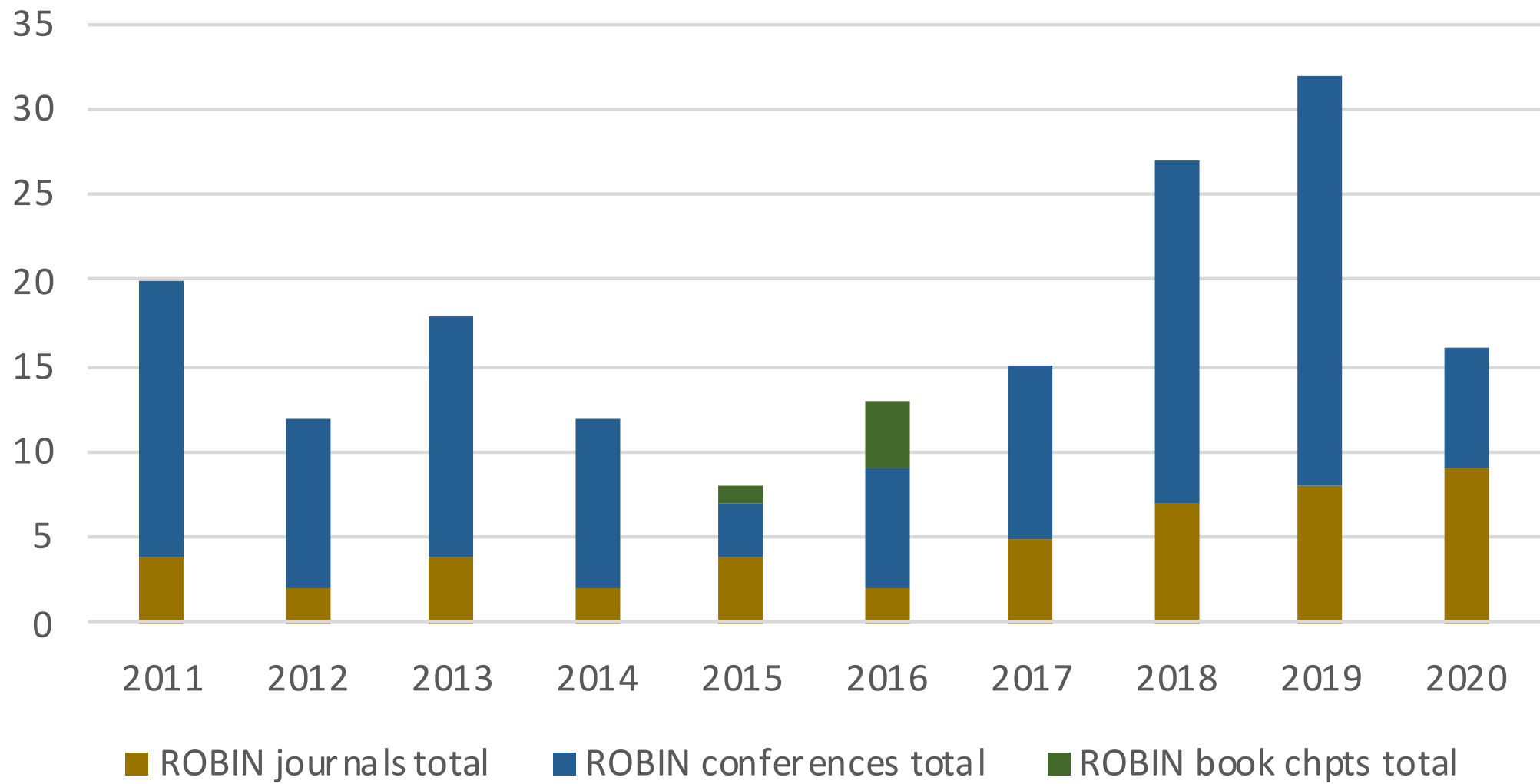
Reception in Oslo City Hall



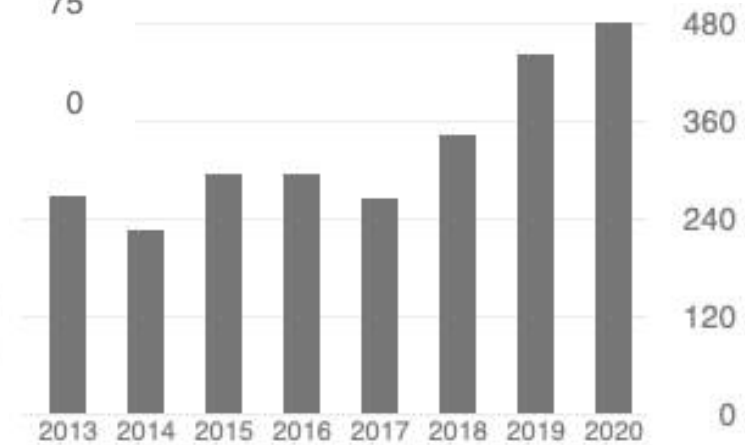
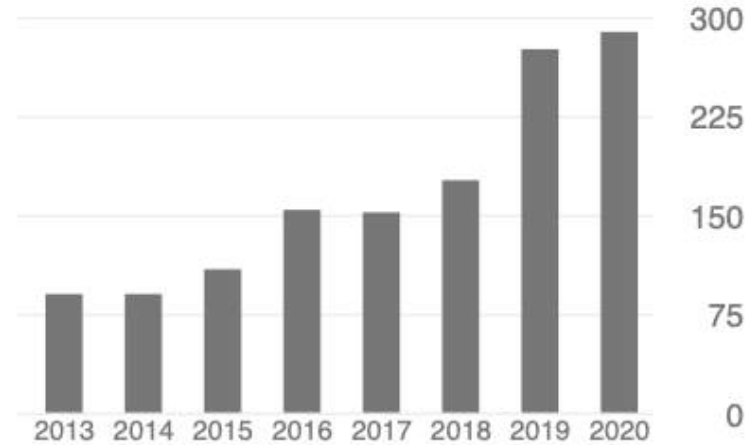
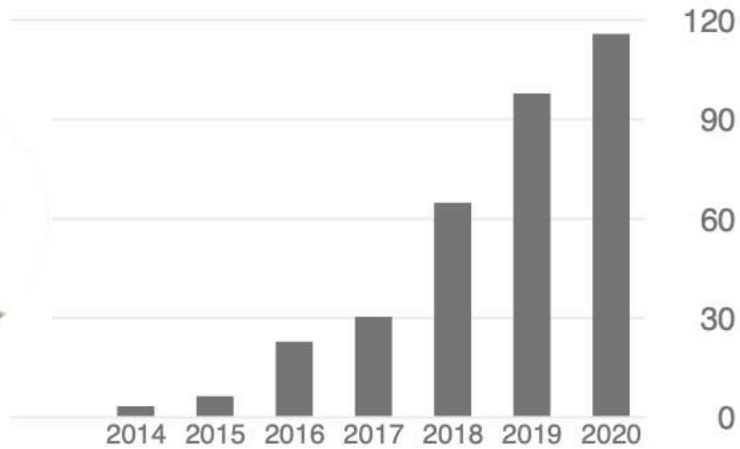
Oslo Fjord Banquet



ROBIN peer-reviewed publications



Increasing annual citations for ROBIN staff



Media/Minister Attention I

På laben fikk næringsministeren
demonstrert ansiktsuttrykk-tolkning.

Media/Minister Attention II



Academic/social ROBIN Activities

- Lunch (~12:00–12:30)
- Seminar (staff + students)
 - Technology intro/journal review
 - Present own research
- Birthday cake
 - The one last having birthday brings cake
- Christmas party
 - downtown or holmenkollen, with last year master students
- Summer barbeque (outside OJD building)



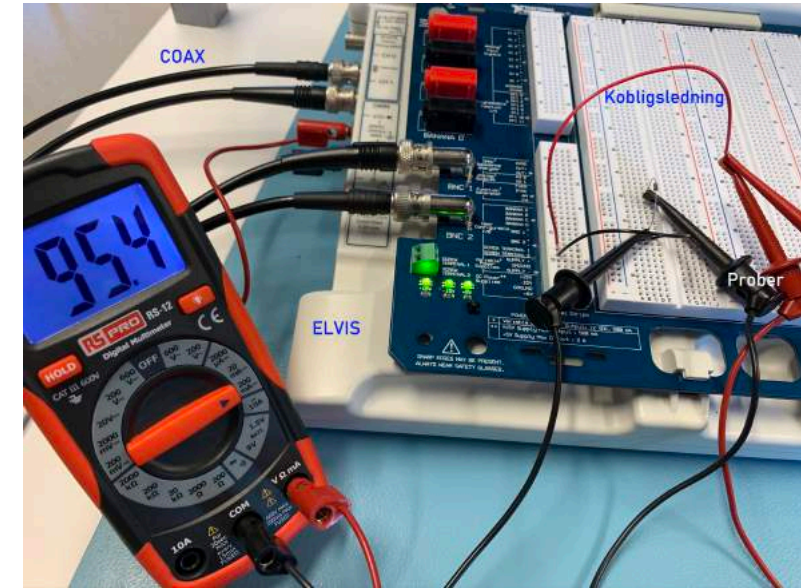
Informatikk: robotikk og intelligente systemer (bachelor)

Yngve Hafting er
programrådsleder og er
også representant i
undervisningsutvalget (UU)

6. semester	IN3050 – Introduksjon til kunstig intelligens og maskinlæring	IN3160 – Digital systemkonstruksjon	EXPHIL03 – Examen philosophicum
5. semester	Utviklingssemester		
4. semester	IN3140 – Introduksjon til robotikk	IN1030 – Systemer, krav og konsekvenser	IN2070 – Digital bildebehandling/INF2310 – Digital bildebehandling (videreført)/FYS-MEK1110 – Mekanikk/IN2140 – Introduksjon til operativsystemer og datakommunikasjon
3. semester	IN2010 – Algoritmer og datastrukturer	IN2060 – Digitalteknikk og datamaskinarkitektur	MAT1120 – Lineær algebra/STK1000 – Innføring i anvendt statistikk
2. semester	IN1010 – Objektorientert programmering	IN1080 – Mekatronikk	MAT1110 – Kalkulus og lineær algebra
1. semester	IN1000 – Introduksjon til objektorientert programmering og HMS-emner	IN1020 – Introduksjon til datateknologi	MAT1100 – Kalkulus

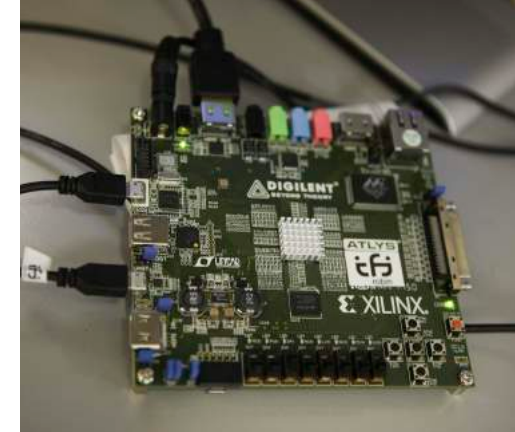
ROBIN Courses (Bachelor)

- IN1080 – Mekanikk (spring)
 - Basic analog electronics, sensors and sensor interfaces, actuators.
 - Programming of mechatronic systems.
- IN2060 – Digitalteknikk og datamaskinarkitektur (autumn)
 - The course addresses principles in digital design
 - Such as combinatorial and sequential logic, state machines and digital building blocks, and builds on this to introduce processor architectures, pipelining, cache, and the interface between hardware and program code.



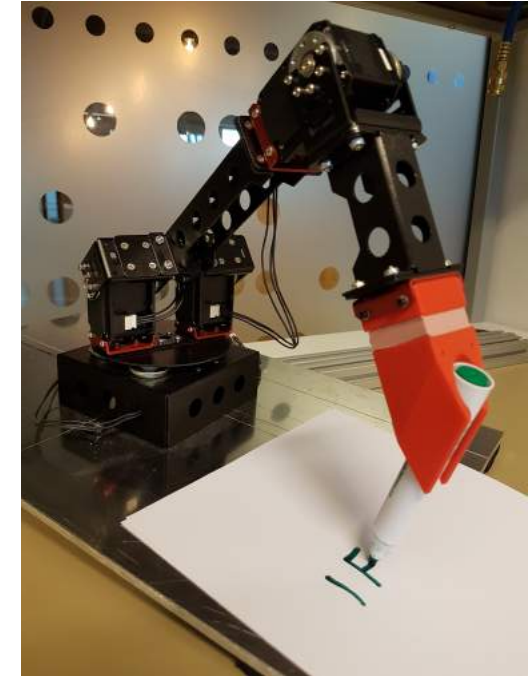
ROBIN Courses 1 – Spring

- IN3160/4161 Digital System Design
 - Design with reconfigurable logic
 - Lab assignments giving practical experience
- IN3050/4050 Introduction to Artificial Intelligence and Machine Learning
 - Introduction to artificial intelligence/machine learning
 - Practical assignments in implementing evolutionary computation and artificial neural networks



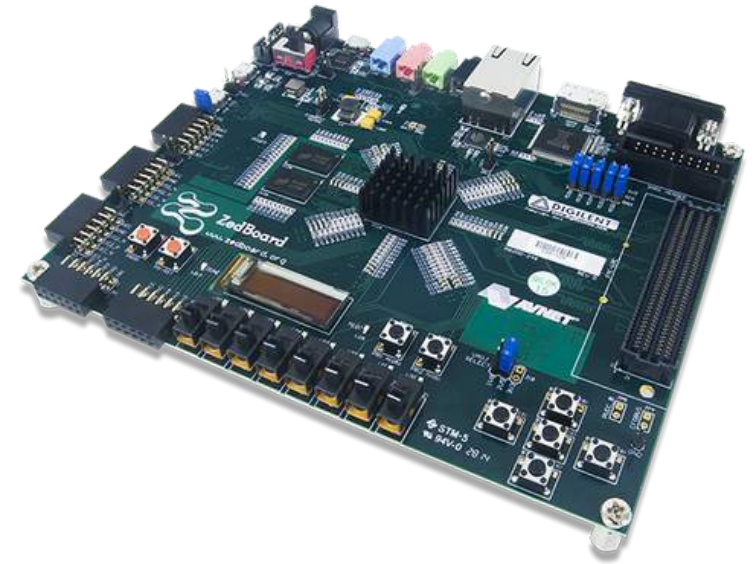
ROBIN Courses 2 – Spring

- IN3140/4140 Introduction to robot techn.
 - Mechanical structure and control of robots, and their applications
 - Laboratory practice to learn simple robot programming
- IN5590 Rapid Prototyping of Robotic Systems
 - An introduction to computer aided design (CAD), rapid prototyping (3D printing) and computer numerical control (CNC/CAM) of milling machines.
 - The knowledge is applied to design, simulate, build and program a robotic/mechatronic system.



ROBIN Courses (Master) – Autumn

- IN5490 Advanced Topics in Artificial Intelligence for Intelligent Systems
 - Selected topics and methods within artificial intelligence (AI), machine learning (ML) and their applications
 - Learn about doing research and writing papers
- IN5200 – Advanced Digital System Design
 - In-depth coverage of systematic development, simulation and synthesis of advanced digital System-on-Chip (SoC) on FPGA (Field Programmable Gate Array) technology.
 - Lab assignments provide hands-on experience in how SoC design is simulated and implemented in FPGA hardware.



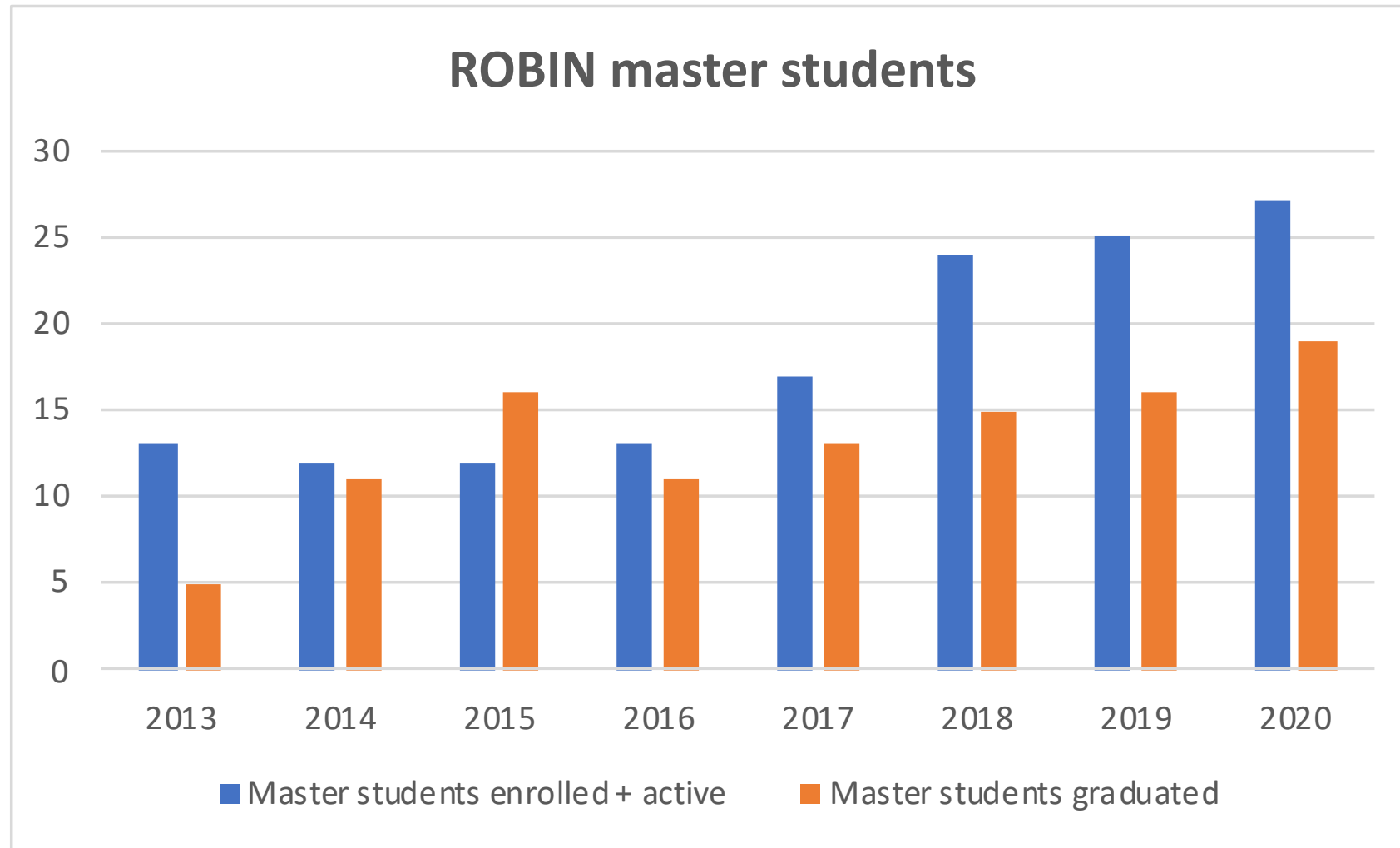
Søkertall masterprogrammer IFI

fakulte..	STUDIEPROGRAM	opptaksramme (LOD)			1.prioritet		
		2018	2019	2020	2018	2019	2020
15 MN	MNM2-AST Astronomi	10	10		22	17	26
	MNM2-BIOS Biovitenskap	100	100		304	323	355
	MNM2-BIS Biodiversitet og systematikk				6	7	4
	MNM2-CS Computational Science	44	44		99	106	125
	MNM2-DS Data Science	10	10		137	135	170

IRIS nr 2 på blant IFI programmene

	MNM2-GEO Geofag	66	66		204	181	167
	MNM2-INFD Informatikk: design, bruk, interaksjon	41	41		122	120	149
	MNM2-INI Informatikk: informasjonssikkerhet						140
	MNM2-INL Informatikk: digital økonomi og ledelse						106
	MNM2-INP Informatikk: programmering og systemarkitektur	158	184		311	326	228
	MNM2-INR Informatikk: robotikk og intelligente systemer	39	51		214	145	152
	MNM2-INS Informatikk: språkteknologi	10	10		21	22	31
	MNM2-KJEMI Kjemi	27	27		84	90	91
	MNM2-MAT Matematikk	20	20		44	54	65
	MNM2-MEK Fluidmekanikk	20	20		30	17	29
	MNM2-MENT Materialvitenskap for energi- og nanoteknologi	19	19		46	48	34
	MNM2-NSA Nettverks- og systemadministrasjon				53		
	MNM2-SMR Stokastisk modellering, statistikk og risikoanalyse	25	25		67	66	72
	MNME-KLIFA Klinisk farmasi				4	6	5

Increasing number of ROBIN Master students



What are ROBIN most proud of?

- **Teaching:** A well running study program (Informatics: Robotics and Intelligent Systems)
- **Labs:** State-of-the-art prototyping facilities and "applied" activity, such as using real robots and hardware systems (integrated both in teaching and research)
- **Research:** A scientifically productive research group
- **Collaboration:** Active international collaboration (staff collaboration and student exchange)

Is there anything that worries ROBIN?

- **Stability:** Sudden changes/worsening in **working conditions** (economically and administratively => worry for a new study reform coming)
- **Offices:** Availability of **office space** that matches the dynamics of the group size
- **Human resources:** Student interest in AI courses and Masters' thesis is growing fast – important that **staff resources** increase to match the demand

What would ROBIN like to improve at IFI?

- **General improvement of administrative SW**
 - Improve existing SW like Inspira, the HR portal (user interface) and Cristin (UI + presentation of content the on web and RCN reports)
 - Cover other needs like for student supervision administration (e.g. a dashboard of students (master and PhD) you are supervising with approved documents)
- **Human resource allocation** to some extent according to activity and production (teaching and research)
- **More incentives for attracting external funding**
 - Strengthening the international profile of our candidates
 - Better support for scientific staff (proposal writing and proj. managem.)
 - Compensate project managers in various ways