Industrial PhD Student Program

Karl-Erik Årzén & Danica Kragic

WASP Industrial PhD program: Why?

- Collaboration between industry and academia is of crucial importance for the dissemination of knowledge from research and development to industry and society at large

- The purpose of the WASP industrial PhD student instrument is to contribute to needs-driven research and to foster in-depth cross-fertilization between academia and industry both in terms of relevant research results and availability of competence

Swedish PhD Education

- Four years at 100% level

- Normally done at 80% level and takes five years
  - University PhD students do 20% teaching
  - Industry PhD students work 20% at the company doing non-research related tasks

- Four years correspond to 240 high school credits (hp)

- All PhD students are required to take 60-120 hp courses
  - Varies depending on department
  - Normally 90 hp (corresponds to 1.5 year full time studies)
  - Normally the departments require that certain mandatory courses are included
  - The WASP mandatory courses are 27 hp, i.e., most courses are not WASP courses

- The rest constitutes the research and the PhD thesis

WASP Industrial PhD Students

- Employed by a company

- PhD studies at a university department of a WASP university

- Four years if 100% research

- Five years if 80% research (20% for other non-research related tasks at the company) – the normal case

- The company receives 600k SEK / year from WASP (100%) or 480k (80%)
  - Includes a travel budget of 30k / year
  - The PhD student should be allowed to travel also if the company has a travel ban

- The academic advisor gets funding from WASP corresponding to 15% for the academic supervision

- The PhD student has an university PhD advisor and an industrial PhD advisor (ideally a person with some research experience)
- The PhD student must spend at least 20% of the time physically at the university and at least 20% at the company
  - However, in practice, spending only 20% at the university is not enough
- A contract is signed between the company and the university
- No contract between the company and WASP
- There should be an individual development plan ("utvecklingsplan") for the PhD student at the company that treats, e.g., main contact person, industrial supervisor, the role of the closest manager, the role of the project in the overall company strategy
- At the university there will be an individual study plan (ISP) for the PhD student that details issues such as time spent, research results obtained etc

Companies Involved

- Around 100 industrial PhDs from 40 companies
- Companies with large involvement
  - Ericsson
  - Saab
  - Zenseact (Zenuity)
  - ABB
  - Astra Zeneca
- Most industries have only one PhD student each
- Research institutes, e.g., RISE, and public organizations may not participate
- Not only the traditional system industry but also, e.g., finance, media, consulting, medicine, ...
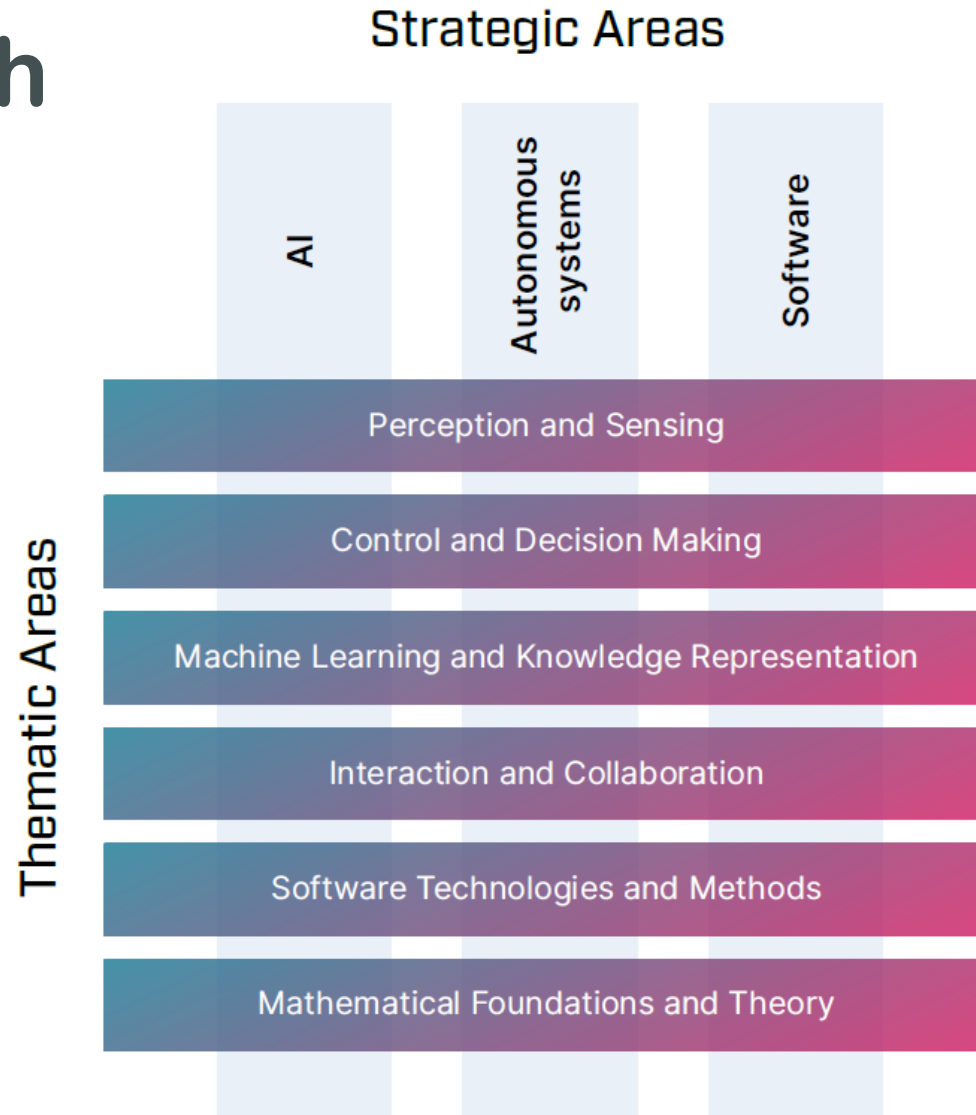
This Call

- Up to 15 positions

- Call opened: 21 January

- Application deadline: 7 April

- Decision by the WASP Board communicated: 3 June

- Earliest start date: 1 August 2022

- Latest start date: 1 January 2023

Applications

- Submitted through the WASP application portal
  - https://wasp-sweden.org/calls/wasp-industrial-phd-student-positions-2022/
  - Use the application form available there

- Should be signed by both the academic and the industry supervisor

WASP Research

Strategic Areas

AI · Autonomous systems · Software

Thematic Areas

- Perception and Sensing
- Control and Decision Making
- Machine Learning and Knowledge Representation
- Interaction and Collaboration
- Software Technologies and Methods
- Mathematical Foundations and Theory

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WASP Structure

- WASP
  - Autonomous Systems and Software
    - The original part of WASP
    - AI and Machine Learning included but mainly as tools or methods in Autonomous Systems and Software
  - AI
    - Added to WASP in 2017 with substantial budget increase
    - Increased emphasis on AI and Machine Learning in WASP
    - WASP-AI/MLX
      - Focused on Machine Learning
    - WASP-AI/MATH
   - Mathematical Foundations of AI/ML

WASP Autonomous Systems

- Research on autonomy, including enabling technologies for autonomous systems

- Transport systems, self-driving vehicles, perception, interaction, visualization, human-machine collaboration, multi-agent systems, robotics, autonomous clouds and networks, security, localization, optimization, ...

- Strong systems focus

WASP Software

The software research in WASP falls primarily within two areas:

1. Software methodology and technology for the modeling, analysis, development, training, verification, and deployment of autonomous or AI and ML-based systems.

2. Software methodology or technology that contains or utilizes autonomy, automation, AI, learning, or feedback. This includes, for example, experiment-driven development practices, self-reflection, self-adaptive software systems, self-repairing software, and automatic programming.

What the Autonomous Systems and Software students actually do

What the AI students actually do
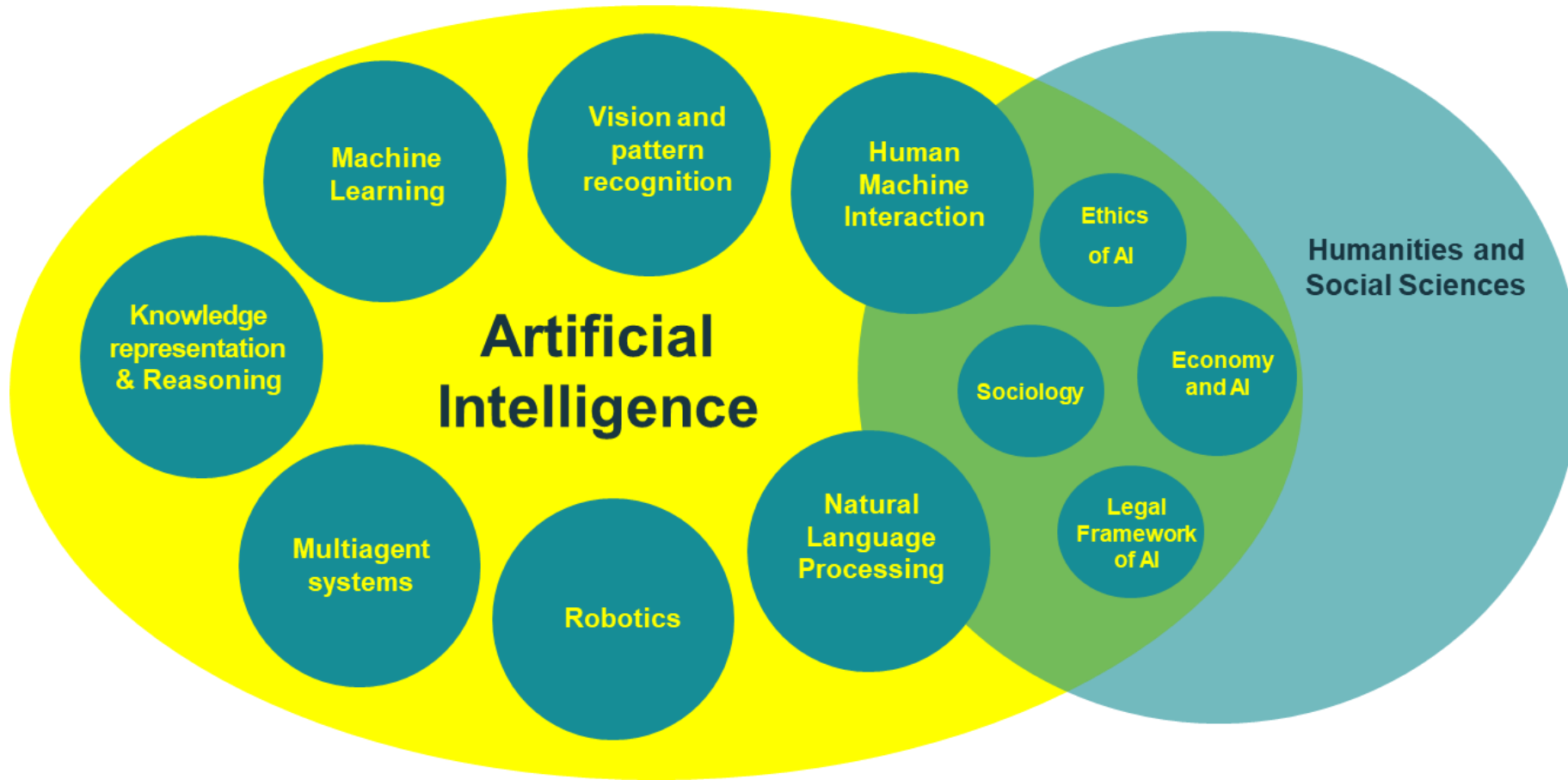
WASP AI-MLX Scientific focus

- Representation learning and grounding

- Sequential decision-making and reinforcement learning

- Learning from small data sets, GANs and incremental/active learning

- Multi-task and transfer learning

- 'Established' 2018 – to be updated given transformers, contrastive l, explainability, ☺

Real-time image guided radiotherapy
Niklas Gunnarsson

Why?
Improve the quality of life for cancer survivors by minimizing unintended dose to healthy tissue.

How?
AI driven sequential decision making in real-time. We will use the information from the MR camera to control the irradiation in real-time.

Main Advisor: Thomas Schön

Elekta

UPPSALA UNIVERSITET

# Hanna Hultin, AI-ML/X (Industry)

Started: Fall 2018

Main Advisor: Henrik Hult

Generative Models and Reinforcement Learning in Finance

- Develop AI for autonomous decision making in electronic markets based on limit order books.
- Model order books using generative models
- Develop trading execution algorithms with reinforcement learning

Johan Fredin Haslum, AI-ML/X
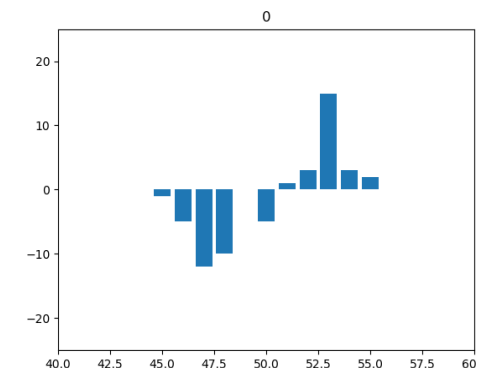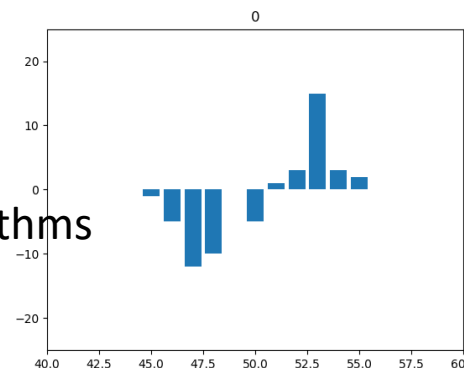
Main Advisor: Kevin Smith

Deep Learning for Drug Discovery

- Deep Learning applied to the problem of predicting drug-target activity
- Repurposing experimental data in order to predict outcomes of future experiments
- Developing Deep Learning methods suitable for the challenges associated with such data, e.g. diverse and sparse datasets
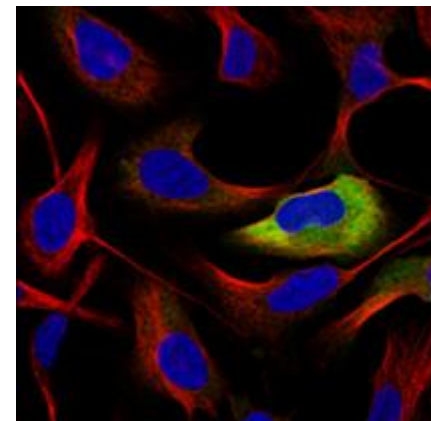
Evaluation Criteria

- Three aspects of the proposal are evaluated
  - Project
    - Scientific excellence
    - Uniqueness, visionary and novelty nature
    - Relevance to WASP
    - Potential to collaborate with other WASP initiatives such as WARA
  - PhD student candidate
    - Grades from Master Education
  - Supervisors
    - Scientific merits
    - International research experience
    - Pedagogical skills and merits
    - Ability and experience to collaborate with academia and industry
    - Doctoral student and supervisor constellation with underrepresented gender are encouraged
- The approval of the proposal is conditioned by the PhD student candidate

News 2022

- The industrial PhD student instrument is primarily aimed at students who already are employed at the company

- Some, e.g., small, companies have no internal candidate. In that case it is also possible to employ a student candidate especially for this position.

- The candidate must be identified at application time, but need not be employed until the latest start date (1 January 2023)

- In the latter case there is a risk that the student disappears after the proposal has been accepted but before the latest start date

- In that case the company is allowed to propose a new candidate if that candidate has at least as good qualifications as the original one

- If the student decides to quit after the start, then the project will be terminated

Elements of a Good Proposal

- Fits into the WASP research program

- Clear and well-described scientific problem / research questions

- Novelty

- Explain why the applicants are the best parties to address this problem – how they complement each other

- Added value to academia, industry, and Sweden

- And above all
  - A strong PhD student candidate

Furher Information and Questions

General Questions

- info@wasp-sweden.org

Further Information and Guidance from the WASP University Representative Group:

- Chalmers: Ivica Crnkovic – ivica.crnkovic@chalmers.se
- KTH: Bo Wahlberg – bo@kth.se
- Lund University: Karl-Erik Årzén – karl-erik.arzen@control.lth.se
- Linköping University: Michael Felsberg – michael.felsberg@liu.se
- Umeå University: Erik Elmroth – elmroth@cs.umu.se
- Uppsala University: Thomas Schön – thomas.schon@it.uu.se
- Örebro University: Amy Loutfi – amy.loutfi@oru.se

Several Questions and Issues

- How should the project topic be defined?
  - Sufficiently long-term so that the results still are of value to the company after five years
  - Sufficient research depth for publications

- How handle deviations?
  - Very few PhD students end up with a thesis that is exactly about the problem that was initially formulated
  - Deviations occur due to several reasons

- What is a good PhD student candidate?
  - An ideal PhD student candidate should have a couple of years of experience of the company but still have the graduate education fresh in mind
    - However, WASP accepts industry PhD students also if they have shorter or longer experience
  - Good analytic competence, excel at problem solving, good oral and written communication skills
  - Good grades, in particular in the courses of relevance
    - Have in mind that many of the WASP courses are rather mathematical in nature

Several Questions and Issues

- What is the objective for the company?
    - Initiate a long-term collaboration with a leading research group in order to improve the company's innovation capacity
    - Solve a challenging problem
    - Increase the knowledge within an area that is of relevance to the company
    - Competence buildup for a promising employee
    - Obtain persons with sufficient skills to take a leading R&D role after 5 years
    - ....

Several Questions and Issues

- The company must be aware of the realities of PhD studies
  - Around 1.5 years full time are spent on taking courses
  - Some of the courses may be of less interest to the company (and the student) but they must still be taken
  - An important part of the studies consists of travels to conference, summer schools, study trips, meetings of different kind, in order to discuss, present, and learn
  - The PhD student must have the possibility to travel also if the company has a travel ban

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Several Questions and Issues

- How should one guarantee that the PhD student remains to be relevant to the company during these five year?
    - Involved in a research-related "shadow" project where intermediate research results can be evaluated and which can generate new research questions
    - Formalize the knowledge transfer using, e.g., regular presentations by the PhD student at the company

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Several Questions and Issues

- How can we be sure that the PhD stays with the company afterwards?
  - Well, …….

- How do we start?
  - Start by identifying the PhD student candidate and the academic supervisor
  - If you do not have contacts in academia yourself then ask the WASP university representatives
  - Start the project discussions with the academic supervisor as early as possible
    - He/she knows best which research problems that fit into WASP and which don't

- More information about industrial PhD studies in WASP can be found at

https://wasp-sweden.org/custom/uploads/2019/12/IndustrialPhD_Final_print.pdf