WASP Industry Days 2022

Photos by Thor Balkhed & WASP

20-22 September

Three days of networking,
research collaboration
and exploring opportunities

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WASP Industry Days 2022 Augmenting Human Intelligence

WASP Industry Days is an annual event aimed at promoting exchanges between the WASP research community and Swedish business. Networking and discussions about common research interests are the core of the event. The unique collaborative environments in WASP play an enabling role in developing knowledge and competence within artificial intelligence, autonomous systems and software.

The WASP Industry days 2022 highlighted how the enabling technologies in autonomous systems, AI and software augment different aspects of human intelligence and capabilities, from the cognitive to the physical in mixed domains.

The event targeted researchers and decision-makers at companies with research actvities in Sweden, and academic researchers in the WASP community, including WASP postdocs and PhD students.

WING Day
WASP Industry Networking Gathering

On September 20th, around 150 attendees from the WASP member universities and 30 different companies, gathered in Norrköping for a unique networking event with the aim to identify common research interests. The conference theme "Augmenting Human Intelligence" guided the presentations and discussions of the day, highlighting how the enabling technologies in autonomous systems, AI and software augment different aspects of human intelligence and capabilities, from the cognitive to the physical in mixed domains. Special attention was given to the role of the human in realizing the potential of these enabling technologies.

> "Nice to have joint problem-solving sessions between industry and academy"
> ***attendee quote***

> "Good opportunity to meet and discuss with professionals, researchers, as well as PhD students working in diverse fields"
> ***attendee quote***

The invited speakers highlighted different aspects of the conference theme, ranging from "Ethical, Legal and Moral Aspects" by Professor Juan Carlos Nieves, Umeå University to "How to create value through AI in finance and furniture" by Salla Franzén, IKEA Retail, Ingka Digital.

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High-profile international speakers gave inspirational scientific talks about Flying Robots (Professor Roland Siegwart, ETH, Zurich) and Frugal Distributed Learning (Professor Anne-Marie Kermarrec, EPFL).

Interaction between participants was facilitated through different means; in-depth group discussions on pre-selected themes according to the AIMDay concept, the Speaker's corner, the doctoral students' poster exhibitions, mingle around selected research areas and the conference dinner.

From the evaluation, it is clear that the WING Day inspired new ideas and networks to form, contributing to WASP's overall goal to strengthen the bond between Swedish industry and academia.

> "The mingle area gave me plenty of new contacts and it was smart to divide the tables into different research areas. It made finding relevant people easier"
> ***attendee quote***

> "Lots of spontaneous interactions and the dinner was great"
> ***attendee quote***

Photo by Peter Svarteld

WARA Expo 21-22 September

At Gränsö slott, located in the archipelago just outside of Västervik, academic-industrial collaboration led by the WASP Research Arenas (WARAs) was in focus. The WARA Expo on September 21-22 included live research demostrations, company exhibitions, challenge clinic workshops and plenty of time for networking.

Close to 240 participants from 60 organizations were present, whereof 22 organizations had booths in the exhibition. The WASP Research Arenas were represented in the exhibition area, arranging demos and presenting their ongoing projects.

The last day was devoted to Challenge Clinic workshops were participants and project groups of the Research Arenas sat down to discuss future research development. A much-appreciated workshop format for the participants who enjoy in-depth exploration of research questions.

On the following pages we present the WASP Research Arenas activities during the WASP Industry Days and the content of the Challenge Clinic workshops.

> "It was great to see how far academic research is reaching and how enthusiastic the people working on it are to push it further, as well as companies to cooperate in valuable knowledge development."
> ***Visitor at WARA Expo***

WARA:
The WASP Resarch Arenas

The main objective of the WASP Research Arenas (WARA) is to increase the value and relevance of research by strengthening and promoting collaboration between WASP researchers and industry partners.

An important part of this is to enable and support collaborative research in challenging and complex scenarios, and to jointly identify new research challenges in the context of these. WARA thus addresses industrially relevant system-level platforms and scenarios which are far beyond the reach of individual university labs.

By creating these WASP state-of-the-art research infrastructures, academic and industrial researchers can conduct and demonstrate more theoretical and component-based research in challenging real-world system applications.

Photo by Peter Svarteld

WARA Public Safety

WARA Public Safety provides a realistic, large scale and industrially relevant demonstration environment using scenarios that focus on keeping society and its citizens safe. It explores and develops collaborative systems of systems with heterogenous agents inheriting a various degree of autonomy that supports teams of humans and systems interacting in a distributed context.

There is an increased interest in research on systems related to human augmentation. This interest is seen from industry as well as from government institutions within public safety.

The wide and active interest serves as example on how WARA Public Safety (WARA-PS) acts as a cross-operational arena, providing platforms suitable for many different domains while still promoting collaborations.

The broad use of our developed Core System proves both the relevance of such a system and how it can be used in different contexts, such as: testing, simulations, scenario building, development, and data collection. The broad usage showcases shared needs and overlaps between groups and lower the threshold for integrating research into systems and access to real data.

To provide insight and details of WARA-PS and the Core System, the joint mission demonstration was this year presented at four stations focusing on different aspects of the mission objective:

- The Core System was showcased through an interactive map of the outdoor area where simulated and real agents conducted joint missions. The presenter interacted with the map to delegate tasks and both live and simulated video feeds from the outside demo could be followed.
- The Artificial Intelligence and Integrated Computer Systems group (AIICS) from Linköping University demonstrated research integration. The mobile robot Spot and a DJI Matrice 300 drone collaborated on transporting a first aid kit to a person in need, demonstrating many of the capabilities available in the arena.
- Examples of resources available in the arena were run: Mini-USVs searched the water, the Piraya boat practiced autonomous collision avoidance, and drones circled the air.
- Ericsson demonstrated their 5G Private Network, acting as a “tactical bubble” for the missions.
- Read more at waraps.org.

Photo by Thor Balkhed

WARA Robotics

WARA Robotics is a physical and digital testbed including robots, materials and other resources needed to deploy research in a multitude of aspects related to robotics for manufacturing. The setup is designed to allow benchmarking of results.

The primary goal of WARA Robotics is to promote challenges in industrial and service robotics, as well as providing an attractive and sustainable infrastructure for research and verification.

The expectation from industry is for the arena to be a collaboration platform where new concepts for sensor-based autonomy are demonstrated, which enables robots to be deployed in less structured environments and applications.

The WARA Robotics is still in a start-up phase. Yet, it has made progress in development of infrastructure of both the physical and digital labs, as well as contributed to scientific results.

At the WARA Expo, the arena showed examples of the following three areas: a physical robotic system demo, a digital simulation model of a robotic system together with its environment and recent scientific results.

The WARA Expo was an excellent opportunity for WARA Robotics to create new connections to researchers and for mutual information exchange. One concrete outcome was that a new academic robotics research team got connected and is now part of the arena.

WARA Common

WARA Common has been active since the start of WASP. The main purpose is to be a lab for autonomous cloud research, but also to be a full-scale cloud environment for WASP researchers. In 2023, WARA Common will be upgraded and act under the new name WARA Ops and focus on research on operational data.

Current research activities include data-driven operations of cloud services and methods for anomaly detection. Large data set are collected and made available to researchers, which creates unique opportunities. Almost everything in the datacenter is connected and a potential data source, from servers and routers, to cooling equipment and backup batteries. In addition, logs from the software stacks and management systems are stored.

In 2023, WARA Common will be upgraded and act under the new name WARA Ops. All current services to the WASP researchers will remain but its focus will be on research on operational data. A core goal is to enable and encourage leading Swedish companies to work closely with academic experts in AI, Autonomous Systems, and Software to solve problems and develop new analytic approaches to streaming data from different kinds of online systems.

A workshop held at WARA Expo was instrumental in guiding in its new direction. Ideas and reflections from the participants enriched the final new arena proposal. In addition to providing data sets from Ericsson cloud and networks environments, WARA Ops will also solicit data sets from other partners. The need for research on synthetic data sets and obfuscation was identified. Several potential partners and future collaborators were identified.

The initial focus of the new WARA will be in two key areas:

- **Anomaly detection:** Collection and sharing of datasets and their associated research challenges, e.g., intrusion detection, denial-of-service attacks, etc. Examples of data include system/software log files, lists of access requests, etc.
- **Autonomous management:** Share and generate datasets that can be used to drive research into next-generation autonomous management systems able to proactively predict future demand, detect, and react to changes in user/network/hardware behavior, etc. Examples include power reduction use metrics such as CPU/Disk/Network/Memory usage over time, and power consumption data.

Photo by Thor Balkhed

WARA Media and Language

The mission of WARA Media & Language is to build a multidisciplinary ecosystem around Media AI and Natural Language Processing, connecting scientific fields and a diversity of industrial segments. It addresses research topics related to the generation and analysis of media data, and extrinsic effects of the same.

Current areas of interest are generative models, applications in human communication, and graph-based approaches. Examples of research questions are: How can we automatically assess the quality of generated media items? How can we model gaze and body language to create virtual clients for psychology education? How can we use graph-based representations to fuse information from parallel modalities?

Our industrial partners are interested in understanding the opportunities and risks involved in using large language models (LLMs), such as the 530 billion parameter model recently trained by NVIDIA. Another point of interest is the creation of synthetic datasets that can be shared with researchers or used to train new models in-house. The motivation is typically to protect sensitive information but can also be to add corner cases or fill in gaps in existing datasets. There is also a need for a data management platform that allows data publishers to share their models and data sets in a controlled way, and for researchers to find relevant data, and to test their solutions against benchmarks.

The WASP Industry Days are characterized by the great diversity in fields of expertise and affiliations represented by the participants, and the overall willingness to collaborate. This event and the arenas in general, act as catalysts that interlink academic research and industrial innovation.

By participating in the event, new industrial partners were recruited, relations to existing partners were strengthened, and more insight into industrial needs was identified. For example, the startup company Parsd which develops an AI-enabled platform for fact-based decision making joined the arena.

Challenge Clinics at WASP Industry Days 2022

The last day of WASP Industry Days was held in the form of challenge clinic workshops centered around future research challenges for the WASP Research Arenas.

The workshop included two keynote presentations:

- Dimos Dimarogonas, KTH Royal Institute of Technology, Multi-robot coordination under spatiotemporal constraints
- Jonas Lundberg, Linköping University, Human-AI Teaming for mission-critical autonomous systems

Photo by Thor Balkhed

The Challenge clinics

WARA Robotics

The recently started WARA Robotics aim to build a research environment that facilitates the development and evaluation of AI-based robot technologies. This clinic discussed how to build a roadmap for future research collaboration and further development. In particular, it was discussed how to use the WARA-PS core system in industrial robotics with IoT techniques and ROS2.

Collaborative Heterogeneous Agents/ Robots in Mixed Domains

The topic covers one of the main areas in WARA-PS, and includes sensing, data fusion, user interaction, planning and control of collaborative autonomous aerial, surface, and underwater vehicles.

Recommendations for future research topics were GPS denied localization, control and motion planning for advanced non-linear motions and trajectory planning, simulations with realistic disturbances and context awareness and more complex scenarios with many agents.

The challenge is to design safe, secure, and robust cyber-physical systems able to operate on different spatial and temporal scales, exhibit multiple and distinct behavioral modalities, and interact with each other and humans in ways that change with context.

Human AI Teaming

Challenges for human interactions with AI in distributed teams, for activities with high-consequence outcomes, are of interest for several of WASP research arenas.

For example, in WARA-PS, teams of AI-systems and humans interact at sea and in the air in joint missions, with high-consequence outputs - and data from the activities in the testbed can be collected. WARA Robotics and WARA Media and Language both include application contexts with Human-AI Teaming challenges.

The following topics were discussed in the workshop: cognitive offload, hybrid cognitive systems, shared workload, emergence, implementation methods for industry, silent failures and trust and transparency.

Data Management for AI-Driven Generation and Processing of Media

Handling of data is a challenging topic in both WARA Media and Language, WARA Public Safety as well as in WARA Common. Together with AI Sweden they discussed their respective challenges and how to overcome them.

Data management has been identified as the most important challenge for progress in machine learning for media (Media ML). This is partly due to difficulty of getting access to real-world datasets, to set meaningful success-criteria for ML tasks on such datasets, to publish speech data under GDPR, and to complement real data with synthetic data to support learning.

Data collection from multiple sources in real world scenarios is an important activity for WARA-PS. For this reason, this clinic discussed support for effective and responsible data management. Data synthesis is a prioritized area to work on, primarily to develop realistic data sets to practice machine learning models on, without having to compromise with GDPR rulings or company restricted information. There is also a large interest to develop tools for quality assurance of data sets.

AI Sweden will write a proposal for a platform for sharing models and data, similar to Huggingface.

The Public Sector

This clinic included a discussion with public stakeholders, companies, and other participants at WASP Industry Days 2022. They wanted to see even more complex scenarios highlighting real challenges to discuss and explore. In particular, demonstrations together with real users during real exercises managed by the Swedish Maritime Administration (Sjöfartsverket) and others. A conclusion was that personal networks and collaboration in workshops are very much appreciated and that WARA-PS puts the research in a context and explains the benefits.

The Wallenberg AI, Autonomous Systems and Software Program (WASP) is a major national initiative for strategically motivated basic research, education and faculty recruitment in artificial intelligence, autonomous systems and software development. WASP was initiated in 2015 and its mandate extends to 2031. WASP is mainly funded by the Knut and Alice Wallenberg foundation.

Knut och Alice Wallenbergs Stiftelse

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Contact for all inquiries to the Program Office: info@wasp-sweden.org