UiT

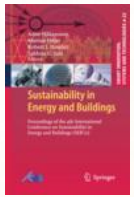
THE ARCTIC UNIVERSITY OF NORWAY

Volatile Multiple Smart CPS

Anne Håkansson
anne.hakansson@uit.no

Professor in CS focus on AI, The Arctic University of Tromsö, Norway
Docent, KTH, Sweden
Chair of Digitalization group, KTH, Sweden

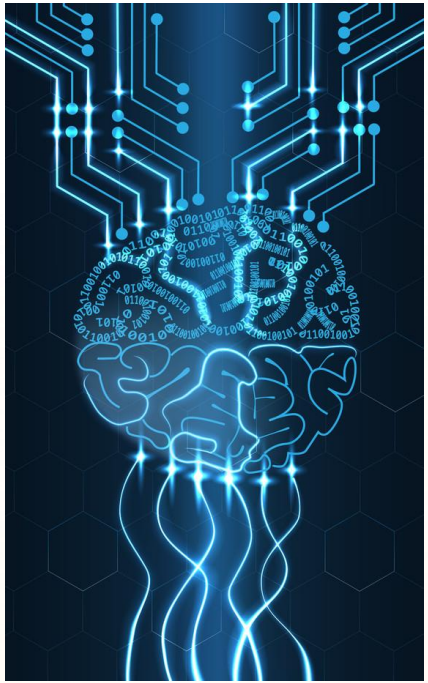
Research in AI, since 1993



- Expert system for "Environmental Impact Assessment", *For Dam sites and water power plants in tropical climates "Today's sustainability"* (Sustainability Method, for whole life cycle)
- The KANAL-system, Expert system shell for non-experts
- Visualizing Knowledge bases/ Reasoning strategies with UML
- Transferring knowledge via system, Dynamic Knowledge bases
- Event-driven algorithm
- Reasoning strategies in Multi-agent system, Meta-agents
- Negotiation, digital negotiation in products and services
- Cyber-Physical Systems, intelligent behaviour for best services
- AIC – system, Combination of senses

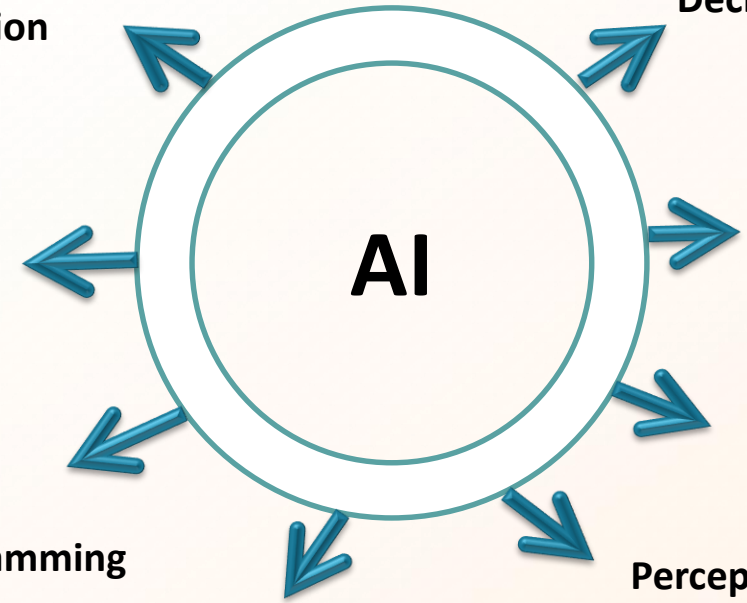
CEO SweAnne-System

Artificial intelligence for the High North



- Challenging climate
- Vulnerable (sub)arctic nature
- Sparsely populated rural areas
- Long transportation distances
- Welfare and quality of life
- Challenges for energy supply
- Communication Networks

Artificial Intelligence areas



Natural Language Processing
Speech Recognition

Expert systems
Knowledge-based systems
Decision-support systems

Machine Learning
Neural Networks
Deep Learning

Multi-agent systems
Intelligent Agents
Meta Agents

Bio-inspired systems

Robotics, Cars
Autonomous Agents

Predictive Programming

Perception and Computer Vision
VR, AR

Cognitive Computing

Near Future with 5G, Smart CPS, Smart IoT

Systems in clothes, buildings, cars, devices, furniture, implanted

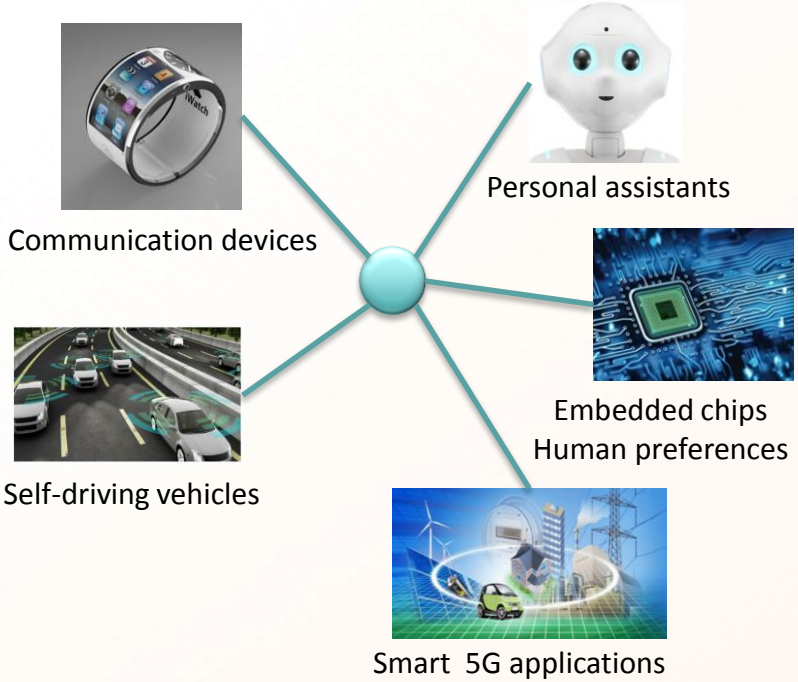
- 2020 estimated 50 billion connected things
  3 trillion dollars spending (hardware)
- Service-oriented economy based on
  Smart cyber-physical systems & Smart Internet of Things (IoT)
- 5G next generation high-performance mobile communications

Connect and combine smart products and services

- Smart self-management systems:
  Self-explanatory, Self-diagnostic, Self-healing system
- Situations-aware systems for real-time applications
- Automated tasks

Connected individual – just another “thing” in IoT?

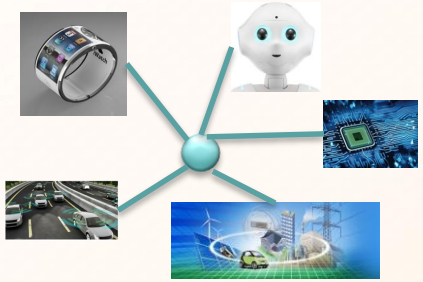
Volatile Multiple Smart CPS



- Virtual digital infrastructure combining heterogeneous cyber-physical systems
- Distributed smart systems that collaborate to provide complex services and products
- Only connected for a particular situation or for a specific purpose
- Purpose and situation-dependent

- ❑ Data-intensive smart environments

→ 5G + IoT + Push technology, Big Data + Human Preferences



- ❑ Automated decision-making
- ❑ Negotiation between objects
- ❑ Predictions for secure services

CHARACTERISTICS

- Distributed, connected, coordinated
- Temporally, heterogeneously, hierarchically, spatially
- Latency sensitive

REQUIREMENTS

- Adaptable
- Scalable
- Robust and responsive
- Resilient
- Safe and secure
- Usable and reusable

Soon everywhere at any time