

# The Importance of Education for the Future of Work

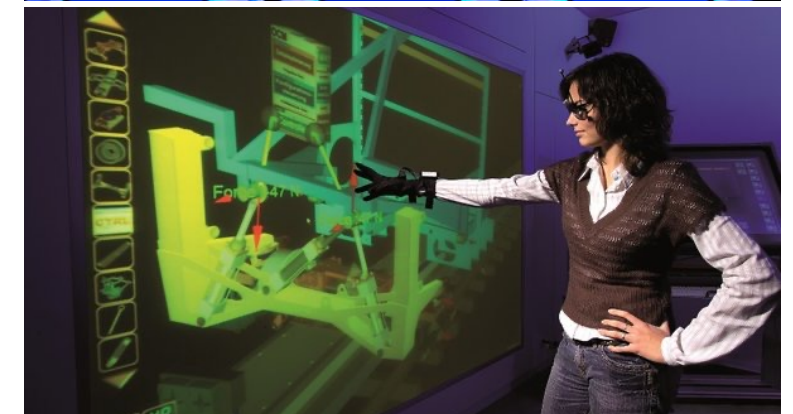
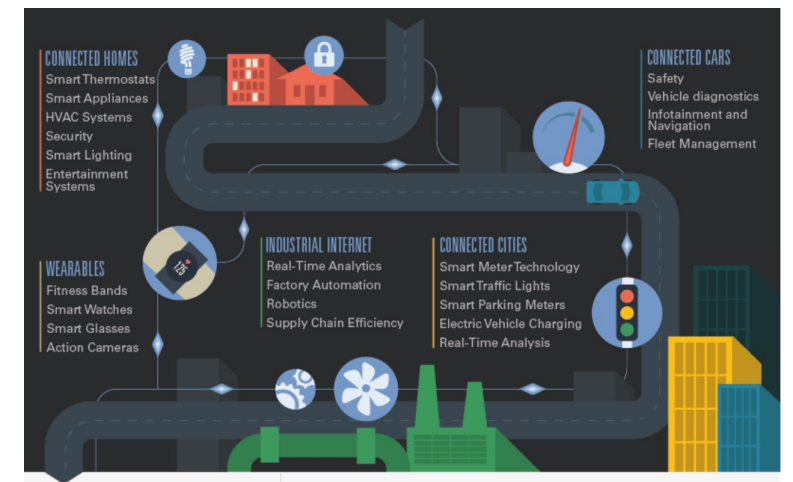
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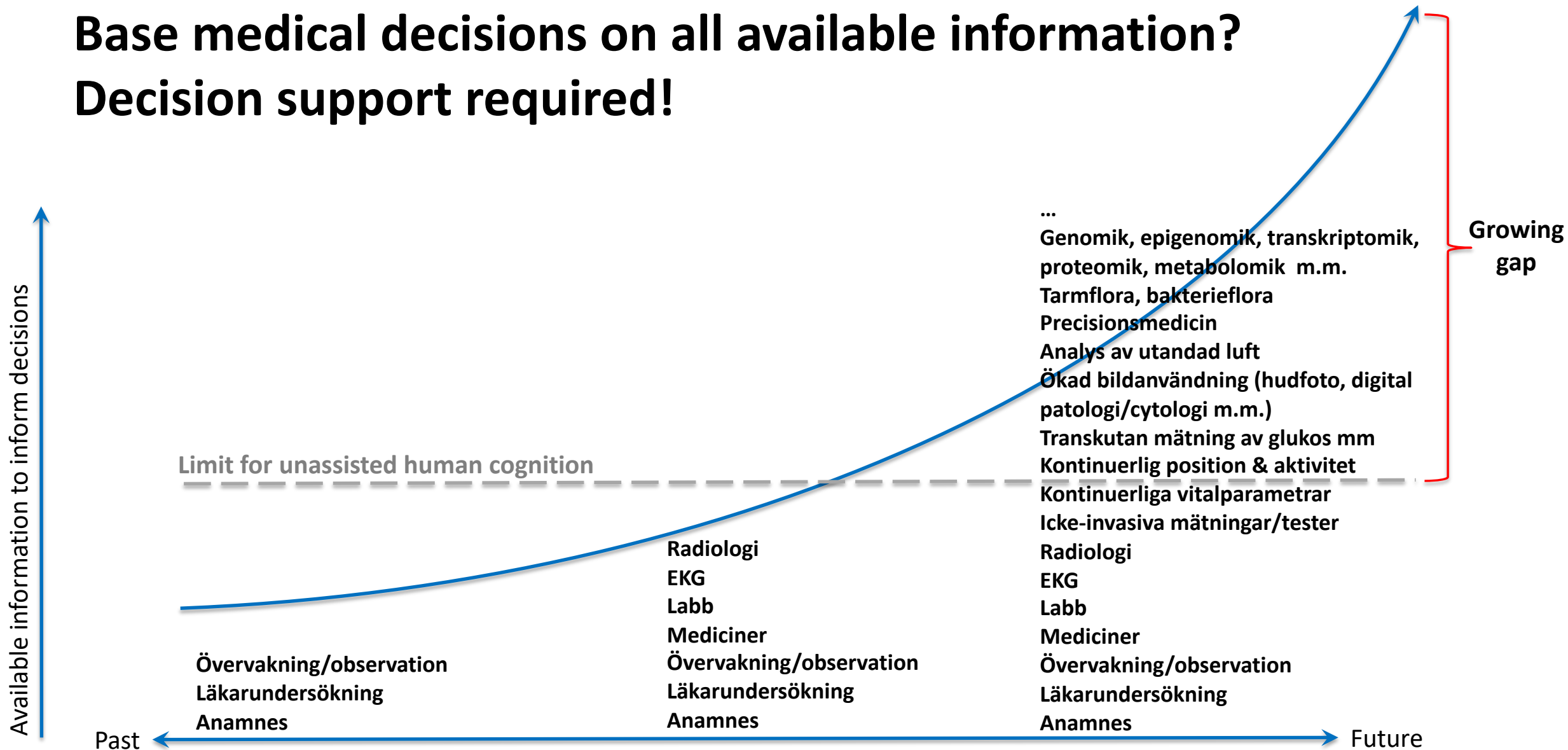


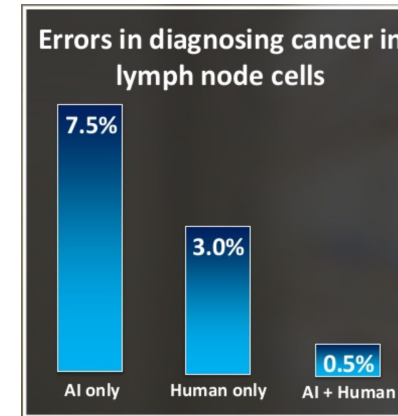
# Background

- Convergence of the **analog** and the **digital** worlds (IoT, social media) making **the digital world as important** as the analog.
- **Software is eating the world!** Software + general purpose hardware replace specialized hardware. **Innovation and value is created through software.**
- **Scale, speed and complexity** requires **support and automation.**
- **AI enables automation of tasks** that previously **only people could do.**
- **People** must solve problems and work together with **digital tools and AI.**



# Base medical decisions on all available information? Decision support required!





“Weak human + machine + superior process was greater than a strong computer and, remarkably, greater than a strong human + machine with inferior process.”

Garry Kasparov

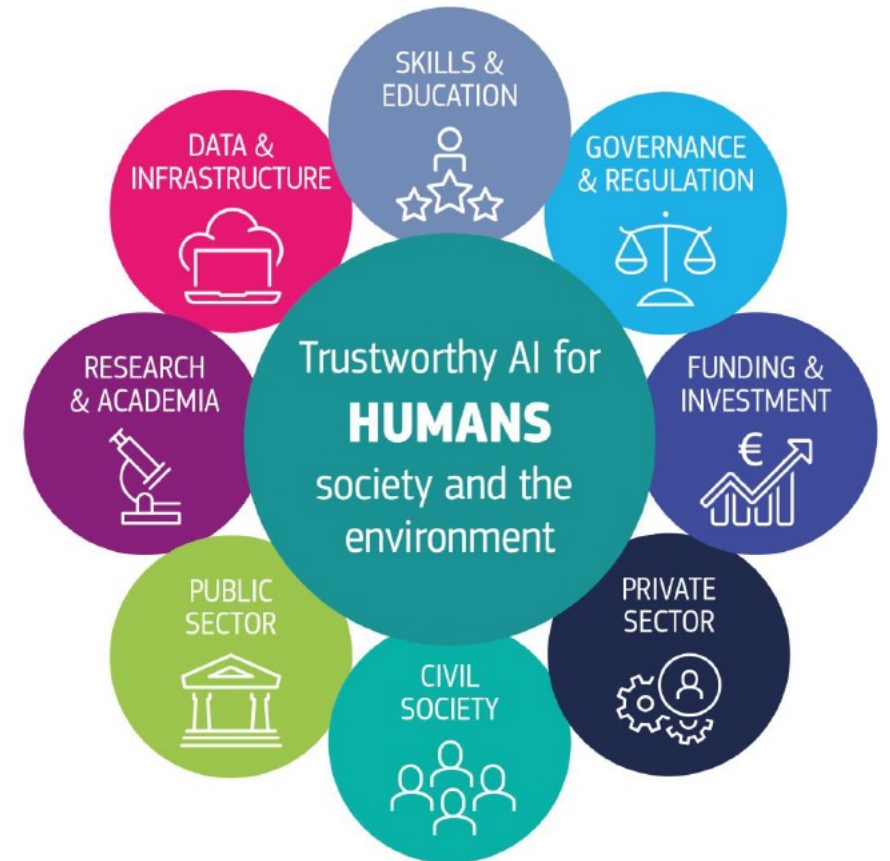
# AI and Computational Thinking – Two Sides of the same Coin



Fredrik Heintz, 2021. **The Computational Thinking and Artificial Intelligence Duality.** In *Computational Thinking Education in K-12: Artificial Intelligence Literacy and Physical Computing*. MIT Press.

# European High-Level Expert Group on AI – Education

- Skills and Education
  - Redesign education systems from pre-school to higher education
  - Develop and retain talent in European higher education systems
  - Increase the proportion of women in science and technology
  - Upskill and reskill the current workforce
  - Create stakeholder awareness and decision support for skilling policies

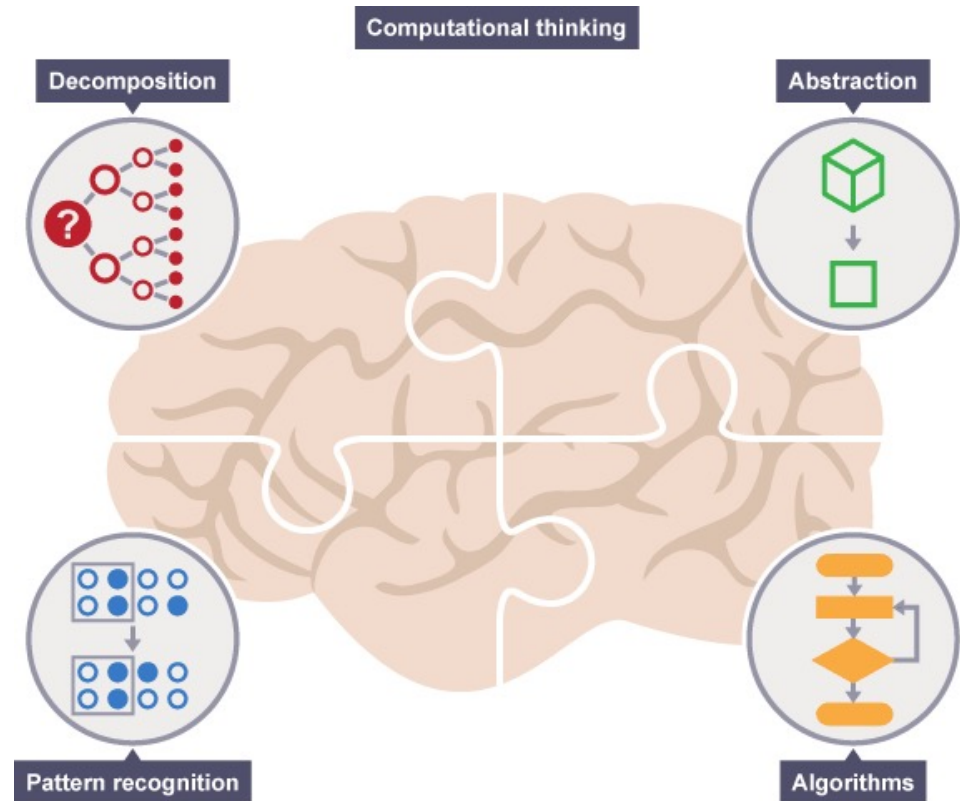




# Primary and Secondary Education (K-12)



Digital Competence



Computational Thinking

# Big Ideas in AI

1. Computers perceive the world using sensors.
2. Agents maintain models/representations of the world and use them for reasoning.
3. Computers can learn from data.
4. Making agents interact comfortably with humans is a substantial challenge for AI developers.
5. AI applications can impact society in both positive and negative ways.

# Lessons Learned from Introducing CT in a Major-City in Sweden

- It is possible to provide good teacher training with relatively modest efforts.
- It is possible to get these teachers to carry out activities in their own classrooms and usually also in other classes.
- The teachers are usually good at adapting the material we present and turn it into their own lessons.
- It is much harder to get the teachers to do their own local teacher training and to get more local teachers at their schools to adopt the new material as it requires an explicit mandate from the local school leaders.
- More efforts are needed in the step from block-based to text-based programming.

Fredrik Heintz and Linda Mannila. 2018. **Computational Thinking for All - An Experience Report on Scaling up Teaching Computational Thinking to All Students in a Major City in Sweden.** In Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE).

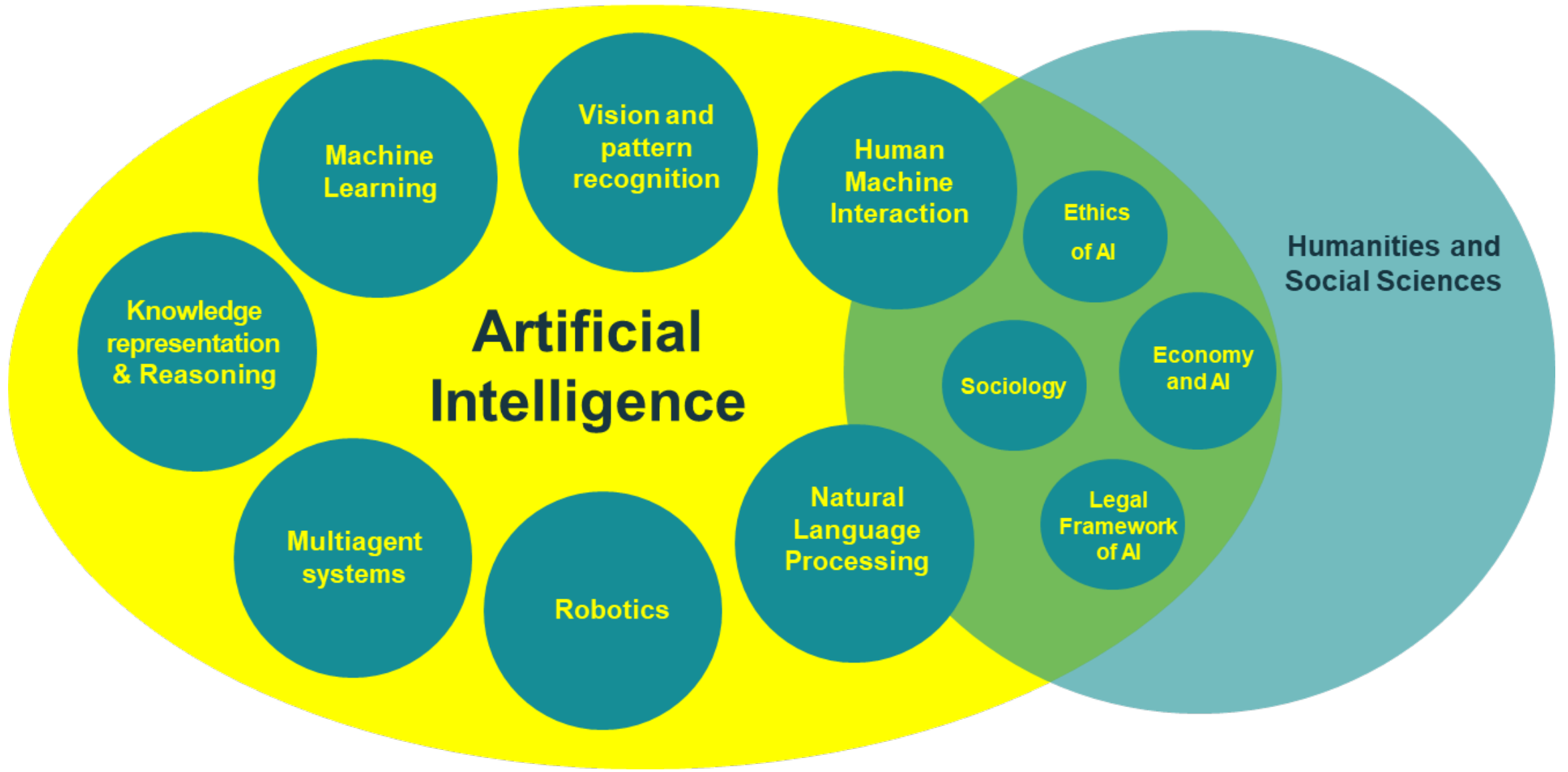
# Higher Education

# Major Challenges for Higher Education

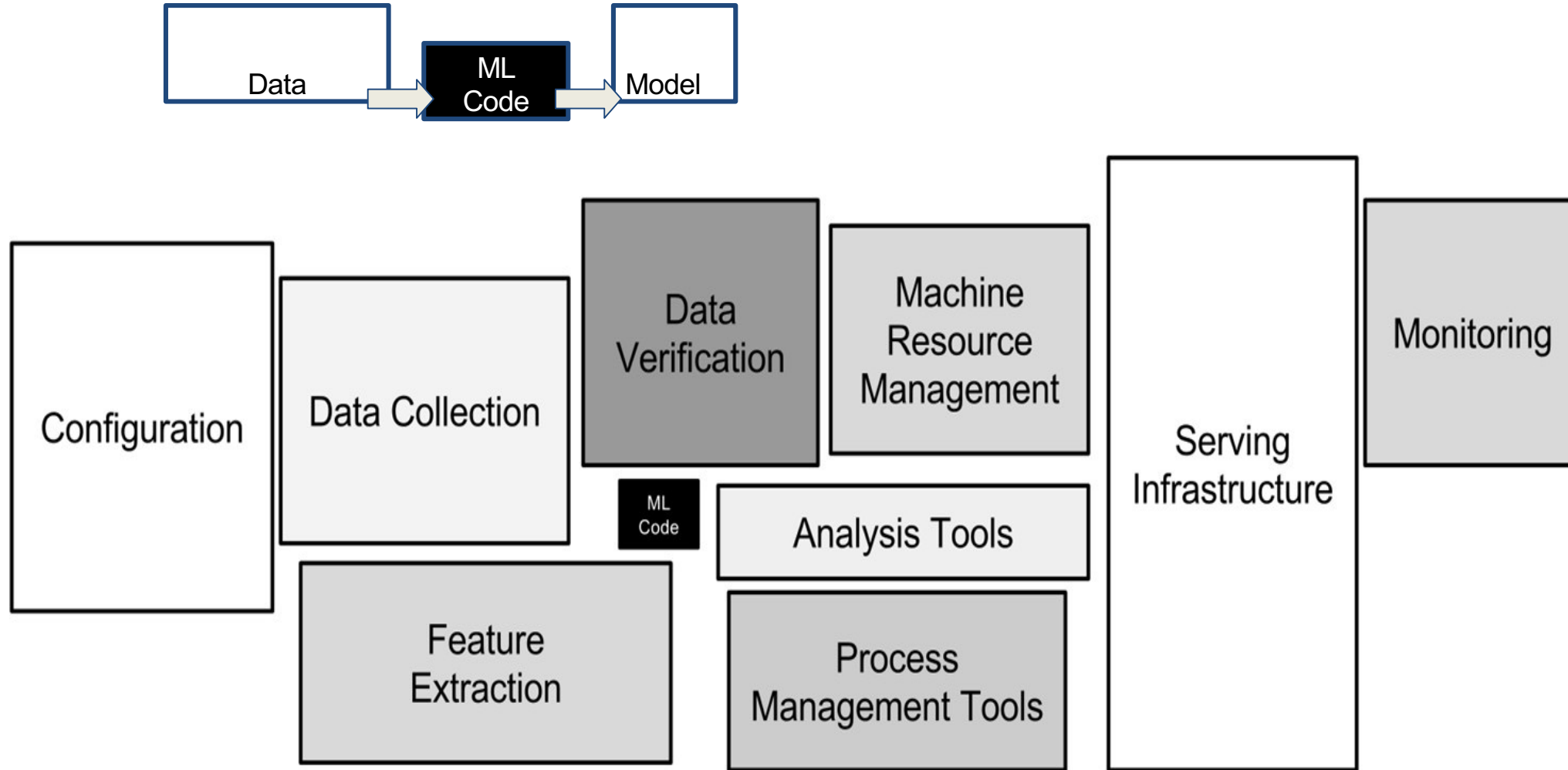
The fundamental challenge is how the educational system can deliver the necessary competence when the demand for competence in new technologies explodes and vastly broadens.

Three particular challenges are to:

- 1. Reach a commonly agreed subject matter content** as the subject is being actively and rapidly developed.
- 2. Introduce AI in education beyond only the specialized education programs** for technical experts, as the need for competence spreads from the experts developing the technology to much broader ranges of professions and disciplines.
- 3. Increase teaching capacity** both to scale-up technical education to broader audiences and to scale-out AI education into other professions and disciplines.

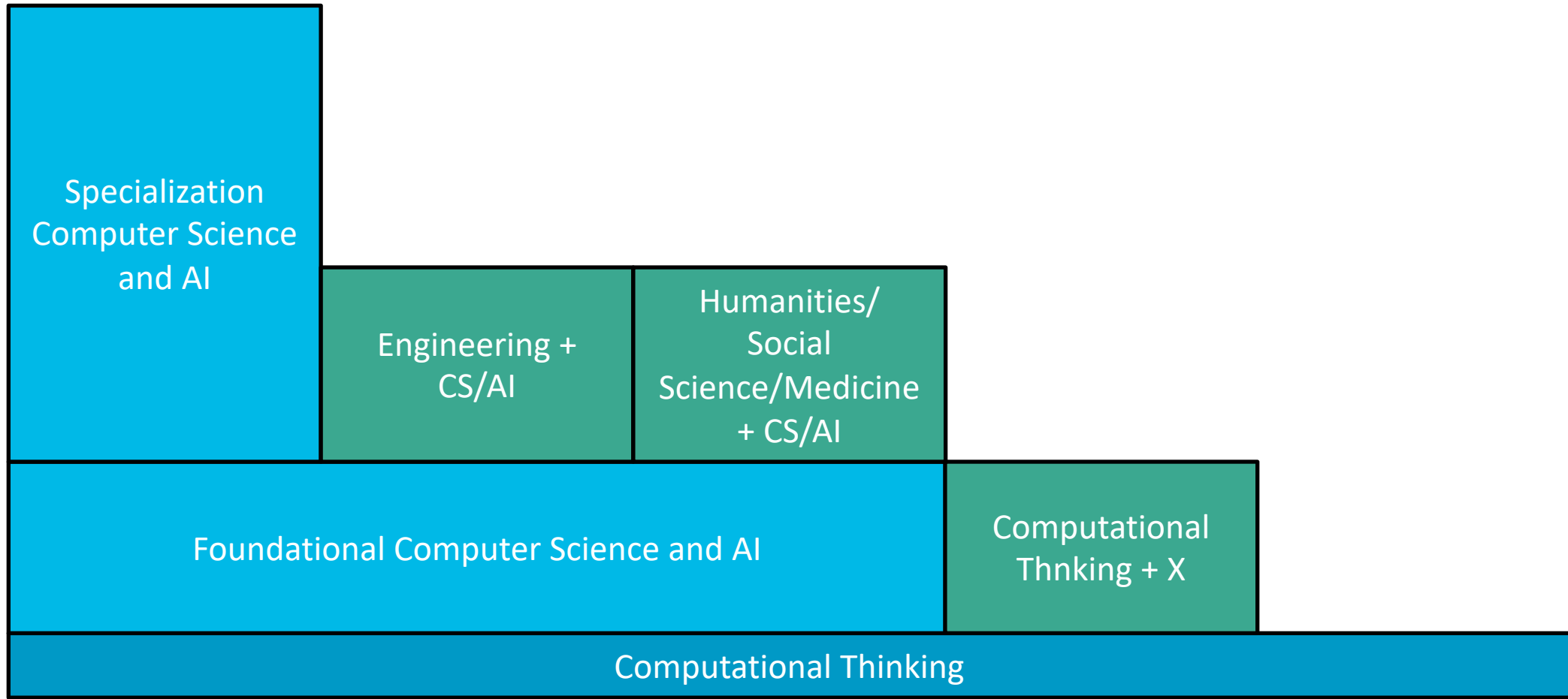


# The Broader Need for Competences and Infrastructure





# Combinations of Competences



# WASP-ED

The fundamental challenge that Wallenberg AI and Transformative Technologies Education Development Program (WASP-ED) is designed to address is how the Swedish educational system can deliver the necessary competence when the demand for competence in new technologies explodes and vastly broadens.

- 1. Provide the educational foundations** for AI and related transformative technologies.
- 2. Scale-up the national educational capacity** in AI and transformative technologies including educating and maturing the teaching staff to make use of and be innovative in the application of AI and transformative technologies in education.
- 3. Scale-out education** in AI and transformative technologies **to disciplines and professions beyond the technical core.**
4. Develop **data-driven education and pedagogical transformation** using learning analytics.

# WASP-ED: Work Areas

## WA3 Course Development

Develop modular course content

## WA6 Teaching Competence Development

Provide professional development support for teachers

## WA2 Program Development

Develop flexible and adaptable course packages for different roles

## WA5 Technical Platform and Education Data

Provide a technical platform for delivering courses and course content

## WA1 Curriculum Development

Provide a comprehensive overview of the subject matter content

## WA4 Pedagogical Development and Learning analytics

Provide support for pedagogical experimentation and development

# Professional Education

# AI Competence for Sweden



Regeringen

40 MSEK 2018-2019



**Purpose** promote increased knowledge about artificial intelligence in both the private and the public sector to strengthen competitiveness and improve the welfare



Knowledge platform  
(10 mnkr)

Competence development  
activities  
(30 mnkr)

# AI Competence for Sweden – Lessons Learned

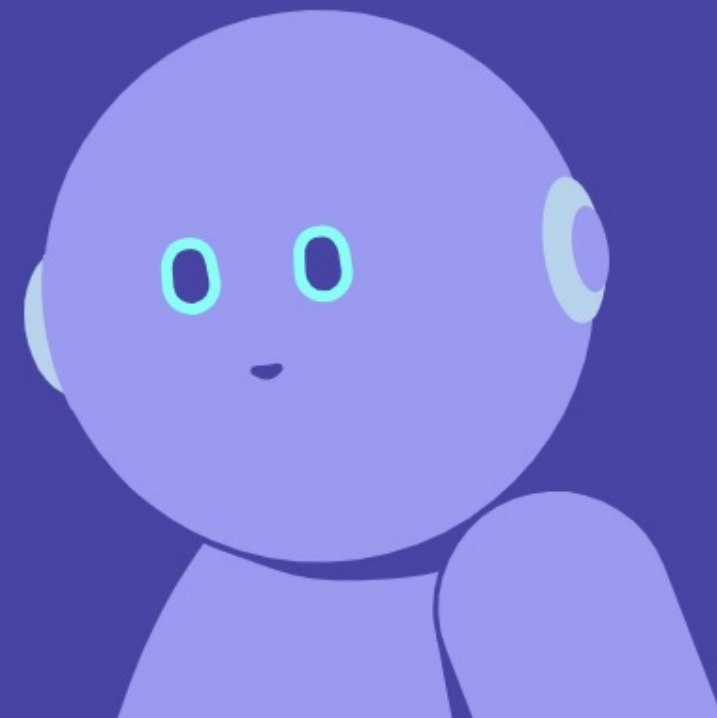
1. The need to clarify the role of Higher Education Institutions (HEIs) in professional education and life-long learning
2. The challenge of coordination with other publicly funded initiatives
3. The importance of adapted learning formats
4. Matching course contents with participants' needs
5. Quality assurance and agile course development
6. Challenges for adult learning in artificial intelligence
7. Deployment and integration of new AI competencies in the home organization
8. Training as a professional service or a free utility provided by the state



# Welcome to the Elements of Artificial Intelligence free online course

English ▾ Start the course

Distance course at Linköping University to get 2ECTS



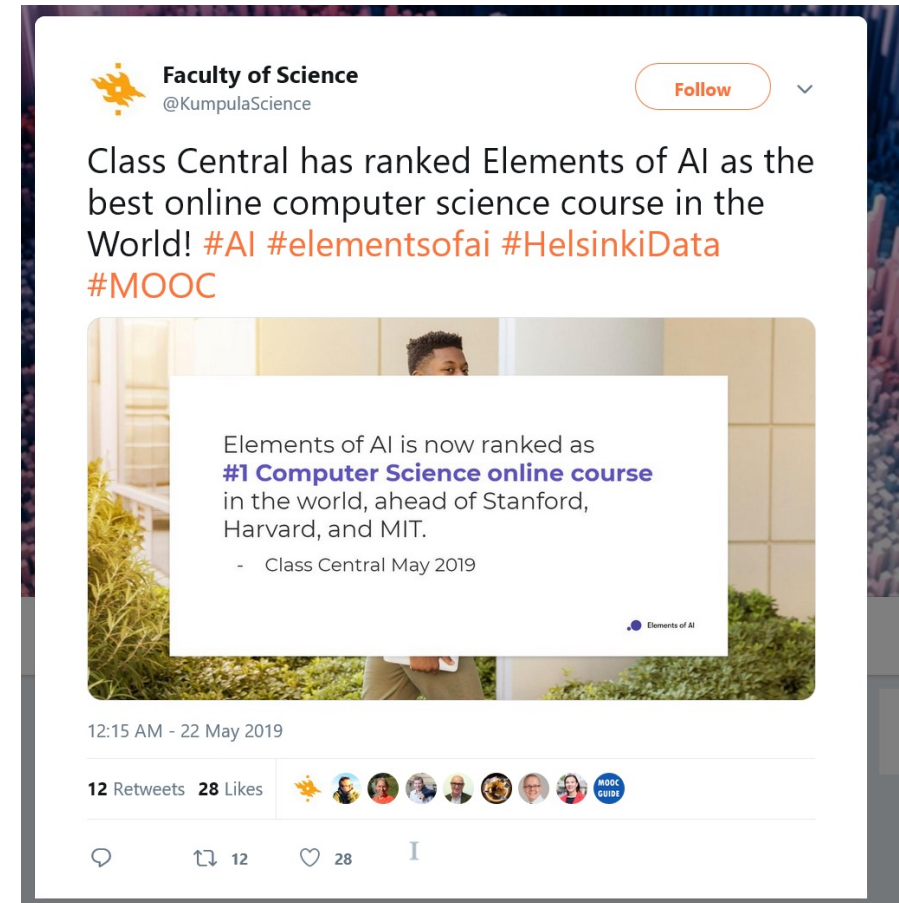
<https://www.elementsofai.se/>

Swedish launch funded by



# Elements of AI – Results so far

- Worldwide
  - > 805 000 signups
  - > 102 000 completed
- Sweden
  - > 37 600 signups
  - > 8 000 completed
  - > 12 300 signed up for the English course with Sweden as their country
  - > 4 300 have received university credits for the course





# AI Innovation, Competence and Research Ecosystem

AI SUSTAINABILITY CENTER

AI INNOVATION of Sweden

Elements of AI

AI Competence of Sweden

WASP-ED = WASP-HS  
WALLENBERG AI,  
AUTONOMOUS SYSTEMS  
AND SOFTWARE PROGRAM

CHALMERS UNIVERSITY OF TECHNOLOGY

KTH VETENSKAP OCH KONST

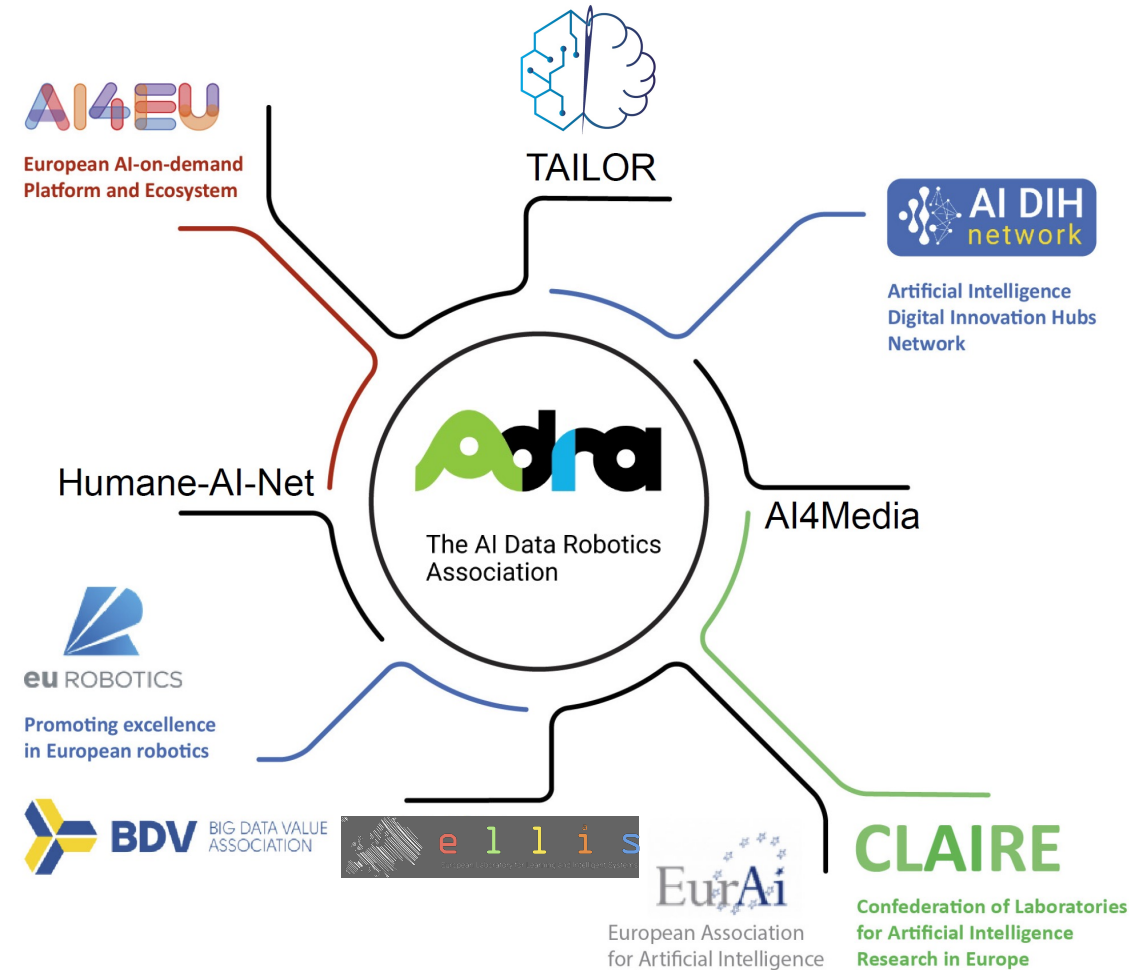
LINKÖPINGS UNIVERSITET

LUNDS UNIVERSITET

UMEÅ UNIVERSITET

UPPSALA UNIVERSITET

ÖREBRO UNIVERSITY



# Take Away Message

- AI will affect **all** aspects of our society.
- **Education and lifelong learning will be absolutely necessary!**
- Educational **challenges**:
  - New ways of working
  - The amount of knowledge grows exponentially
  - We need domain experts that also understands AI
- Educational **opportunities**:
  - New exciting content
  - Individualize exercises/teaching
  - Fast, detailed and tailored feedback
- Need initiatives on **all levels** from primary to professional education
  - Computational thinking is the foundation
  - Every engineering program needs AI/CS courses
  - We need AI/CS content/profiles on all programs
- **We need to act now!**



Respect for  
human autonomy



Prevention of  
harm



Fairness



Explicability