FCAI

fcai.fi

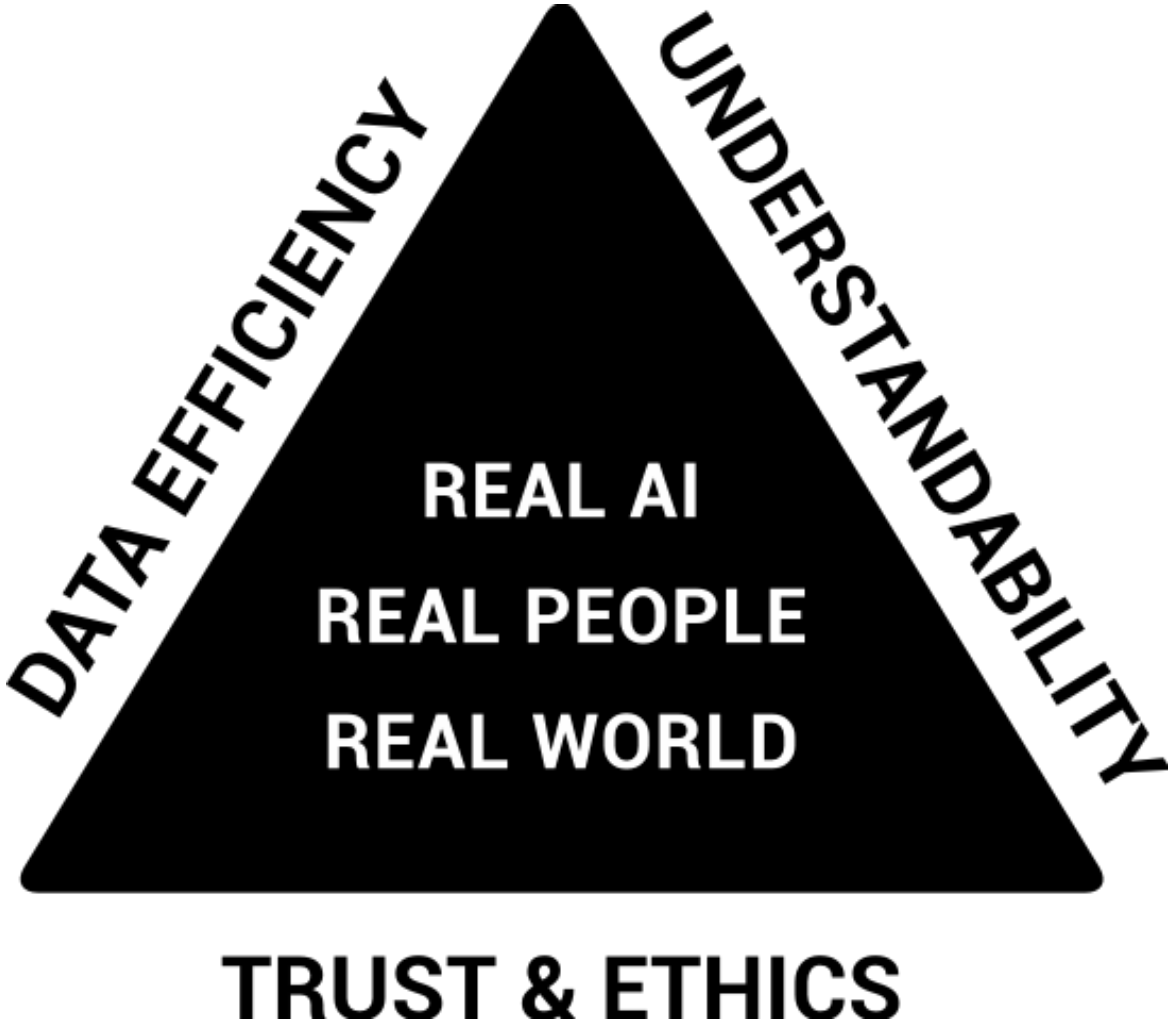
Understandable Data-Efficient AI

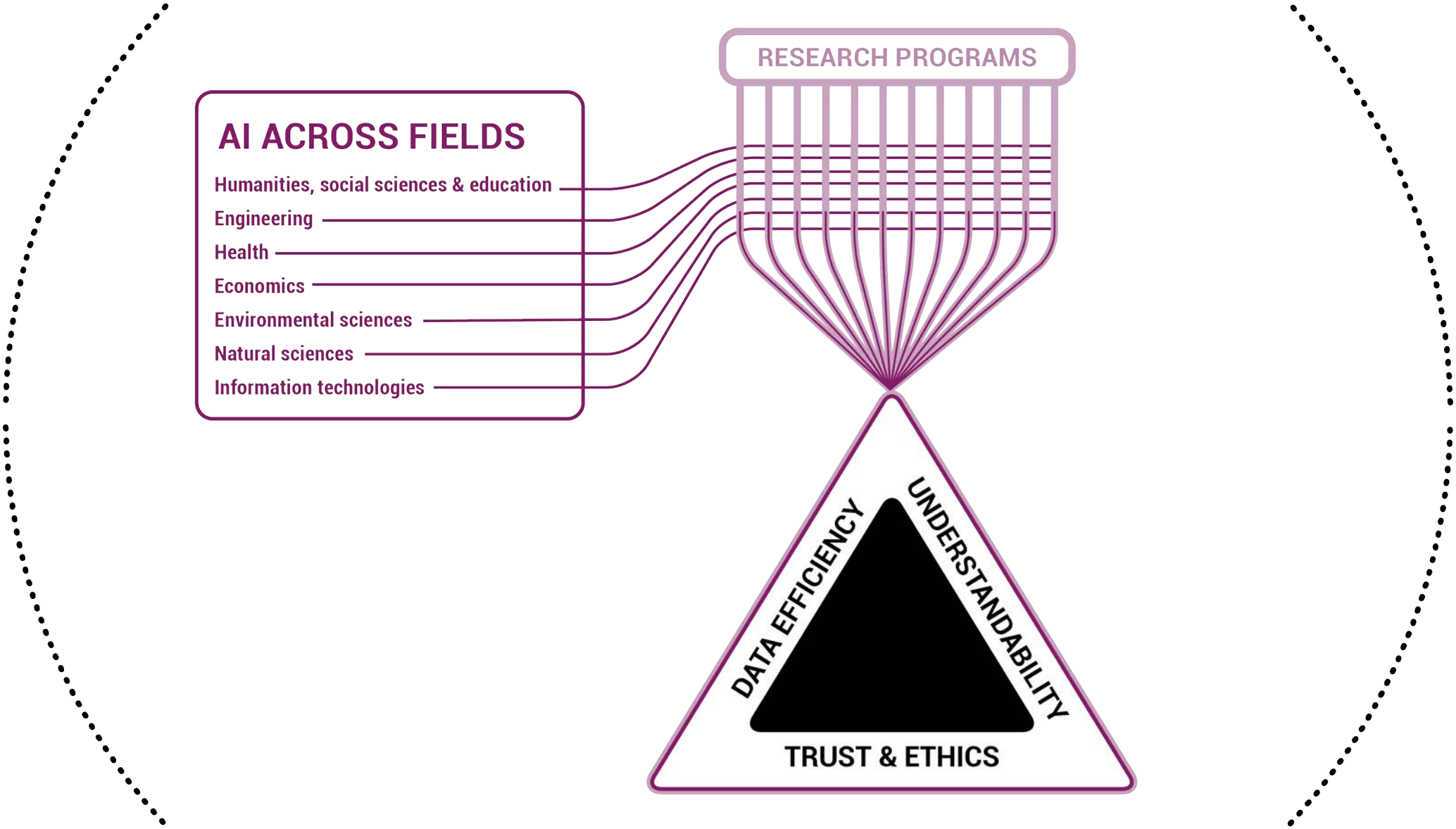
Samuel Kaski

Aalto University

UNIVERSITY OF HELSINKI

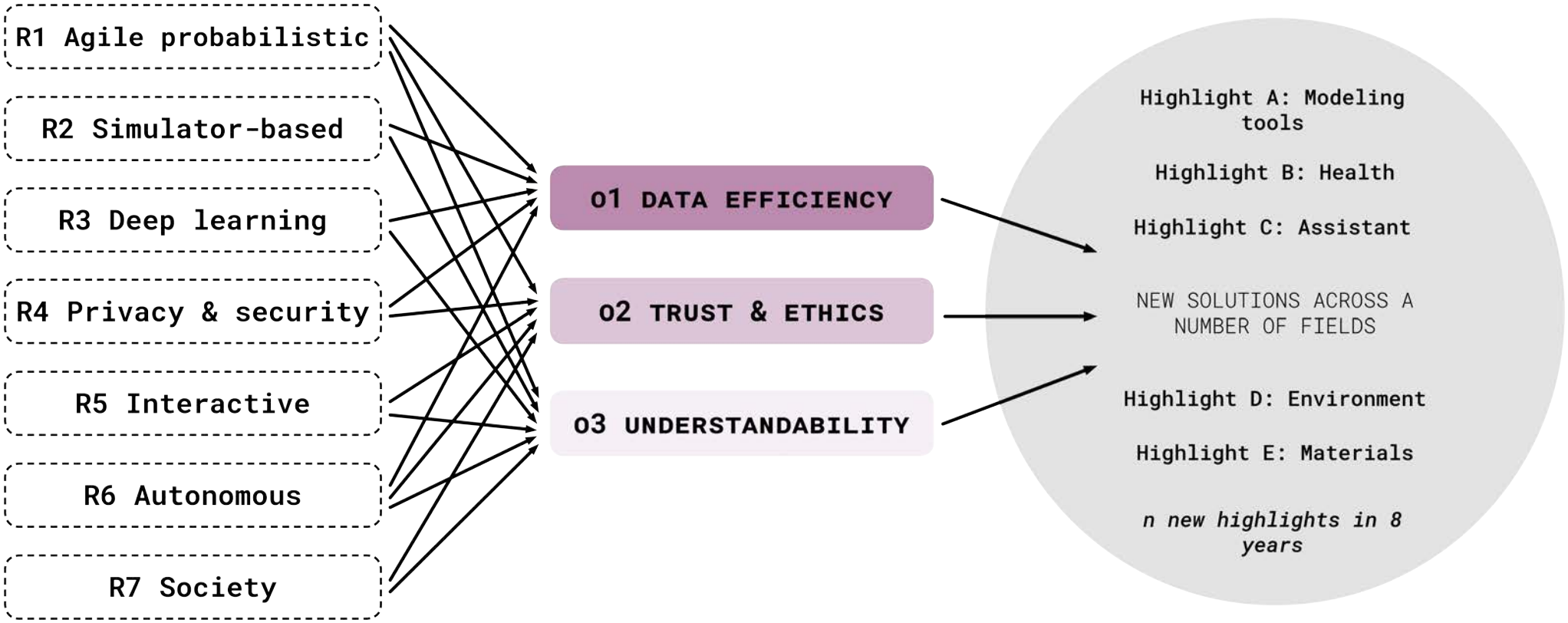
VTT


DATA EFFICIENCY
UNDERSTANDABILITY
REAL AI
REAL PEOPLE
REAL WORLD
TRUST & ETHICS


AI ACROSS FIELDS
Humanities, social sciences & education
Engineering
Health
Economics
Environmental sciences
Natural sciences
Information technologies
RESEARCH PROGRAMS
DATA EFFICIENCY
UNDERSTANDABILITY
TRUST & ETHICS

FCAI research in a nutshell

From fundamental research to high-impact



Continuing the long-term strategy

Based on strong investments in foundations of AI over decades

1980's
Neural networks

1995–99
First AoF CoE on Neural Networks (Aalto)

1999
HIIT founded as joint institute between UH and Aalto

2000–05
Neural Networks CoE (Aalto)

2002–07
From Data to Knowledge CoE (UH)

2006–11
Adaptive Informatics CoE (Aalto)

2008–13 Algorithmic Data Analysis CoE (UH)

2012–17 Computational Inference CoE (Aalto/UH)

2014
Profi 1 Aalto: ICT & Digitalization
UH: Large Data & Life-Science Informatics

2015
Profi 2 UH: Digital Humanities

2016
Profi 3 Aalto: Data Science and Analytics, Digital Technology Ecosystems
UH: Data Science

HIIT
150 researchers, budget 11 M€/year

2020's Flagship

1. Finland a leader in development and application of AI, generating wealth and prosperity for the country as a whole.

2. Experts with skills and capabilities to employ the latest AI methodologies

3. Analytic data-based decisions using AI methods.

VTT: Building national and international ecosystems

Collaboration

NSF Science and Technology Center for Science of Information (USA)

Alan Turing Institute (UK)

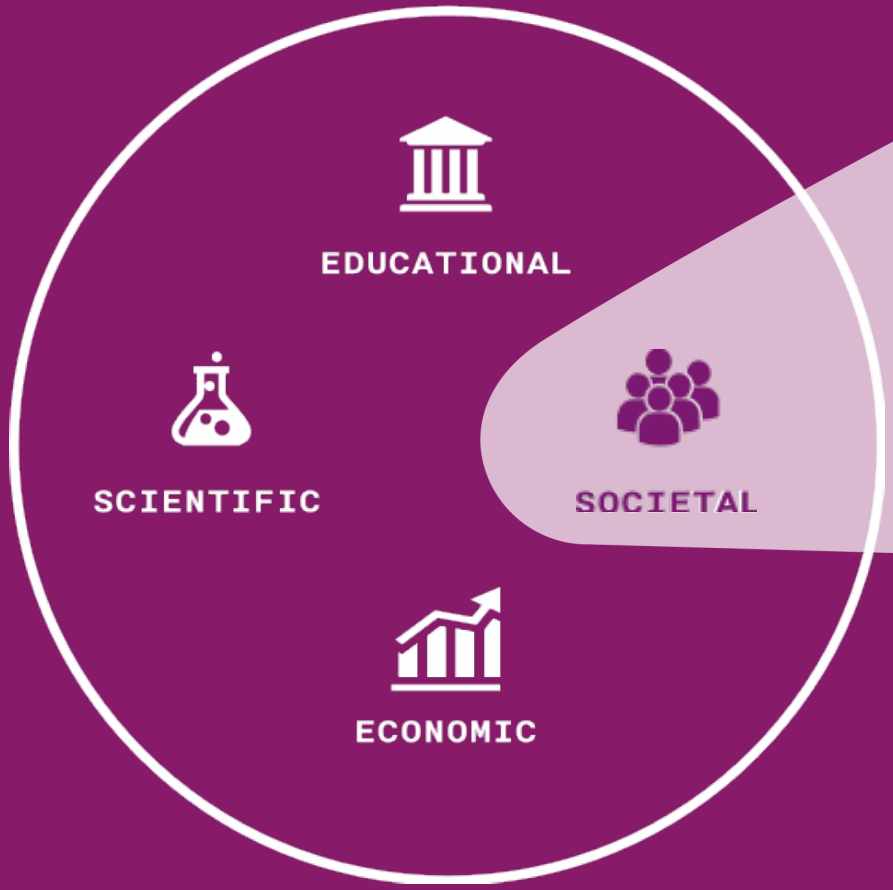
EIT Digital (EU)

Japan

FCAI Industry and Society Members

+ a large number of others

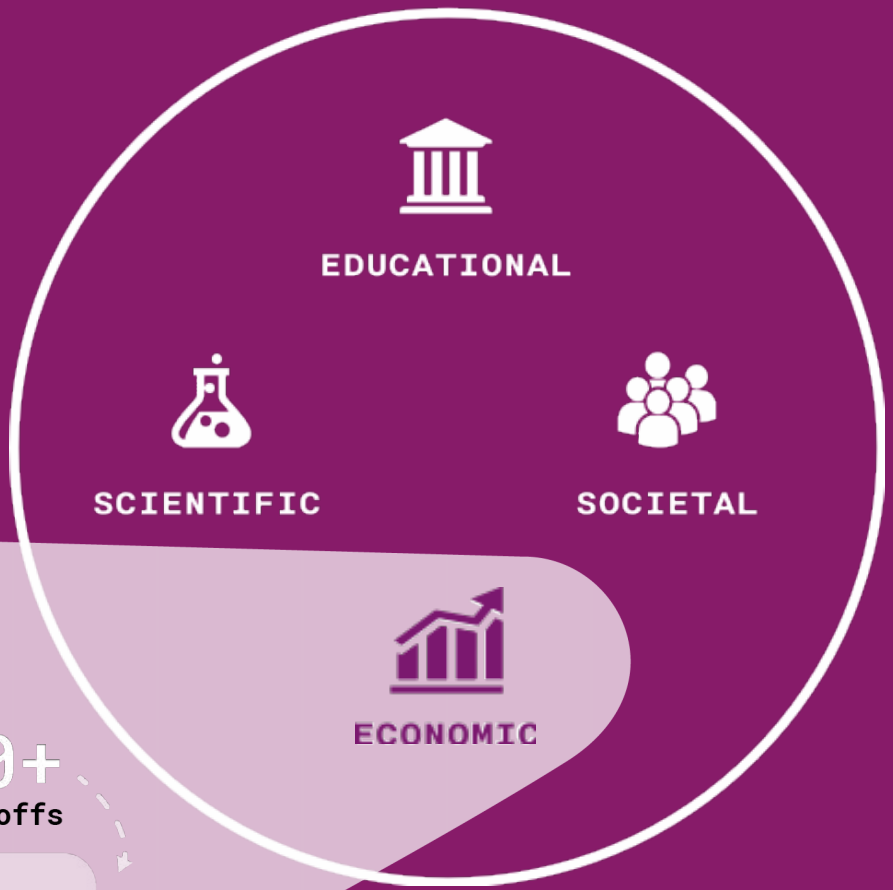
IMPACT



Tekoälyaika

FINLAND WANTS
TO BE A LEADING
COUNTRY IN AI

IMPACT



First 4 years

work with

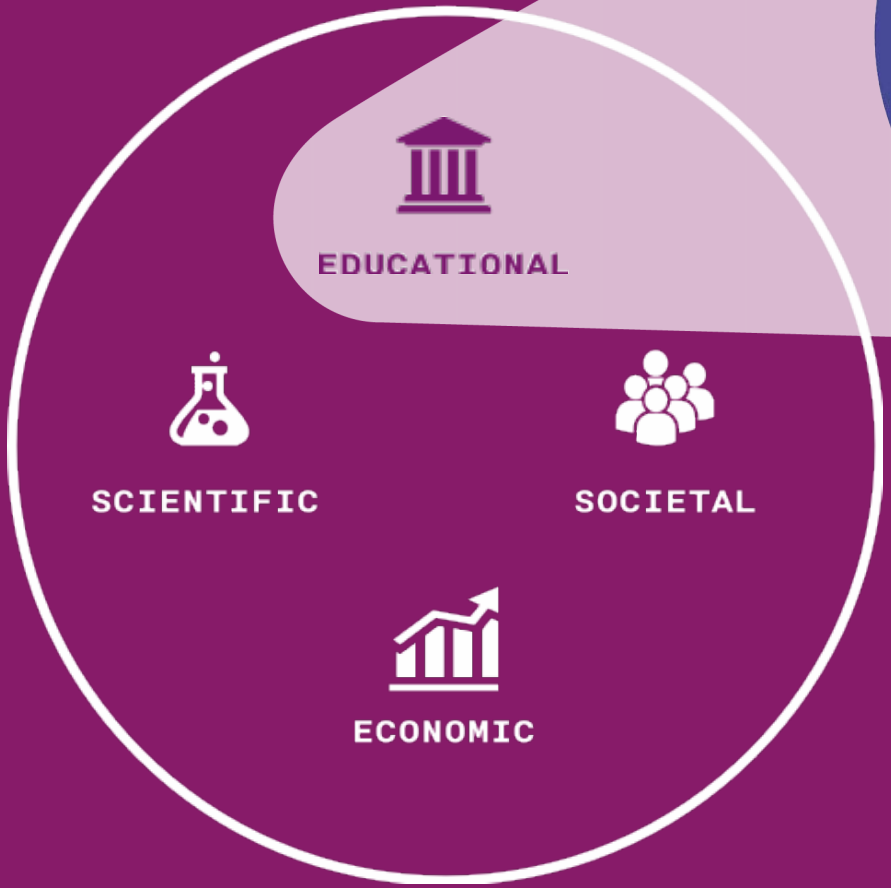
30+ leader companies

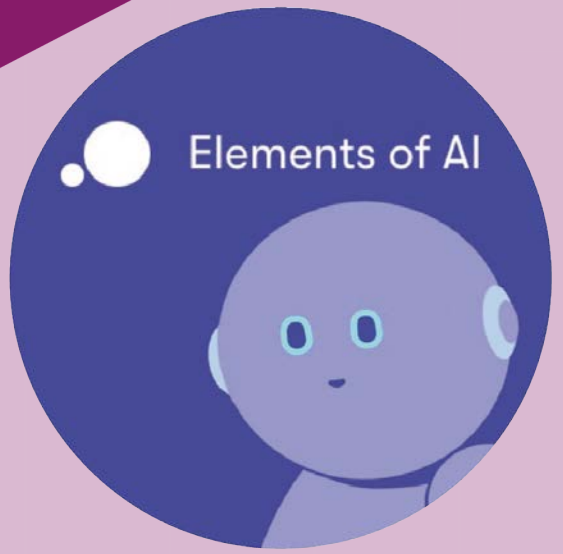
1000+ benefit

20+ spinoffs

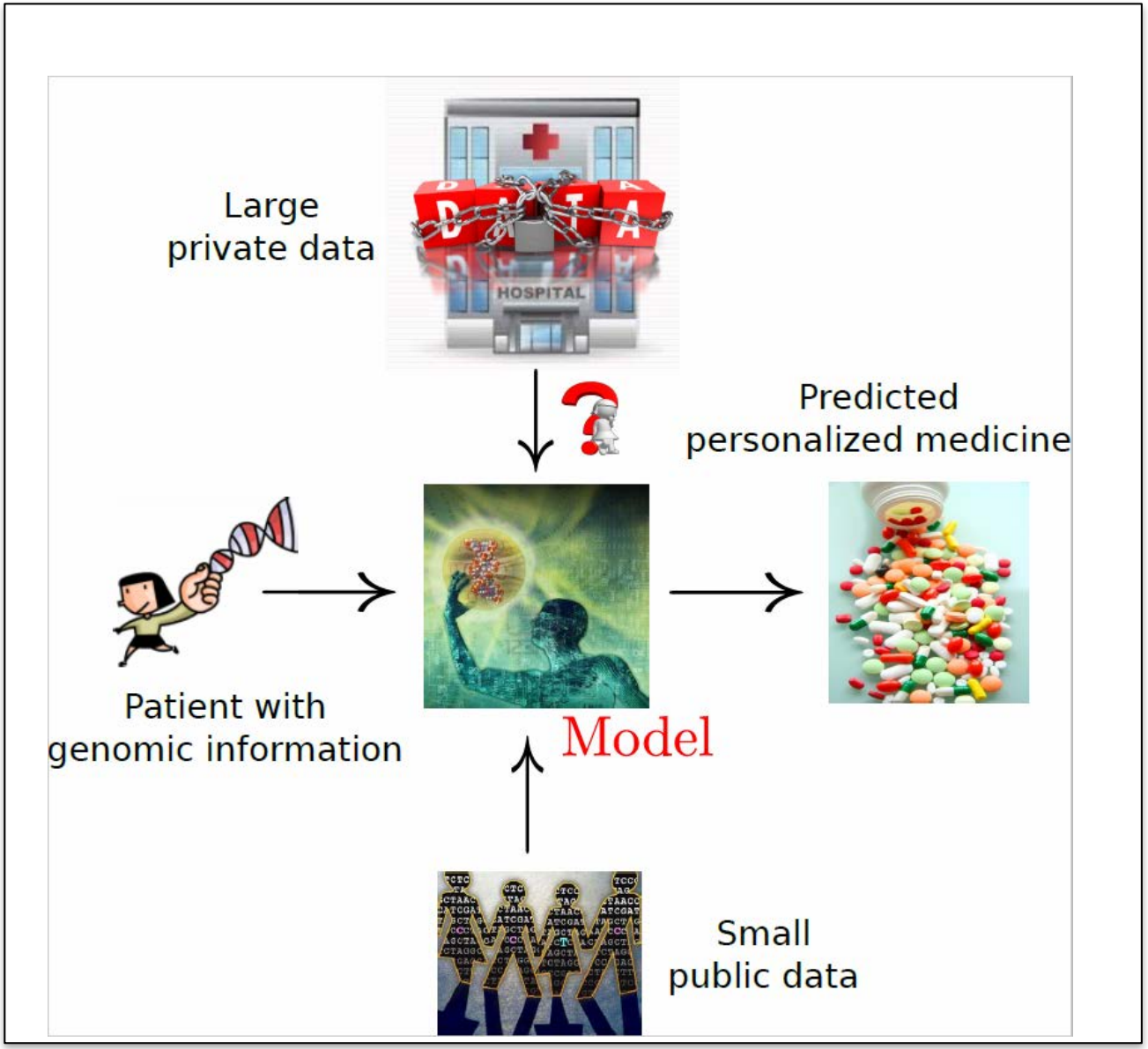
20B€ *AI-based growth*

IMPACT



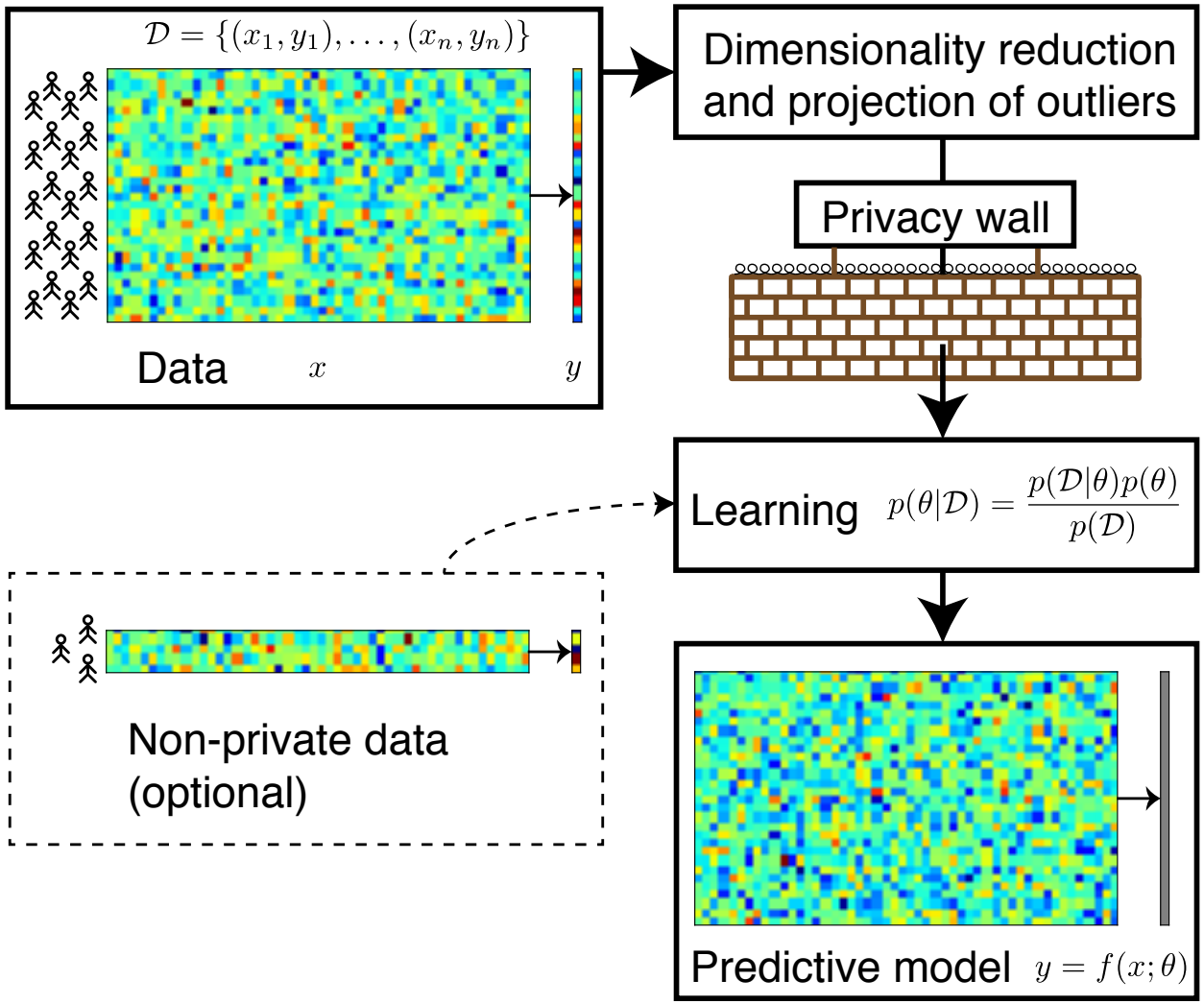


Modelling for personalized medicine - private data



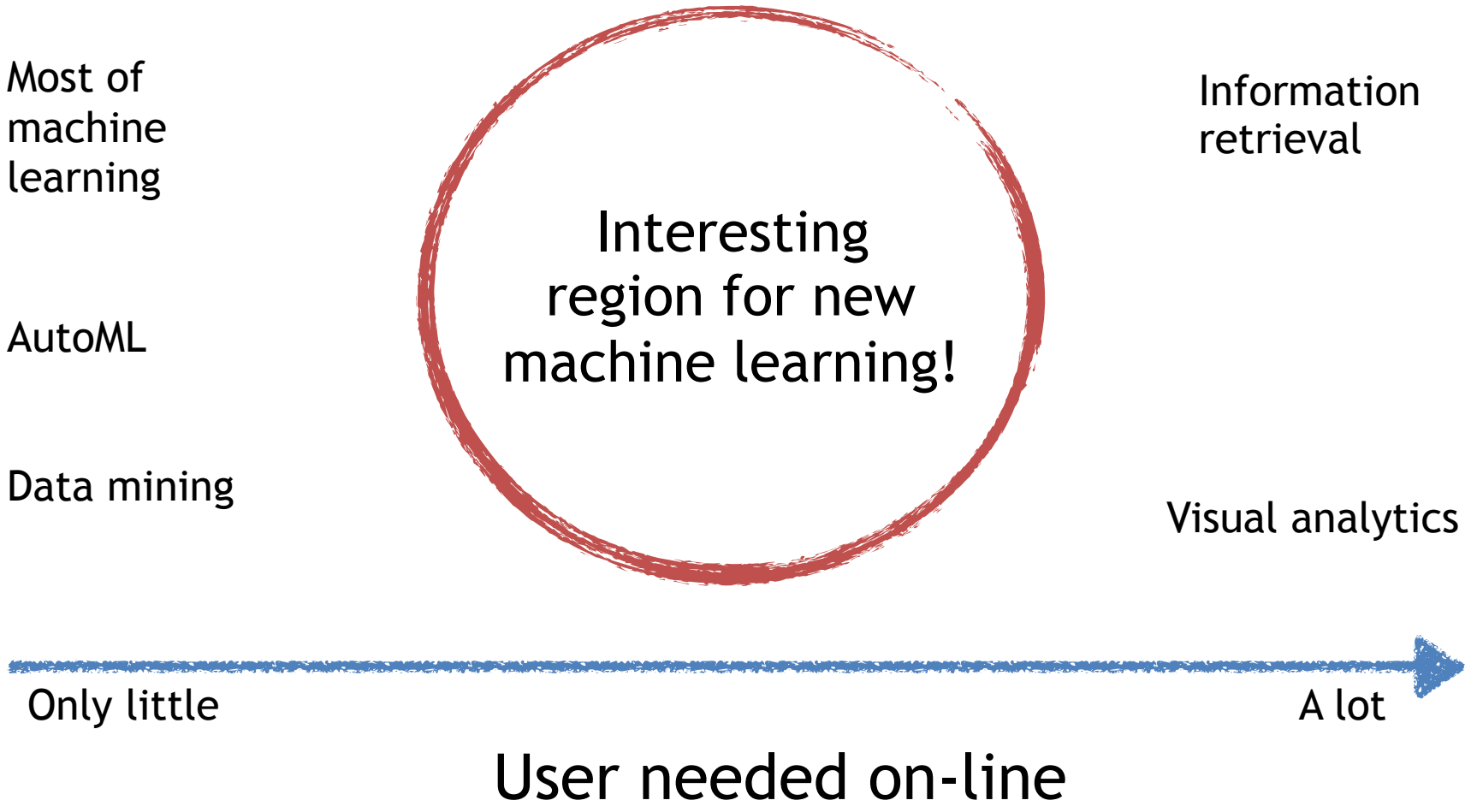
Privacy-preserving machine learning

What if data could be shared without losing privacy?



Honkela et al., Biology Direct 2018
Heikkilä et al., NIPS 2017

Machine learning problem types



Augmented intelligence?

Hugo human-centered designer:

- Humans use AI

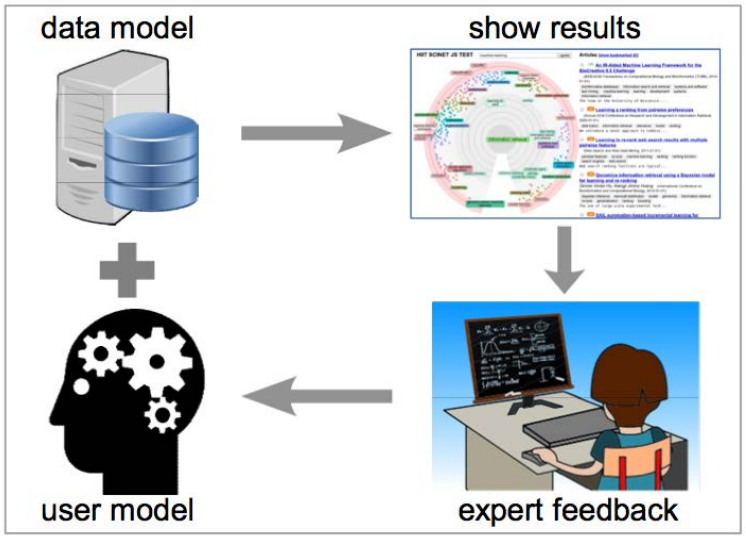
Amanda AI / AI developer:

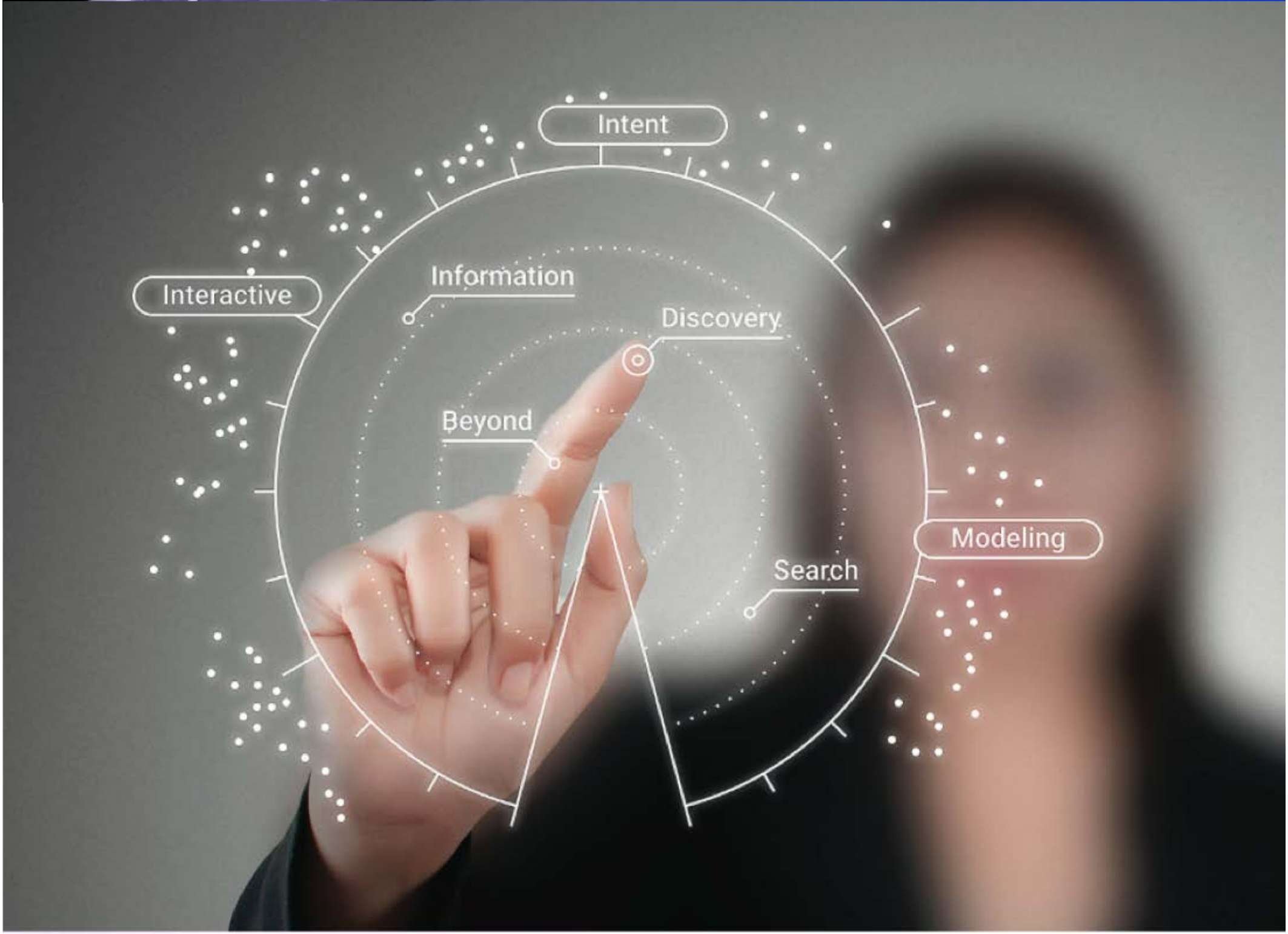
- AIs use humans

Yamaguchi先生 CC BY-SA

Marta Modeller:

- Humans and AI are collaborating parts in a system, which can be modelled, in principle




Intent
Information
Interactive
Discovery
Beyond
Modeling
Search

IntentRadar: A Search User Interface that Anticipates User's Search Intents

Helsinki Institute for Information Technology

HELSINKI INSTITUTE FOR INFORMATION TECHNOLOGY

Glowacka et al. IUI 2013,
Ruotsalo et al. Commun ACM 2015, ACM TOIS 2018

Bioinformatics, 34, 2018, i395–i403
doi: 10.1093/bioinformatics/bty257
ISMB 2018

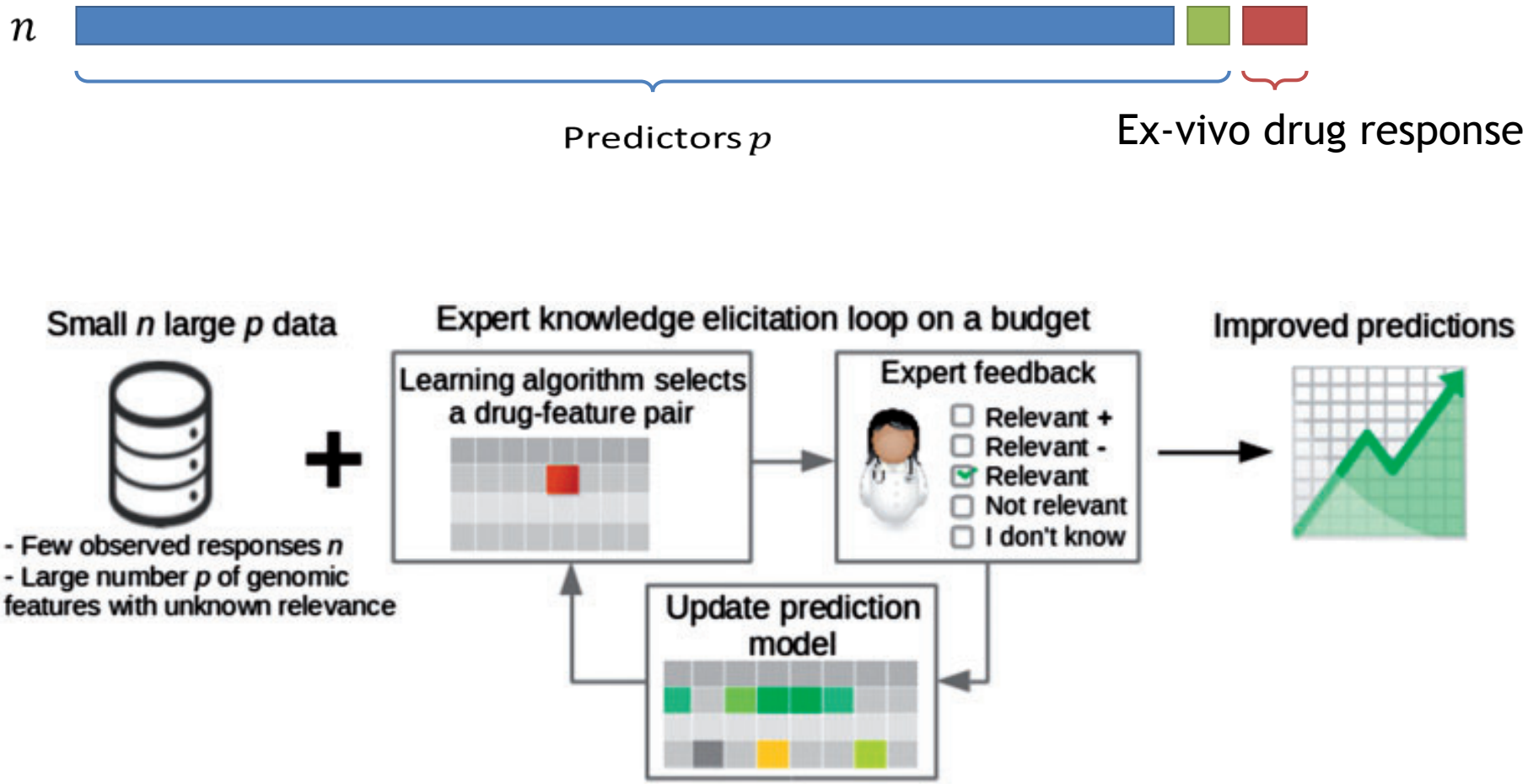
OXFORD

Improving genomics-based predictions for precision medicine through active elicitation of expert knowledge

Iiris Sundin[1,†], Tomi Peltola[1,†], Luana Micallef[1], Homayun Afrabandpey[1], Marta Soare[1,‡], Muntasir Mamun Majumder[2], Pedram Daee[1], Chen He[3], Baris Serim[3], Aki Havulinna[2,4], Caroline Heckman[2], Giulio Jacucci[3], Pekka Marttinen[1,*] and Samuel Kaski[1,*]

[1]Department of Computer Science, Helsinki Institute for Information Technology HIIT, Aalto University, Helsinki, Finland, [2]Institute for Molecular Medicine Finland FIMM, Helsinki Institute of Life Science and [3]Department of Computer Science, Helsinki Institute for Information Technology HIIT, University of Helsinki, Helsinki, Finland and [4]National Institute for Health and Welfare THL, Helsinki, Finland

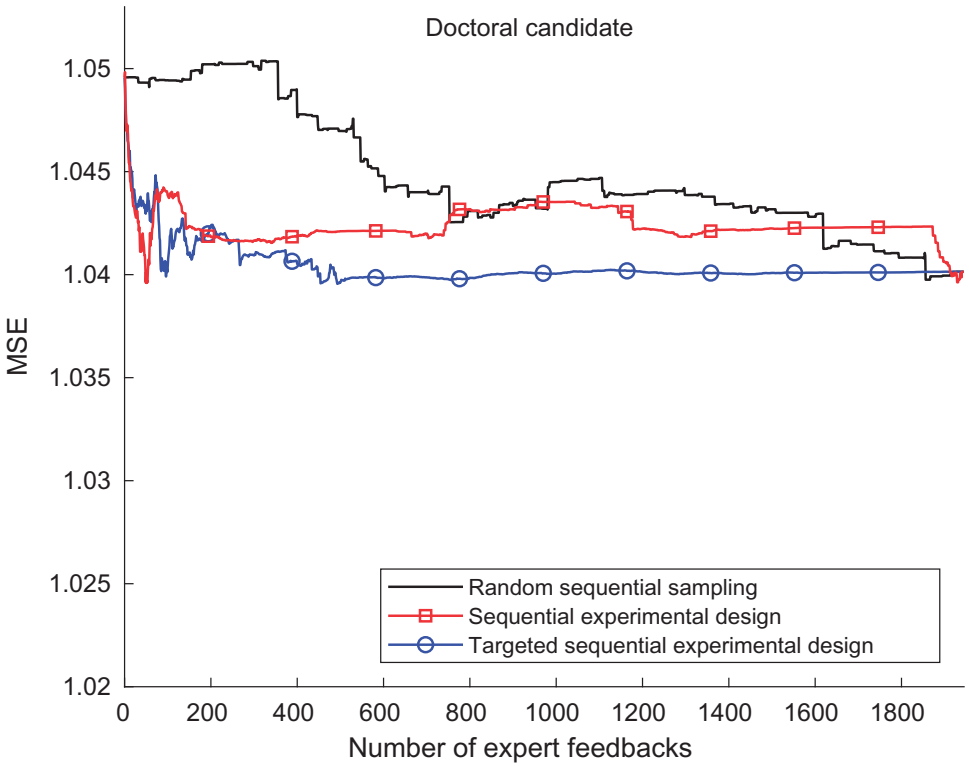
Interactive expert knowledge elicitation

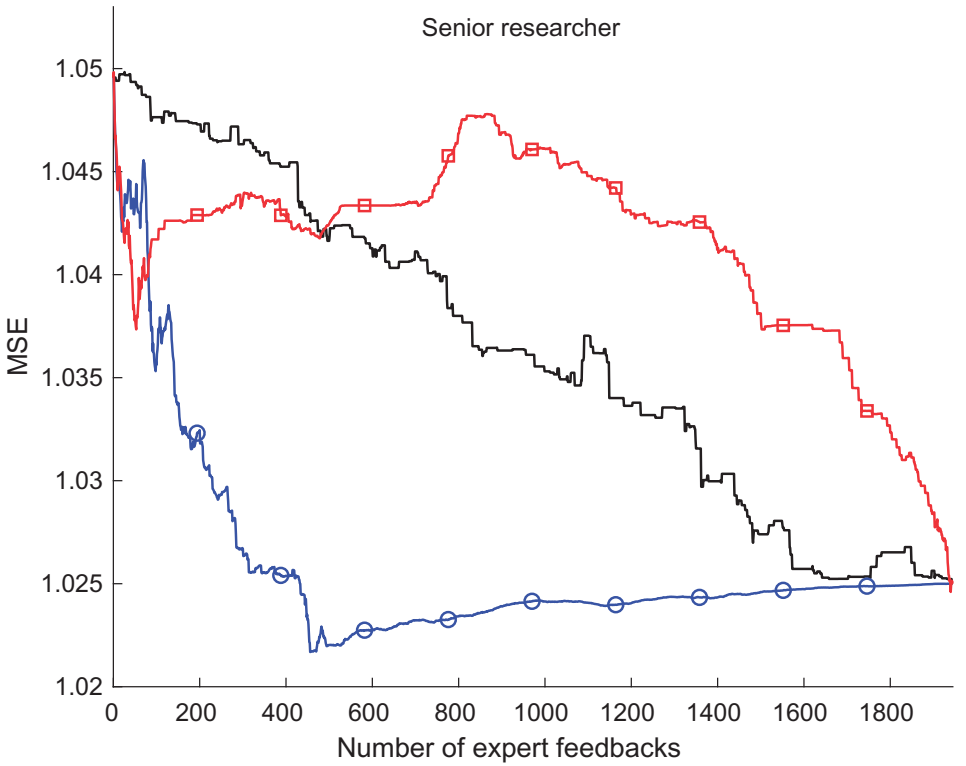


Sundin et al., Bioinformatics 2018

Sequential knowledge elicitation **reduces the number of queries** required from the expert

- Task: predict drug effectiveness on MM based on genomics





Sundin et al., Bioinformatics 2018

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INFERRING COGNITIVE SIMULATORS FROM DATA

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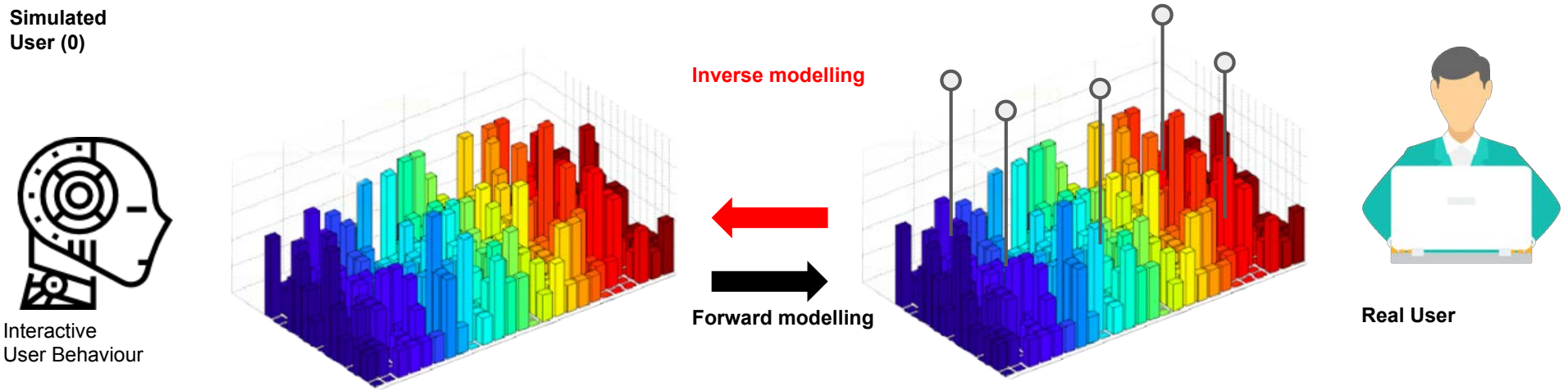
Inverse modelling of complex interactive behavior



Inferring Cognitive Models from Data using Approximate Bayesian Computation

Antti Kangasrääsiö[1], Kumaripaba Athukorala[1], Andrew Howes[2], Jukka Corander[3], Samuel Kaski[1], Antti Oulasvirta[4]

CHI 2017

Parameter Inference for Computational Cognitive Models with Approximate Bayesian Computation

Antti Kangasrääsiö,[a] Jussi P. P. Jokinen,[b] Antti Oulasvirta,[b] Andrew Howes,[c] Samuel Kaski[a]

CHI 2017; Cognitive Science, in press

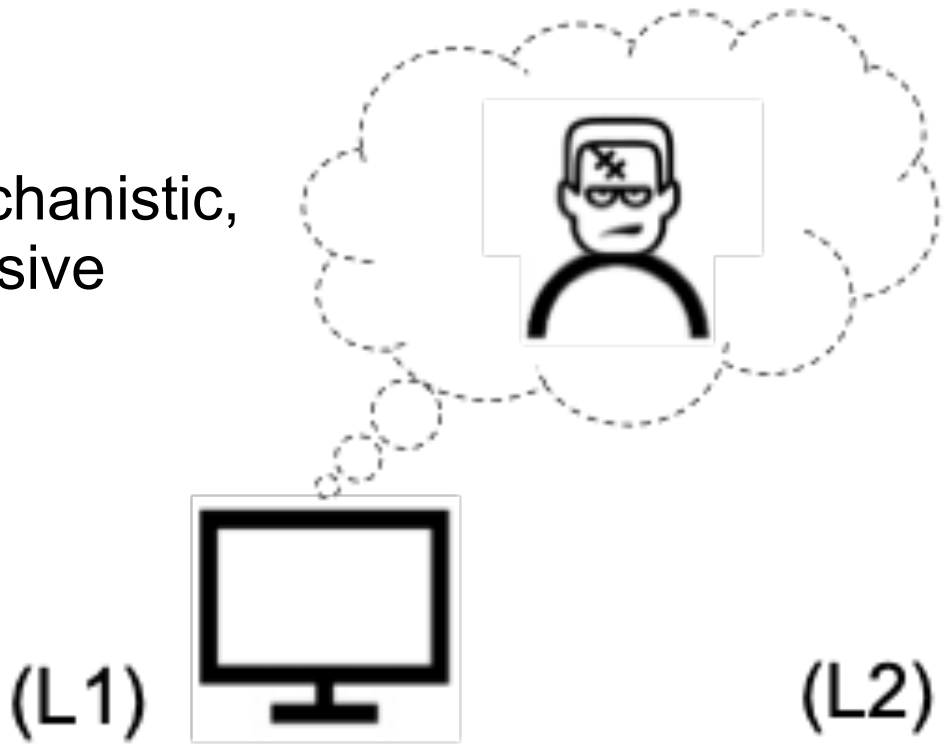
Inverse Reinforcement Learning from Summary Data

Antti Kangasrääsiö [1] Samuel Kaski [1]

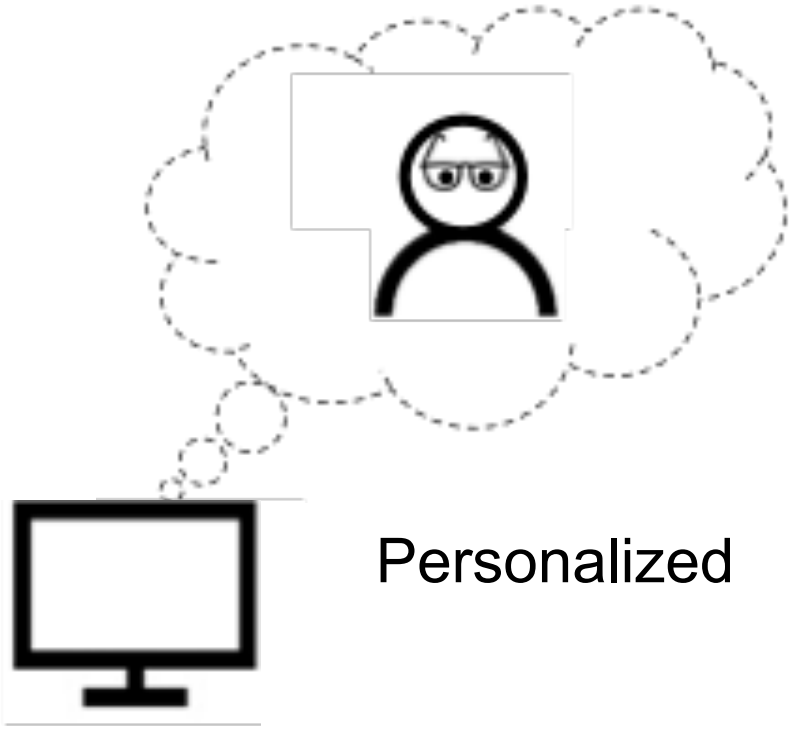
Machine Learning; arXiv:1703.09700

Levels of interactive AIs. Assumptions of user

Mechanistic, passive



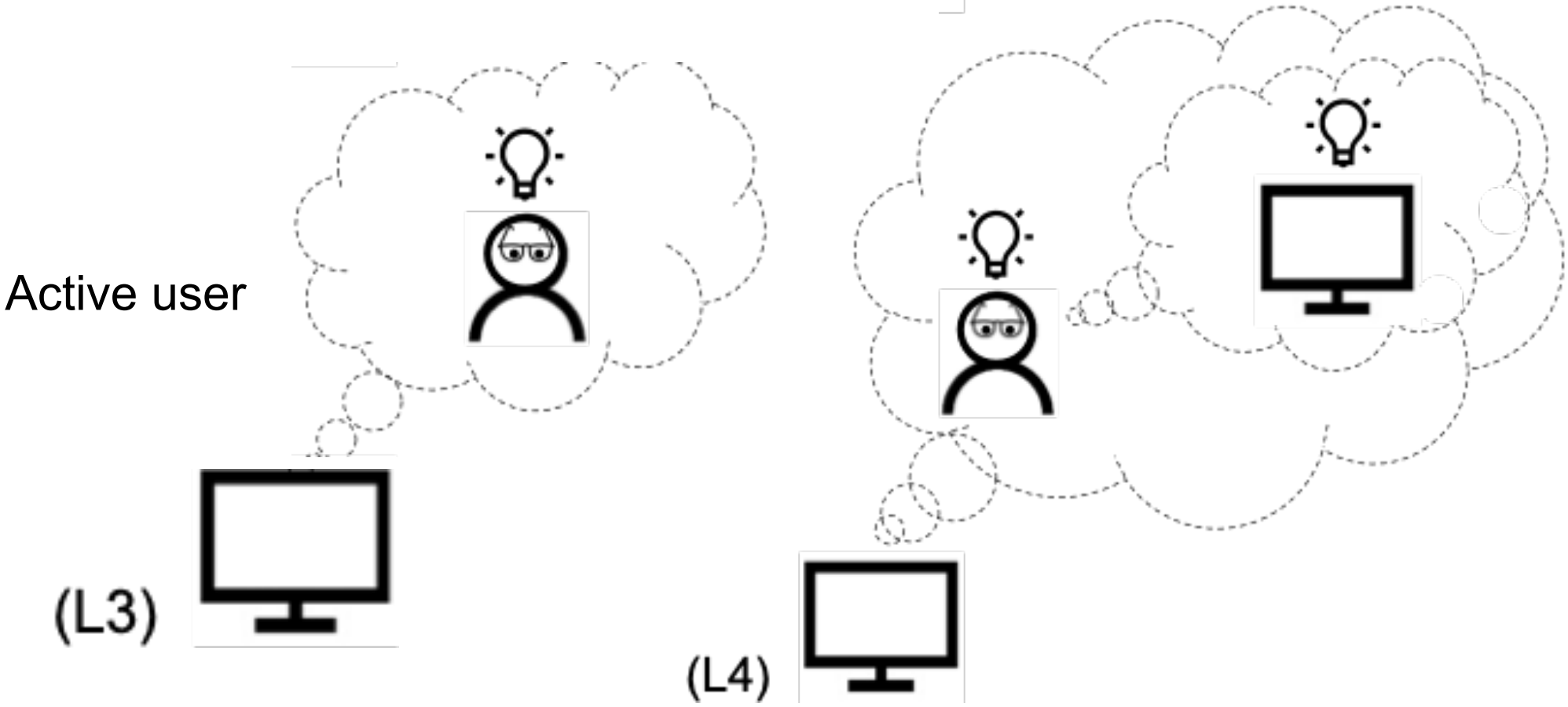
(L1)



(L2)

Personalized

Levels of interactive AIs



Modelling User's Theory of AI's Mind in Interactive Intelligent Systems

Tomi Peltola, Mustafa Mert Çelikok, Pedram Daee, Samuel Kaski

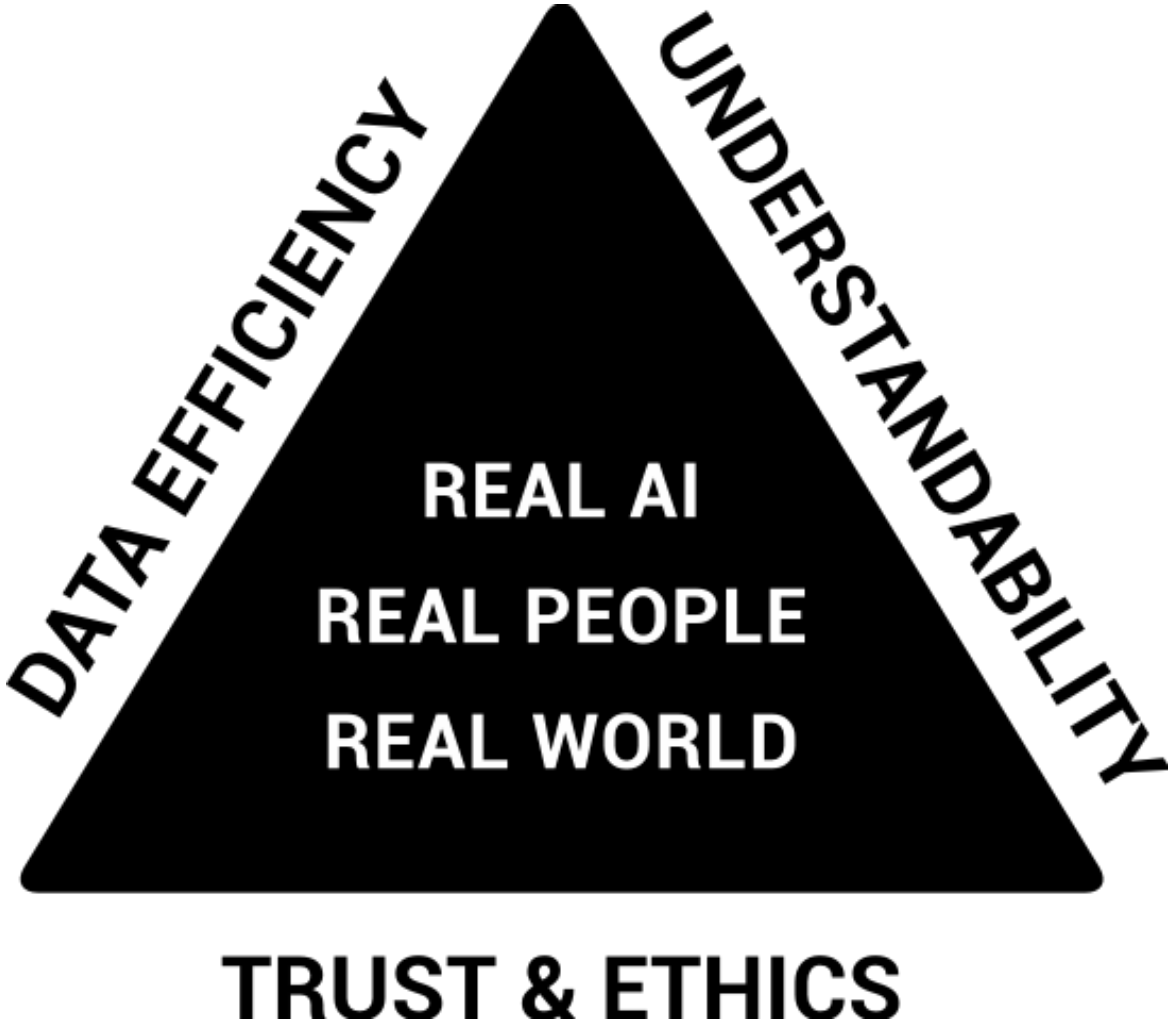
arXiv.org > cs > arXiv:1809.02869

Interactive AI with a Theory of Mind

CompHCI2019

Machine Teaching of Active Sequential Learners

Peltola, T., Çelikok, M. M., Daee, P. & Kaski, S., NeurIPS 2019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