FCAI Finnish Center for Artificial Intelligence

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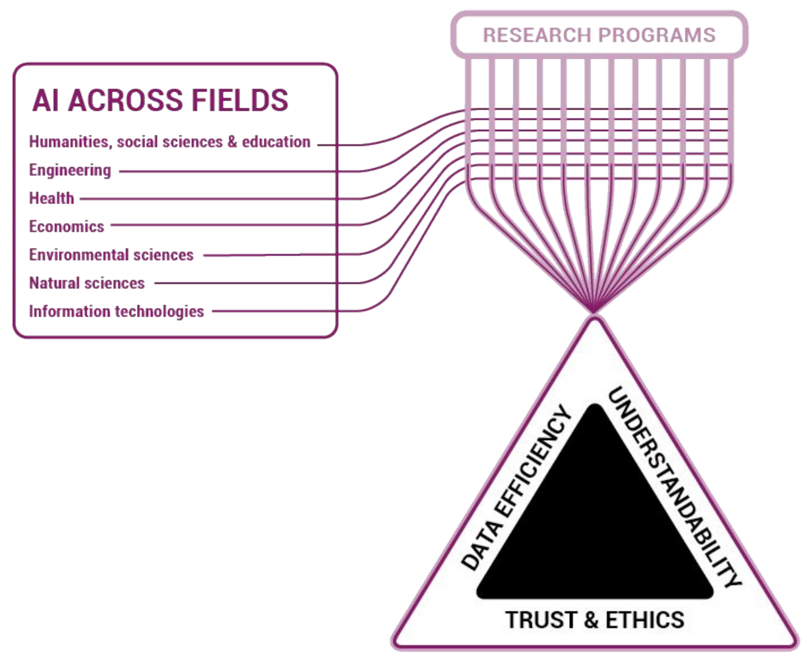


Interactive AI (Research Program R5)

Our goal is a new form of AI that people can naturally work and solve problems with, and which is based on the ability to better understand people's goals and abilities, take initiative more sensitively, align objectives with them, and support them.

Program objectives

AI needs to understand people's preferences and capabilities in order to make itself understandable and collaborate. In order to be trustworthy, AI needs to work in a way that does not diminish people's autonomy and competence. To be efficient, AI needs to adapt based on scarce data - even just few observations from a single person - and work robustly, as large datasets may not be available.

1. Understanding Humans

AI that understands people must be able to infer people's goals and capabilities, as well as counterfactually predict what the consequences of its actions would be. In machine learning terms, it needs to infer the latent and non-stationary reward function. Alas, this function is practically impossible to learn from observations only.

2. Accurate Interventions

To operate in an environment with human partners, interactive AI agents must be able to predict the consequences of its actions on human partners. Every action is an intervention with possible positive and negative consequences. When planning its actions, the AI agent must also account for the uncertain and dynamically changing nature of joint environments.

3. AI-assisted Design and Decision-making

Our objective is AI methodology that is able to assist human partners in design and decision-making, achieving demonstrable improvements in both the process and outcomes. The new, human-centric form of AI will be designed to boost the felt autonomy and competence of the human partner, as opposed to 'automating' tasks or replacing them.

Methodologies

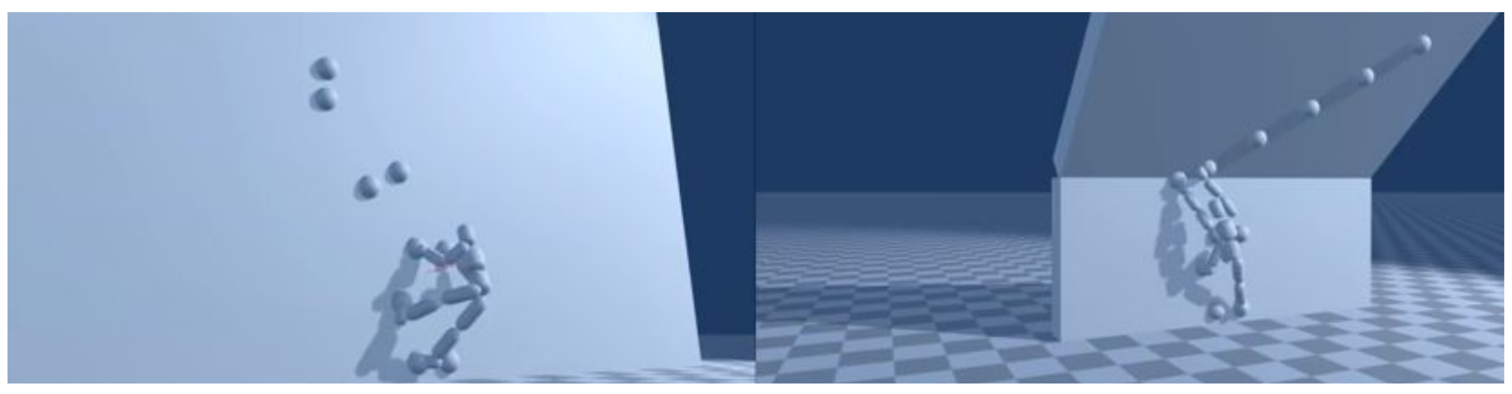
To reach our objectives, we apply a diverse set of methodologies:

- Computational models of human behavior and experience, especially computational rationality -based models. This class of modeling approaches human behavior as optimal adaptation to bounds.
- Simulator-based machine learning: We study methods that allow combining first principles -based models, which allow stronger counterfactual reasoning, with learning and inference.
- Multi-agent systems: We formulate human-AI interaction formally as a decision problem involving multiple agents with diverse abilities.
- Experimental research for theory- and model-building

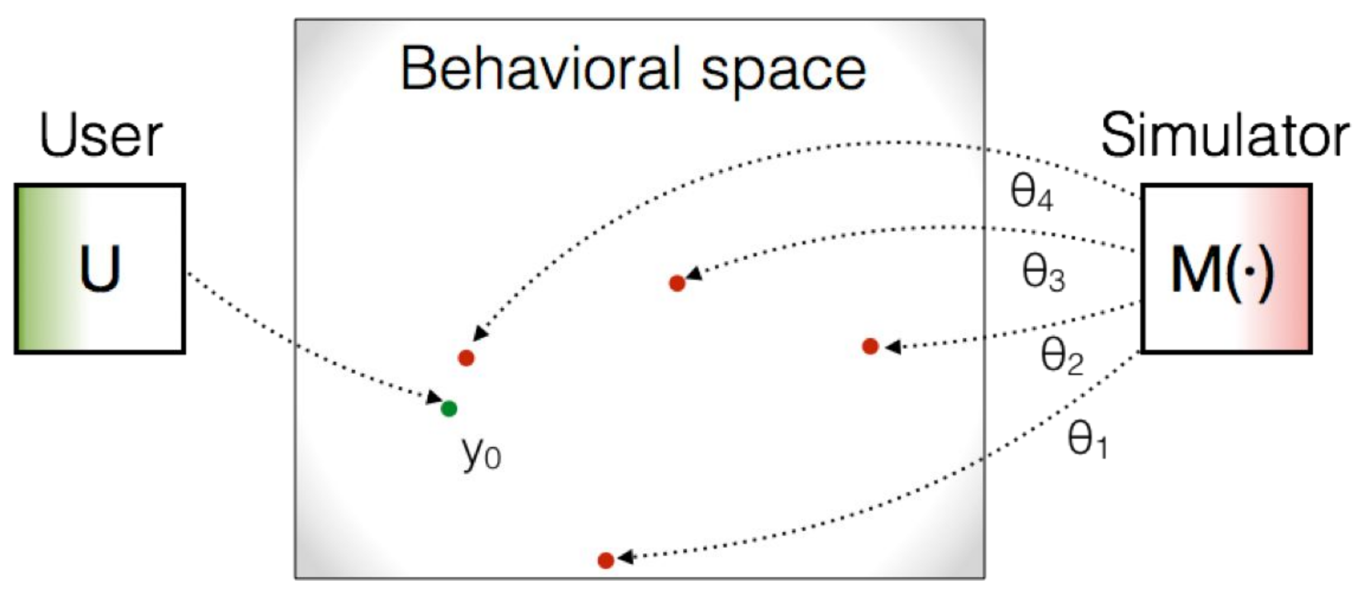
Research results

The program started in 2018.

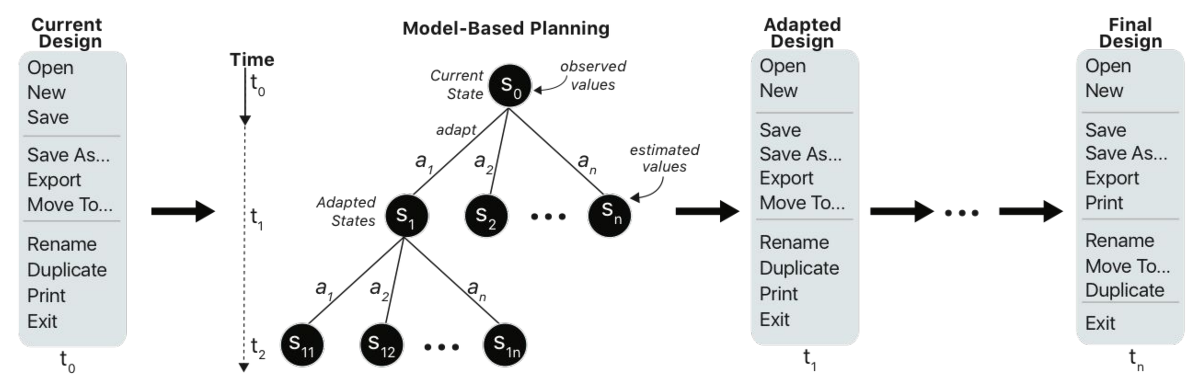
Simulation of complex motoric problem-solving in humans: A physics model of the body is used to plan movements for previously unseen climbing routes (Hämäläinen et al. SIGGRAPH'17)



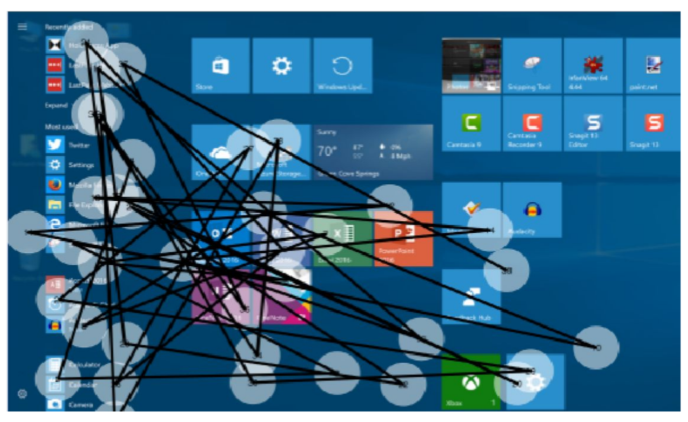
Users' cognitive capabilities are inferred from log data using Approximate Bayesian Computation (Kangasrääsiö et al. CHI'17, Cognitive Science journal 2019)



Adapting interfaces according to users' skill and interest: Deep model-based reinforcement learning (submitted, CHI'21)



Predicting the consequences of changing user interfaces on visual search and exploiting that to adapt them (Jokinen et al. IJHCS 2020; Todi et al. TIIS 2019)



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Finnish Center for Artificial Intelligence FCAI is a community of experts in artificial intelligence in Finland, initiated by Aalto University, University of Helsinki, and VTT Technical Research Centre of Finland. FCAI is one of the six Academy of Finland Finnish flagships.

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