Section for Cognitive Systems at DTU Compute

Our research has a strong foundation in statistical machine learning, and in the neuro-, cognitive and social sciences, which allows us to address fundamental issues in general information processing and in natural and artificial cognition.

We have helped establish – and we host – the DTU arm of the Danish Pioneer Centre for AI and the Danish Data Science Academy.

The section's research is generously funded by Danish Public and Private foundations and by the European Union, e.g., through active grants including an ERC consolidator grant and a number of the Novo Nordisk Foundation grants (currently, three collaborative data science grants, two personal data scientists grants and, two Challenge grants).

Research Areas

Statistical Machine Learning – Machine Learning turns unstructured data into actionable knowledge by identifying predictive relations. Machine learning has become the engine of the AI-based society.

Our research in machine learning is rooted in statistics and has a strong algorithmic component.

We have made fundamental contributions to the characterization of non-Euclidean latent spaces, missing data modeling, human-AI alignment, as well as transformational applications in the sciences

Neurotechnology – concerns new methods for the analysis of neuroscience data and establishing mental state decoding.

Our neurotechnology research has made basic contributions to neuroimaging, including the first machine learning based "mind reading" methods for fMRI and PET imaging. We developed the first machine learning explainability tools for this important domain.

Current work concerns decoding electric brain waves (EEG) inspired by large language models.

Contact
Lars Kai Hansen
Professor,
Head of Section.
DTU Compute
lkai@dtu.dk

www.compute.dtu.dk/sections/cogsys

January 2026

Technical University of Denmark

Cognitive Science – Our research investigates the behavioral and brain basis of social cognition and interaction. We develop joint action paradigms, machine learning and dynamical systems methods, and employ behavioral, physiological (HRV, respiration), and neuroimaging techniques (EEG, fMRI) both within and between (dual-EEG, heart-rate synchronization) interacting individuals.

We are interested in the mechanisms that enable us to engage in successful social interaction.

More generally we study human cognition and perception through behavioral and neurophysiological experiments combined with mathematical modeling.

Human-Computer Interaction – concerns design, implementation, and evaluation of systems and processes involving humans and computers. This becomes increasingly important as human well-being and productivity depends more and more on information processing and services.

Our research in HCI concerns the interaction between humans and intelligent systems with a focus on the signals they exchange. This includes audio, video, and physiological signals.

Our vision is to design cognitive systems for augmented human cognition in real-life environments. We have contributed real-life demonstrations of augmented cognition in the context of mobile applications, audio search engines, and scientific discovery.

Computational Social Science – Our work focuses on quantitative understanding of social systems based on massive data sets. The research draws on approaches from the physics of complex systems, machine learning, and statistical analysis.

We work on large-scale behavioral data and while the primary focus is on modeling complex networks, the research has made fundamental contributions to topics such as human mobility, sleep, academic performance, complex contagion, epidemic spreading, and social media behavior.

Services to the community

Cognitive Systems' faculty organizes important scientific events including the 2025 inaugural EurIPS AI conference with more than 2000 participants, as well as several smaller conferences and summer schools. The annual *Generative models and Uncertainty Quantification* meeting has been organized since 2019.

The Section's faculty serves as program committee member, area chair and senior area chairs for important meetings like NeurIPS, ICML, ICLR and AISTATS.

The section hosts the DTU component of the Danish Pioneer Centre for AI (2021-2034) and to the Danish Data Science Academy (2021-2026).

Innovation

The Section's faculty, alumni and students have been involved in several start-ups (e.g., Spectral Experience, BrainCapture, Raffle, Corti, Alvenir) and the section hosts many industrial PhDs and Postdoc projects, and generally participates in numerous business projects, including projects funded through the Innovation Fund Denmark and DIREC.