

“Computational Machinery of Cognition (CMC)” lab (cmclab.org) based in the Faculty of Medicine of TU Dresden will offer 1 PhD position (m/f/x) (TVL-65%, 3 years).

The overarching research theme of the CMC Lab is understanding the computational machinery that supports our cognitive processes. Cognition spans a wide range of functions (from perception to action and planning), and it is one of the most remarkable capabilities of the brain. In the CMC lab, we want to understand the computations (in particular, inference, and decision processes) that support our cognition and the biophysical machinery that implements these computations. We develop normative and biophysical modeling of cognitive functions, test these models with neural and behavioral data (in collaboration with experimental labs), and develop methods for multi- and cross-scale analysis of neural data to better capture the neural markers of these processes. We value the culture of collaboration, thus we extensively collaborate with labs in Dresden and other labs nationally and internationally (e.g., MPI for Biological Cybernetics and MPI for Intelligent Systems, Harvard Medical School).

The project will focus on developing reinforcement learning (RL) models to understand internal cognitive processes (in particular perception, and perceptual multistability; for example, see, Safavi and Dayan, *Neuron* 2022 and *BioRxiv* 2024). In the course of the project, we, together, will develop decision-theoretic models, for instance, based on partially observable Markov decision processes (POMDP), and assess them with psychophysical experiments, and will have the possibility to analyze neural data recorded from animals while doing similar tasks to understand the neural implementation of these computations. We will also collaborate with Peter Dayan (MPI for Biological Cybernetics) and Philipp Sterzer (University of Basel).

Broad familiarity with cognitive computational models (e.g., reinforcement learning, Bayesian inference, recurrent neural networks) and psychophysics are advantageous.

Our wishes (N=necessary, D=desired, P=plus):

- (N) Have background (Master/Diploma) in computational neuroscience, neuroscience, physics, mathematics, statistics, machine learning, psychology, and other related fields.
- (N) Being comfortable with programming (best would be, Python, or/and Matlab).
- (N) Communication skills in English.
- (N) Willingness to work responsibly and within part of a team.
- (D) Have experience with computational and cognitive neuroscience.
- (P) Have experience in the analysis and modeling of behavioral data.
- (P) Have experience with psychophysics experiments
- (P) Have experience with training recurrent neural networks
- (P) Have experience in the analysis of neural data.

Your gains:

- Being part of a team that cares about you and your career (see, our mentorship philosophy)
- Having tons of opportunities to constantly learn about computational neuroscience and artificial intelligence (through regular supervision, external talks, lab meetings, journal clubs, conferences, and many more).
- Having access to structured PhD programs
- Being part of a highly multidisciplinary environment (both locally, and through our extensive network of collaborators)

- Working in an international and diverse environment
- Mentorship and opportunities for your long-term career developments
- Possibility of remote working
- Care of your children through partnerships with children's institutions near the University Hospital
- Use of company prevention offers, courses, and fitness in our Carus Vital health centre.
- Job-oriented further and advanced training with individual planning of your professional career

We value the diversity of our team (in a broad sense), so we encourage everyone with any training, expertise, gender, race, nationality, ethnicity, geographic location, sexual orientation, age, religion, neurodiversity, disability status (and any other identity which is not noted above).