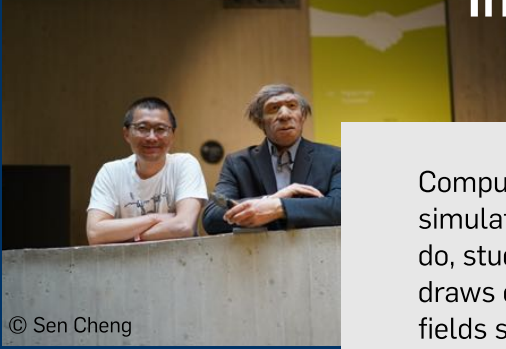


Computational Neuroscience Research Group

Information Sheet

What is Computational Neuroscience?



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Computational neuroscience uses mathematical models, computer simulations, and statistical analyses to describe what nervous systems do, study how they function, and explain the underlying principles. It draws on methods and concepts developed in many different scientific fields such as computer science, cognitive science, neurobiology, neurology, psychology, and even philosophy. In turn, research in computational neuroscience has had a major impact on those fields. For example, computational neuroscience has inspired artificial neural networks, reinforcement learning, robotics, and brain-computer-interfaces. Computational neuroscience has significantly advanced our understanding of brain functions, neurological disorders, cognitive processes, and behavior.

What is your area of research?

How do humans and animals navigate in space? How are past experiences stored and retrieved in the brain? In our group, we look for answers to these questions by investigating how agents learn to solve tasks in simulated environments and by performing advanced data analysis. Broadly, we take two different modeling approaches in our group - a more abstract approach known as reinforcement learning, where algorithms decipher the interplay between actions and rewards, and a more biologically inspired approach that uses spiking neural networks as models of the hippocampus, a region of the brain involved in spatial cognition and episodic memory.



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What type of projects are available?

All projects are related to our ongoing research. Hence, they broadly focus on spatial navigation and episodic memory and use either reinforcement learning or spiking neural networks. Your research will be embedded in a larger project that is being pursued by your supervisor, a doctoral student or a postdoc in the group. Some specific ideas can be found on our webpage <https://rub.de/cns>. However, if you have an idea that you would like to develop we would be happy to work with you.

What skills can I learn in your group?

Doing a research project in computational neuroscience, you will naturally learn many skills that are valuable for other fields and for industry. You will learn analytical skills such as problem solving, quantitative modeling, and critical thinking. You might learn technical skills including machine learning, data analysis, visualization, parallel computing, and literature research. For example, we apply state-of-the-art machine learning tools such as PyTorch and neural simulation tools such as NEST. Soft skills emphasized in our group are teamwork, communication in English, giving presentations, scientific writing, and time management.



What are the requirements?

You should be proficient in at least one modern programming language (preferably Python) and familiar with common concepts like OOP, procedural programming, etc. Furthermore, basic math skills are required, i.e., calculus, linear algebra, statistics. Since we are an international team, it is important to be proficient in English. The ability to work independently as well as enthusiasm for scientific research are also appreciated. For a smooth start, we recommend the courses Introduction to Python, Introduction to Computational Neuroscience, and Artificial Neural Networks.

Contact

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