PhD Student Position: Machine Learning in Biology & Medicine

We are recruiting an ambitious PhD student who wants to pursue a scientific career in machine learning, with applications in precision medicine, high-throughput biology, synthetic biology, or cell therapy. The successful candidate will be based at the Institute of Artificial Intelligence at the Medical University of Vienna, with ample opportunities to integrate into the national and European research landscape, including the European Lab for Learning and Intelligent Systems (ELLIS). This call is open to students who are about to finish or recently finished their undergraduate degree in any field of computational sciences, as well as to candidates with a background in biology/medicine and strong quantitative skills.

The Goal

Machine learning is transforming medicine, for example by enabling physicians to incorporate vast amounts of data and knowledge into each of their clinical decisions. Machine learning also advances our understanding of the biology that underlies human diseases, with the future perspectives of identifying the key molecular mechanisms in each individual patient and devising personalized therapies. Researchers at the Medical University of Vienna, in partnership with the CeMM Research Center for Molecular Medicine and the Austrian Academy of Sciences, are building an ambitious research program focusing on "Machine Learning in Biology & Medicine", with three pillars: (i) methodological research in machine learning, for example focusing on interpretable deep learning, causal modeling, federated machine learning, or time series analysis; (ii) proof-of-concept applications in biomedical research, including personalized medicine and systems biology; (iii) dissemination and impact through sustainable clinical applications, contribution to international consortia, creation of startup companies, and a commitment to research-centric teaching and public outreach. The successful candidate will contribute creatively and proactively to one or more of these directions.

The Candidate

We are looking for candidates who want to pursue cutting-edge research in the wider field of machine learning in biology & medicine. A typical background would be a Bachelor and/or Master in machine learning, computer science, statistics, bioinformatics or in another quantitative field, ideally combining methodologically and applied research (in any field). We are also open to candidates with a background in biology, medicine, or a related field if they have strong quantitative skills and a keen interest to engage in machine learning research. The position is fully funded for four years and includes ample opportunities for advancing a scientific career, developing academic leadership skills, engaging in international collaborations, and contributing to the advancement of biology/medicine through computational research. Through the ELLIS network and other consortia, there is also the option to pursue a research stay abroad in a leading machine learning lab with complementary expertise.

The Research Group (https://bocklab.org)

We seek to advance biomedicine with technology-driven research, combining functional genomics, bioinformatics, and machine learning with a focus on understanding epigenetic cell states and contributing to cancer and immunity. We are internationally well-connected and strongly committed to the career development of all group members. PhD students and postdocs in our research group have won prestigious fellowships and prizes. Three out of four PhD students and five out of six postdocs who graduated from our group have already obtained principal investigator positions and started their own research groups at universities / research institutes in Austria and abroad. Main areas of research include:

- *Computational biomedicine*. Bioinformatic methods are essential for data-driven biomedical research. We develop AI-driven algorithms and software for large-scale data analysis, and we pursue clinical collaborations to establish medical impact.
- *Single-cell genomics*. Many diseases involve deregulated epigenetic cell states. As members of the Human Cell Atlas, we use single-cell sequencing and organoids to dissect the gene-regulatory foundations of cancer and immunity.
- *High-throughput biotechnology*. Groundbreaking discoveries are often driven by technological advances. We develop and apply new technologies in areas such as single-cell sequencing, CRISPR screens, epigenome editing, and synthetic biology.
- *Machine learning*. Huge datasets pose new analytical challenges. As members of the European Laboratory for Learning and Intelligent Systems, we develop methods for interpretable deep learning and artificial intelligence in biology.
- *Immune cell engineering*. CAR T cells have shown dramatic efficacy for blood cancers and may spearhead a broader shift toward personalized, cell-based therapies. We use high-throughput technology to design synthetic immune cells.

The Principal Investigator (https://scholar.google.com/citations?user=9qSsTcIAAAAJ)

Christoph Bock is a Principal Investigator at the CeMM Research Center for Molecular Medicine of the Austrian Academy of Sciences and Professor of [Bio]Medical Informatics at the Medical University of Vienna. He is also the scientific coordinator of the Biomedical Sequencing Facility at CeMM, member of the Human Cell Atlas Organizing Committee, fellow of the European Lab for Learning and Intelligent Systems (ELLIS), and co-founder of a Vienna-based start-up company (Myllia Biotechnology). He has received major research awards, including an ERC Starting Grant (2016-2021), an ERC Consolidator Grant (2021-2026), the Otto Hahn Medal of the Max Planck Society (2009), the Overton Prize of the International Society for Computational Biology (2017), and the Erwin Schrödinger Prize of the Austrian Academy of Sciences (2022).

The Host Institutions (https://www.meduniwien.ac.at/web/en/ & https://www.cemm.at/research)

The *Medical University of Vienna* is Europe's largest medical school and one of the oldest in the world. It was founded in 1365 as the medical faculty of the University of Vienna, and it has operated as an autonomous university since 2004. Within the university's data science department, the Institute of Artificial Intelligence pursues machine learning and artificial intelligence research with biomedical and clinical applications, including research groups focusing on Medical Image Computing (Hrvoje Bogunovic), Machine Learning for Signal Processing (Georg Dorffner), AI in Systems Biology (David Fischer), Dynamics of Neural Systems (Adam Gosztolai), and Trustworthy AI (Matthias Samwald). Moreover, there is the opportunity for joint PhDs with the *CeMM Research Center for Molecular Medicine of the Austrian Academy of Sciences*, which is one of Europe's leading biomedical research institutes. A study by "The Scientist" put CeMM among the top-5 best places to work in academia worldwide. Vienna is frequently ranked the world's best city to live. It is a United Nations city with a large English-speaking community.

Please apply via the ELLIS PhD Program (https://ellis.eu/news/ellis-phd-program-call-for-applications-2024) and include Christoph Bock in your ranking of potential PhD advisors (deadline: Nov 15). If you are interested in a joint PhD with CeMM, please also apply to the CeMM PhD Program, which opens in December (https://www.cemm.at/phd-program). Start dates are flexible between spring and autumn 2025.