We are looking for a **doctoral researcher** (PhD student) with a strong background in probabilistic machine learning, statistics, applied mathematics, computer science, or a related field, and strong programming skills, to work on biology-informed machine learning for dynamical systems (see project description below). The position is based at the Department of Computer Science at Aalto University, Finland, within a research environment spanning the Computational Systems Biology group, the Finnish Center for Artificial Intelligence (FCAI), and ELLIS Institute Finland. You will be supervised by **Dr Julien Martinelli** and **Associate Professor Harri Lähdesmäki**. The position offers a broad local research network in Bayesian machine learning and computational biology.

Dr Martinelli is an independent Research Fellow supported by an Academy Research Fellowship of the Research Council of Finland and develops Biology-Informed Machine Learning methods for biomedical applications. Associate Professor Lähdesmäki leads Aalto's Computational Systems Biology group and has extensive expertise in Bayesian inference for biological systems.

Project description

Ordinary differential equation (ODE) models provide interpretable descriptions of biological processes, but they are often incomplete: mechanisms may be only partly known, data are noisy and sparsely sampled, measurements vary across individuals and conditions, and some relevant biological states are unobserved. Purely data-driven models offer flexibility, but often ignore known biology and provide limited insight into uncertainty and mechanisms. These challenges motivate a broader Biology-Informed Machine Learning perspective [1].

The doctoral student's thesis will focus on operationalising this perspective through the development of Biology-Informed Gaussian Processes (BioGPs). These are Bayesian dynamical models that combine known mechanistic components with flexible Gaussian process terms representing unknown or misspecified biology. Depending on the candidate's interests, there may also be opportunities to connect this research with emerging foundation-model approaches for dynamical systems [2]. Key methodological questions shared across these directions include reliable uncertainty quantification, inference from heterogeneous trajectories, partial observability, and the integration of uncertain prior knowledge. A central goal will also be to go beyond trajectory prediction by coupling these approaches with methods for learning explicit, interpretable mechanistic ODEs, including their symbolic structure [3]. Lastly, recent work from the team includes nonparametric mixed-effect ODE models for population- and subject-specific dynamics [4], as well as GP-based approaches to modelling temporal single-cell data [5].

Selected references

[1] J. Martinelli. "Position: Biology is the Challenge Physics-Informed ML Needs to Evolve". In: *Advances in Neural Information Processing Systems*. Vol. 38. OpenReview. 2025.

[2] J. R. Hübers et al. "Foundation Inference Models for Ordinary Differential Equations". In: *Forty-third International Conference on Machine Learning*. 2026.

[3] C. Métayer, A. Ballesta, and J. Martinelli. "Data-driven discovery of digital twins in biomedical research". In: *Briefings in Bioinformatics* 27.1 (2026), bbaf722. DOI: 10.1093/bib/bbaf722.

[4] J. Martinelli et al. *Bayesian Nonparametric Mixed-Effect ODEs with Gaussian Processes*. 2026. arXiv: 2605.13088 [cs.LG].

[5] M. Y. Balik and H. Lähdesmäki. "Modeling Temporal scRNA-seq Data with Latent Gaussian Process and Optimal Transport". In: *Proceedings of the 43rd International Conference on Machine Learning*. OpenReview. 2026.

About Aalto University

Aalto University is a community of bold thinkers where science and art meet technology and business. We are committed to identifying and solving grand societal challenges and building an innovative future. Aalto has six schools with nearly 12 000 students and a staff of more than 4000, of which 400 are professors. Our main campus is located in Espoo, Finland. Diversity is part of who we are, and we actively work to ensure our community's diversity and inclusiveness. This is why we warmly encourage qualified candidates from all backgrounds to join our community.

***The Department of Computer Science** is an internationally-oriented community and home to world-class research in modern computer science, combining research on foundations and innovative applications. With over 40 professors and more than 450 employees from 50 countries, it is the largest department at Aalto University and the largest computer science unit in Finland. Computer science research at Aalto University ranks high in several prominent surveys (47th worldwide and 9th in Europe in Shanghai subject ranking 2019; and 56th worldwide in Times Higher Education subject ranking 2020).*

Ready to apply?

Please submit your application through our recruitment system Workday. **The deadline for applications is 21.09.2026.** The position will be filled as soon as suitable candidate has been identified.

To apply, please share the following application materials in one pdf file with us:

- CV
- Cover letter (highlighting your research interests and how they align with project; see Dr. Martinelli's prior publications for reference)
- Example of academic writing (B.Sc/M.Sc thesis, project report from a course, etc.)
- Transcripts of MSc and BSc studies
- The degree certificate of your latest degree

The candidates must have completed their Master's degree before the start of the contract period. Aalto University reserves the right for justified reasons to leave the position open, to extend the application period, reopen the application process, and to consider candidates who have not submitted applications during the application period.

For further information, please contact Dr. Julien Martinelli, e-mail julien.martinelli@aalto.fi.

Want to know more about us and your future colleagues? You can watch these videos: Aalto University – Towards a better world, Aalto People , and *Shaping a Sustainable Future*.
And this webpage about Aalto and Finland. https://www.aalto.fi/en/services/welcome-to-aalto-university-and-finland-info-package

Check out our new virtual campus experience: https://virtualtour.aalto.fi/ !

About Finland

Finland is a great place for living with or without family – it is a safe, politically stable and well-organized Nordic society. Finland is consistently ranked high in quality of life and was just listed again as the happiest country in the world: https://worldhappiness.report/news/its-a-three-peat-finland-keeps-top-spot-as-happiest-country-in-world/. For more information about living in Finland: https://www.aalto.fi/services/about-finland

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