

Siiri Rautio

I am a dedicated and enthusiastic researcher specializing in inverse problems and deep learning. My primary research interest lies in integrating deep learning with analytical mathematical methods to develop hybrid algorithms that leverage the strengths of both approaches. I have extensive experience with inverse problems in imaging, particularly in electrical impedance tomography and X-ray tomography (2D and 3D), including applications such as digital breast tomosynthesis and endodontic CBCT imaging. I work regularly with real-world measurement data and am actively involved in its acquisition and analysis processes.

Contact Information

Mail: siiri.rautio@gmail.com

Personal Information

Date of birth: December 4, 1994

Nationality: Finland

Languages: Finnish (native), English (excellent), Japanese (basics), Swedish (basics), French (basics)

Research Interests

Inverse problems, deep learning, medical imaging, tomography

Education

Doctor of Philosophy

University of Helsinki, Finland, May 2025

Dissertation title: *Ill-posed microlocal imaging using targeted deep learning*
(Thesis graded as "pass with distinction")

Master of Science, program: Mathematics of imaging

University of Helsinki, Finland, August 2019

Bachelor of Science, major: mathematics, minor: computer science

University of Helsinki, Finland, May 2017

Submitted manuscripts

1. Sippola, Sara et al. *Learned enclosure method for experimental EIT data*. arXiv preprint arXiv:2504.11512 [math.AP]
2. Agnelli, Juan Pablo, et al. *Stroke classification using Virtual Hybrid Edge Detection from in silico electrical impedance tomography data*. arXiv:2501.14704 [math.AP]
3. Alsaker, Melody, et al. *CT scans without X-rays: parallel-beam imaging from nonlinear current flows*. arXiv:2408.12992 [math.AP]

Publications in peer-reviewed series

1. Bubba, Tatiana A., et al. *Bilevel learning of regularization models and their discretization for image deblurring and super-resolution*. INdAM Workshop: Advanced Techniques in Optimization for Machine learning and Imaging. Singapore: Springer Nature Singapore, 2022.
2. Rautio, Siiri, et al. *Learning a microlocal prior for limited-angle tomography*. IMA Journal of Applied Mathematics 88.6 (2023): 888-916.

Service in the scientific community

- Coordinator of FCAI and FAME Special interest group: AI for inverse problems and imaging. (2024 – present)
- Secretary and board member of the Finnish Inverse Problems Society. (2020 – 2022)

Conference organization activities

1. Local organizing committee for *31th Inverse Days conference* (December 10-12, 2025 in Helsinki, Finland)
2. Minisymposium organization: *XAIP: Explainable algorithms for inverse problems* at Applied Inverse Problems (July 28 - August 1, 2025 in Rio de Janeiro, Brazil)

3. Minisymposium organization: *Celebrating Diversity in Inverse Problems* at Applied Inverse Problems (July 28 - August 1, 2025 in Rio de Janeiro, Brazil)
4. Local organizing committee for *Finland–Japan Workshop in Industrial and Applied Mathematics* (August 26-30, 2024 in Helsinki, Finland)
5. Organizer for *Finnish Inverse Problems Society career day: Highlighting women in inverse problems* (August 7, 2024 in Helsinki, Finland)
6. Organizer for *FCAI AIX Forum: Inverse Problems* (November 29, 2023 in Helsinki, Finland)

Grants and awards

- Salaried doctoral candidate position for 4 years, earmarked for projects on artificial intelligence and AI solutions in all fields of science and scholarship. University of Helsinki.

Work and project experience

- Project: *TOMOHEAD – Mobile cone-beam computed tomography of the head*, University of Helsinki
Reduction of beam hardening and metal artifacts in CBCT with AI
Researcher (01/2024 – present)
- Project: *Artificial intelligence guided diagnostics in medical imaging (AIDMEI)*, University of Helsinki
Recovering feature boundaries in digital breast tomosynthesis
Research assistant (09–12/2019)
- Planmeca Oy, R&D department, algorithms research group
Thesis title: *Combining deep learning and iterative reconstruction in dental cone-beam computed tomography*
Master’s thesis worker (01–07/2019)
- Project: *New imaging method for cardiology*, University of Helsinki
Machine learning algorithms for dynamic CT imaging of the heart
Research assistant (08–12/2018)
- Planmeca Oy, R&D department, algorithms research group
Automating and optimizing CT imaging parameters
Summer intern (06–09/2017)

Conferences and invited seminars

A total of 29 presentations given in international scientific conferences and seminars. Here are a few selected ones:

1. Invited talk: Inverse Problem Seminar from Theory to Applications, Finland–Japan Seminar for Inverse Problems (27-28 January, 2025 in **Tokyo, Japan**) *Computed tomography without X-rays: parallel-beam imaging from nonlinear current flows*
2. Invited talk: Ehime University (January 24, 2025 in **Matsuyama, Japan**) *Electrical impedance tomography and virtual X-rays*
3. Invited talk: RIMS Symposium: Theoretical and numerical approaches for inverse problems (January 20-22, 2025 in **Kyoto, Japan**) *Computed tomography without X-rays: parallel-beam imaging from nonlinear current flows*
4. Invited talk: Colorado State University (October 17th, 2024 in **Fort Collins, Colorado, US**) *Learning to deblur virtual hybrid parallel-beam sinograms*
5. Conference talk: SIAM Conference on Imaging Science (May 28-31, 2024 in **Atlanta, Georgia, US**), *Real data EIT reconstruction using virtual X-rays and deep learning*
6. Conference talk: 10th International Congress on Industrial and Applied Mathematics (August 20-25, 2023 in **Tokyo, Japan**), *New insight on electrical impedance reconstruction using virtual X-rays and machine learning*

Public outreach

I have been active in giving presentations at different events and schools and hosting multiple laboratory visits at the Industrial Mathematics Laboratory at the University of Helsinki. Here are a few selected ones:

1. Biannual national science fare in Finland 2025: *The secret of shadows: the curious world of inverse problems* (January 8, 2025 in Helsinki, Finland)
2. MAOL teachers autumn union meeting: *Interactive workshop on AI* (November 11th, 2023 in Helsinki, Finland)

Research visits and mobility

- Department of Mathematics, Colorado State University, CO, USA. October 2024. 2-week research visit under professor Jennifer Mueller.

- KONE Oyj, Espoo Finland, November 2021. Visiting researcher through University of Helsinki and KONE collaboration program.
- Department of Mathematics, Rice University, Houston TX, USA. March 2020. 2-week research visit under professor Maarten V. de Hoop.

Teaching

- Lecturer: Inverse problems II: tomography and regularization (2025, 2024, 2023)
- Lecturer and creation of course: Basics of mathematics of machine learning (2024)
- Teaching assistant: Inverse problems I: convolution and deconvolution, Inverse problems II: tomography and regularization, Basics of mathematics of machine learning I, Applications of matrix computations, Linear algebra I-II, Analysis I, Algebraic methods I-II, Mathematics everywhere, Introduction to university mathematics (2015 – 2024)

Memberships and research network

- Inverse Problems International Association, 2025 – present.
- Society for Industrial and Applied Mathematics, 2022 – present.
- Women in AI in Finland, 2022 – present.
- Finnish Inverse Problems Society, 2020 – present.

References

Samuli Siltanen samuli.siltanen@helsinki.fi (PhD supervisor)

- Professor of Industrial Mathematics at University of Helsinki, Finland
- Vice Dean of the Faculty of Science, University of Helsinki, Finland

Matti Lassas matti.lassas@helsinki.fi

- Professor, Department of Mathematics and Statistics, University of Helsinki, Finland

Tatiana Bubba tatiana.bubba@unife.it

- Assistant Professor in Numerical Analysis at the Department of Mathematics and Computer Science of the University of Ferrara, Italy