Santeri Kaupinmäki

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Research Interests

Applying mathematics, physics, and inverse problems theory in order to solve practical problems.

Education

University College London, London, United Kingdom — 2018 – March 2023
PhD Medical Imaging, Supervised by Simon Arridge and Ben Cox

- **Thesis -** *Ultrasound tomography using pyroelectric and piezoelectric sensors*

University of Helsinki, Helsinki, Finland — 2014 – 2018
MSc Theoretical Physics (4.94/5 course average, *Eximia cum laude approbatur* thesis grade)

- **Thesis -** *Reaction coordinate approach to non-Markovian dynamics in the spin-boson model*

University of Waterloo, Waterloo, Ontario, Canada — 2009 – 2014
BSc Mathematical Physics, Pure Mathematics Minor (83.5% cumulative average)

- Dean's Honours List

Publications

[1] **Santeri Kaupinmäki**, Ben Cox, Simon Arridge. "Phase-insensitive versus phase-sensitive ultrasound absorption tomography in the frequency domain" (2023) Applied Mathematics in Science and Engineering **31** 2252571.

[2] **Santeri Kaupinmäki**, Ben Cox, Simon Arridge, Christian Baker, David Sinden, and Bajram Zeqiri. "Pyroelectric ultrasound sensor model: directional response" (2020) Measurement Science and Technology **32** 035106.

[3] Ilona Ylivinkka, **Santeri Kaupinmäki**, Meri Virman, Maija Peltola, Ditte Taipale, Tuukka Petäjä, Veli-Matti Kerminen, Markku Kulmala, and Ekaterina Ezhova.
"Clouds over Hyytiälä, Finland: an algorithm to classify clouds based on solar radiation and cloud base height measurements" (2020) Atmospheric Measurement Techniques **13** 5595–5619.

[4] David Villacis, **Santeri Kaupinmäki**, Samuli Siltanen, Teemu Helenius. "Photographic dataset: playing cards" (2017) arXiv:1701.07354.

Research and Relevant Work Experience

University of Oulu — Inverse Problems Group — 2024 – *present*
Postdoctoral Researcher
Supervisor: Andreas Hauptmann

Researching inverse problems in low-field MRI.

University College London — Multi-Sensory Devices Group — 2022 – 2023
Research Assistant/Research Fellow
Supervisor: Sriram Subramanian

Researching topology optimization for acoustic reflector design.

Participation in interview panel for prospective postdoctoral researchers.

University College London — Biomedical Ultrasound Group 2018 – 2023
PhD Student
Supervisors: Simon Arridge, Ben Cox

Researching and publishing a paper on the modelling of pyroelectric ultrasound sensors.

Researching the use of phase-insensitive sensors in ultrasound tomography.

University of Helsinki — Institute for Atmospheric and Earth System Research 2018
Research Assistant
Supervisor: Ekaterina Ezhova

Helped in developing a cloud classification algorithm based on radiation and cloud base height data.

Tested finalized algorithm against cloud types determined through visual inspection.

Co-authored paper on the cloud classification algorithm.

University of Helsinki — Inverse Problems Research Group 2017
Research Assistant
Supervisor: Samuli Siltanen

Tested total generalized variation (TGV) regularization for image inpainting.

Researched the multiresolution method for TV regularization parameter choice.

University of Helsinki — Inverse Problems Research Group 2016 – 2017
Civil Service
Supervisor: Samuli Siltanen

Researched patch based image reconstruction with TGV inpainting.

Teaching assistant for 'Applications of Matrix Computations'.

Teaching assistant for 'Inverse Problems'.

Lead developer in making a new website for the inverse problems research group.

Created webpage for an open photographic dataset on the FIPS website.

Helped develop webpage advertising the master's program in mathematics and statistics.

Aalto University — Quantum Computing and Devices group 2015 – 2016
Research Assistant
Supervisor: Mikko Möttönen

Studied the non-Markovian dynamics of open quantum systems through the reaction coordinate method, and derived a master equation for a tuned two-level system in a bosonic bath.

Wrote master's thesis on the theoretical framework of the reaction coordinate master equation and its computational results.

Institute for Quantum Computing — Optical Quantum Communication Theory Group 2014
Undergraduate Research Assistant
Supervisor: Norbert Lütkenhaus

Studied the thesis 'Symmetric extension of bipartite quantum states and its use in quantum key distribution with two-way postprocessing' by Geir Ove Myhr.

Investigated the gap problem in quantum key distribution through symmetric extendability of states.

University of Waterloo — Hawthorn Group 2013
Undergraduate Research Assistant
Supervisor: David Hawthorn

Programmed an Igor Pro procedure to help characterize a low energy electron gun.

Helped design and constructed an RC circuit to connect a voltage bias picoammeter to a sample.

Helped replace a Geiger-Müller tube on an ultra-high vacuum chamber.

Performed troubleshooting and fixed parts of the LabVIEW code used to run the. instruments

Teaching

Postgraduate Teaching Assistant, UCL, Department of Computer Science 2020 – 2021

Workshop supervision and grading for Inverse Problems in Medical Imaging module.

Postgraduate Teaching Assistant, UCL, Faculty of Engineering 2019 – 2022

Workshop supervision and grading for Mathematical Modelling and Analysis 1 module.

Workshop supervision for Engineering Standard Pace lectures.

Workshop lead for two sessions

Postgraduate Teaching Assistant, UCL, Department of Medical Physics and Biomedical Engineering 2018 – 2021

Supervision of laboratory work for students' Biomedical Ultrasound project work.

Grading of Biomedical Ultrasound coursework.

Tutoring of a first year medical physics student on a weekly basis.

Teaching Assistant, University of Helsinki, Department of Mathematics and Statistics 2016 – 2017

Teaching assistant and substitute lecturer for two lectures of 'Applications of Matrix Computations'

Teaching assistant for 'Inverse Problems'

Grading of coursework and exams for both courses

Conferences and Workshops Attended

International Workshop on Medical Ultrasound Tomography June 2022
National Physical Laboratory – London

ASA Meeting 2019 Dec. 2019
Hotel del Coronado – San Diego

Inverse Days 2017 Dec. 2017
University of Oulu – Lasaretti Hotel

Inverse Days 2016 Dec. 2016
University of Eastern Finland – Kuopio Music Centre

Arctic School on Open Quantum Systems Dec. 2015
University of Helsinki – Kilpisjärvi Biological Station

Presentations

International Workshop on Medical Ultrasound Tomography June 2022
Title: *Comparison of Phase-Insensitive and Phase-Sensitive Ultrasound Absorption Tomography in the Frequency Domain*

ASA Meeting – San Diego Dec. 2019
Title: *Pyroelectic ultrasound sensor model*

CMIC Science Day June 2019
Title: *Pyroelectic ultrasound sensor model*

Bayesian Inversion Project Work May 2016
Title: *Deblurring a greyscale photograph using the MAP estimate*

Inverse Problems Project Work May 2015
Title: *X-ray tomography on a Lego block*

Awards and Scholarships

ASA Travel Fund	2019
CERN Summer Student Programme (*Declined offer*)	2015
NSERC Undergraduate Student Research Award	2014
President's Research Award	2013
NSERC Undergraduate Student Research Award	2013
University of Waterloo President's Scholarship of Distinction	2009
Penelope Glasser Memorial Entrance Scholarship	2009
University of Toronto Book Award	2009
Vale Inco Award	2009

Relevant Skills

Advanced Mathematics Courses:
Inverse Problems • Bayesian Inversion • Operator Algebras • Calculus of Variations • Real Analysis • Complex Analysis • Lebesgue Integration & Fourier Analysis • Functional Analysis • Group Theory • Polynomials, Rings & Finite Fields • Differential Geometry • Riemannian Geometry

Advanced Physics Courses:
Plasma Physics • Condensed Matter Theory • Particle Physics • Quantum Field Theory • Electrodynamics • Astrophysics • Statistical Mechanics • Quantum Physics • Quantum Theory • Quantum Information Processing • General Relativity • Quantum Field Theory for Cosmology

Programming:
- MATLAB (8 years)
- IGOR Pro, C++ (4 months)
- Python (3 months)

Miscellaneous Interests

Weight training (personal records: squat – 125 kg, benchpress – 90 kg, deadlift – 170 kg)

Last updated: February 9, 2024