MARC HARKONEN

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CAREER SUMMARY

Machine Learning Researcher • Mathematician • Software Developer

- ***Mathematics PhD*** with 8 year full-time research and project experience in mathematics, machine learning, statistics, data analysis and computational algebra. Proven track record of coming up with innovative, state-of-the-art solutions to a wide variety of applied problems, with several scientific publications.
- ***Machine learning enthusiast*** with academic and industry experience designing and implementing models using Transformers, RNNs and CNNs, as well as advanced Gaussian Process models.
- ***A passion for problem solving,*** driven by rigorous mathematical intuition and a dedication to learning and developing myself. I thrive in settings where problems may be ambiguously posed.

AREAS OF EXPERTISE

- Machine Learning
- Gaussian Processes
- Speech AI
- Software Development
- Python (PyTorch)
- C++
- R
- Algorithm Design
- Mathematics
- Statistics
- Data Analysis
- Scientific Communication

PROFESSIONAL EXPERIENCE

Fano Labs, Hong Kong SAR China **02.2023 – Present**

Research Scientist

Research and development of technologies in speech AI. Current focus is in the design and implementation of computationally efficient state-of-the-art speaker diarization models. Tasks include ML model implementation and testing (PyTorch), profiling, experiment design, and data pre-processing.

Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany **05.2022 – 02.2023**

Postdoctoral Researcher

Academic research in non-linear algebra and applications. Research includes applications of algebraic partial differential equation theory to machine learning and Gaussian Processes, using PyTorch.

Key accomplishments:

- ***ICML 2023 paper, with an oral presentation.***
- ***Organized a 3-day workshop*** with participants from around the world.
- ***Acting as a computational consultant for the research group,*** where my expertise in computational methods and C++ programming was used to improve research output in several projects.

Georgia Institute of Technology, Atlanta, GA, USA **08.2017 – 05.2022**

Graduate Student Researcher, and Graduate Student Instructor

Academic research and teaching activities. Wrote and published research papers in mathematics, accompanied by code or software. Attended and presented at numerous conferences, workshops, and organized the weekly student algebra seminar at Georgia Tech.

Key accomplishments:

- ***Was an active member of the Applied Algebra community,*** with several research visits throughout my PhD studies, including at Brown University (Providence, RI), the Institute of Statistical Mathematics (Tokyo, Japan), Sorbonne Universite (Paris, France), and Max Planck Institute (Leipzig, Germany).
- ***Instructed two full undergraduate courses in Statistics and Differential Equations.*** Due to COVID-19, I designed the courses from the ground up in a remote format, prepared a syllabus, lectures, exercises and exams. Student feedback after the courses was excellent.

CERN, Geneva, Switzerland **06.2015 – 09.2015**

Research Intern

Statistical data analysis and particle identification in proton-proton collisions inside the Large Hadron Collider. Data consisted of central diffractive processes with 7 TeV and 13 TeV collisions in the ALICE detector. Data analysis was performed using in-house tools using the ROOT C++ interpreter.

Key achievements:

- ***Analyzed data on several levels***, ranging from low-level, raw sensor voltages, to higher level, expert reconstructions of particle trajectories in 3D, and implemented novel data analysis routines in C++.

EDUCATION

PhD, Mathematics **08.2017 – 05.2022**
Georgia Institute of Technology, Atlanta, GA
Minor in Statistics, GPA: 4.0/4.0, recipient of the Vaisala Fellowship (Finland) & Chateaubriand Fellowship (France)

Master of Science (Tech), Mathematics **08.2015 – 05.2017**
Aalto University, Helsinki, Finland
GPA: 5.0/5.0

Exchange year, Statistics and Computer Science **09.2016 – 05.2017**
University of Tokyo, Tokyo, Japan
Also studied Japanese (Intermediate level), GPA: 4.0/4.0

Bachelor of Science (Tech), Mathematics **09.2012 – 05.2015**
Aalto University, Helsinki, Finland
Minor in Computational Science and Engineering, GPA: 4.96/5.0

Exchange semester, Computer Science and Numerical Mathematics **05.2014 – 08.2014**
Stanford University, Stanford, CA, USA
Attended the Stanford Summer International Honors Program.

SELECTED PROJECT EXPERIENCE

Physics Constrained Gaussian Processes https://mathrepo.mis.mpg.de/EPGP/index.html
(ICML 2023, oral) Designing Gaussian Process kernels for solving partial differential equations. This injects "physical laws" into GP machine learning models. Uses an algebraic representation developed in my PhD thesis to encode the solution space of a system of partial differential equations.

Machine learning and time series forecasting github.com/haerski/mortality
Predicting life insurance client mortality during a pandemic. Resulted in a model that would learn and predict based on local COVID infection patterns. Joint with the University of Minnesota and Securian Financial.