

Alexander Soen

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Summary

I have a broad research interest within machine learning with a primary interest on utilizing information geometric tools and utilizing the theory of loss functions. My current research focus involves exploring bounds for domain adaptation and exploring novel perspectives for learning with rejection. I also have a strong interest in fairness and boosting algorithms in machine learning, which I explored earlier in my PhD. Previously I have worked on topics including theorem provers, visualisation of academic influence, universal approximation theorems, and point process models.

Education

Doctor of Philosophy in Computer Science

THE AUSTRALIAN NATIONAL UNIVERSITY; CANBERRA, AUSTRALIA

Anticipated Submission 2025 July

2021 – Pres.

Bachelor of Advanced Computing (R&D) (First Class Honours, University Medal)

THE AUSTRALIAN NATIONAL UNIVERSITY; CANBERRA, AUSTRALIA

GPA: 7.0/7.0

2016 – 2019

Secondary School

RADFORD COLLEGE; CANBERRA, AUSTRALIA

ATAR: 98.75

2014 – 2015

Publications

Published

- [1] Koc O, **Soen A**, Chiang CK, Sugiyama M, “Domain Adaptation and Entanglement: an Optimal Transport Perspective” *AISTATS 2025*
- [2] Calderon P, **Soen A**, Rizioi MA, “Linking Across Data Granularity: Fitting Multivariate Hawkes Processes to Partially Interval-Censored Data” *IEEE TCSS 2024*
- [3] **Soen A**, Husain H, Schulz P, Nguyen V, “Rejection via Learning Density Ratios” *NeurIPS 2024*
- [4] **Soen A**, Sun K, “Tradeoffs of Diagonal Fisher Information Matrix Estimators” *NeurIPS 2024*
- [5] Nock R, Amid E, Nielsen F, **Soen A**, Warmuth MK, “Tempered Calculus for ML: Application to Hyperbolic Model Embedding” *NeurIPS 2024*
- [6] Zhu H, **Soen A**, Cheung YK, Xie L, “Online Learning in Betting Markets: Profit versus Prediction” *ICML 2024*
- [7] Wang EX, et al., “3D NLTE Lithium abundances for late-type stars in GALAH DR3” *MNRAS 2024/3*
- [8] **Soen A**, Husain H, Nock R, “Fair Densities via Boosting the Sufficient Statistics of Exponential Families” *ICML 2023*
- [9] **Soen A**, Alabdulmohsin I, Koyejo S, Mansour Y, Moorosi N, Nock R, Sun K, Xie L, “Fair Wrapping for Black-box Predictions” *NeurIPS 2022*
- [10] Rizioi MA, **Soen A**, Li S, Calderon P, Dong L, Menon AK, Xie L, “Interval-censored Hawkes processes” *JMLR 2022*
- [11] **Soen A**, Sun K, “On the Variance of the Fisher Information for Deep Learning” *NeurIPS 2021*
- [12] **Soen A**, Mathews A, Gixti-Cheng D, Xie L, “UNIPoint: Universally Approximating Point Processes Intensities” *AAAI 2021*
- [13] Shin M, **Soen A**, Readshaw BT, Blackburn SM, Whitelaw M, Xie L, “Influence flowers of academic entities” *IEEE VAST 2019*

Preprints (arXiv)

- [14] **Soen A**, Nielsen F, “pyBregMan: A Python library for Bregman Manifolds” 2408.04175
- [15] Li S, Walder C, **Soen A**, Xie L, Liu M, “Sampled transformer for point sets” 2302.14346

Work Experience and Projects

Student Trainee

RIKEN

Remote + Tokyo, Japan

2023 – Pres.

- 6 month internship at the RIKEN Imperfect Information Learning Team.
- Machine learning research on generalized exponential families, importance weighting, and PAC-Bayesian generalization bounds.
- Coauthored a paper on unsupervised domain adaptation [1].

PhD Student

AUSTRALIAN NATIONAL UNIVERSITY

Canberra, Australia

2021 – Pres.

- In collaboration with the interdisciplinary Humanising Machine Intelligence group at the Australian National University.
- Developing novel algorithms using tools from theoretical machine learning and information geometry, with applications in algorithmic fairness.

PyBregMan - Co-creator

AUSTRALIAN NATIONAL UNIVERSITY / RIKEN

Remote + Tokyo, Japan

2024 - Pres.

- An open source Python library for geometric computing on BREGman MANifolds with applications. Available on [GitHub](#) and [PyPi](#).
- Tutorial “Data Representations on the Bregman Manifold” accepted at ICML’24 GRaM workshop with [Google Colab](#).
- Website at: <https://franknielsen.github.io/pyBregMan/index.html>. Reference documentation for software [14].

Applied Scientist Intern

AMAZON

Canberra, Australia

2023

- 6 month internship at the Amazon Australian Machine Learning team.
- Machine learning research on causal inference, uncertainty quantification, and learning with rejection. Paper published [3].
- Working on business projects in the retail product space.
- Analysing data, building models, and using Amazon's tool-kits (AWS, Python, Tensorflow).

Interval-Censored Point Processes – Research Assistant

UNIVERSITY OF TECHNOLOGY SYDNEY

Sydney, Australia

2020

- Worked in a Facebook funded project which involves the collaboration of computer scientists and social scientists to study hate speech.
- Built and deployed various web-crawlers from scratch in Python using numerous APIs.
- Developed new algorithms to fit interval-censored data to Hawkes Process; which resulted in publications [10, 2].

Knowledge Graphs – Research Assistant

AUSTRALIAN NATIONAL UNIVERSITY

Canberra, Australia

2020

- Collaborated with departments of the Australian Government to integrate different data sources for analysis.
- Created a software pipeline to create knowledge graphs using various technologies (RDF, SPARQL, external APIs).

Point Processes and Neural Networks – Summer Research + Research Student

AUSTRALIAN NATIONAL UNIVERSITY + AUSTRALIAN SIGNALS DIRECTORATE

Canberra, Australia

2018 – 2019

- Collaborated with the Australian Signals Directorate in linking different types of Hawkes process models.
- Proposed a novel architecture for incorporating universal approximation of neural networks for Hawkes process models.
- The work resulted in publication [12].

Visualisation of Academic Influence – Research Assistant

AUSTRALIAN NATIONAL UNIVERSITY

Canberra, Australia

2017 – 2019

- Maintained and developed the InfluenceMap website (<https://influencemap.cmlab.dev>): a visualisation tool for examining citation and publication based influence patterns in research.
- Worked with Microsoft Academic API to gather the data used for visualisation.
- Presented and demoed the project at the 2018 ACM Multimedia Conference business meeting in Seoul, South Korea.
- The insights and tools developed resulted in publication [13].

Theorem Provers – Summer Research

AUSTRALIAN NATIONAL UNIVERSITY

Canberra, Australia

2016

- Investigated translating formal semantics defined in HOL4 to executable code in CakeML.
- Presented a talk with a poster at the Fifth Data61 Software Systems Summer School.

Other Experience

Teaching Assistant

AUSTRALIAN NATIONAL UNIVERSITY (VARIOUS COURSES)

Canberra, Australia

2017, 2020 – 2024

- Taught courses ranging in topics from machine learning (primarily), data management, to logic with various conveners.
- Helped design and release course material, including, original assignments and lecture plans.
- Taking a head tutor role in 2022 and part of 2023 for a machine learning course of 250+ students, which includes overseeing course design and day-to-day logistics. I have advised in the material and topics taught in the course; and have been strongly involved in developing and creating all course content including examination material.

Honors & Awards

- Australian National University Vice-Chancellor's HDR Travel Grants (\$1500)2024
- NeurIPS Scholar Award (Registration + Accommodation Cover)2022, 2024
- Australian Government Research Training Program2021
- Australian National University: University Medal [Top 2 First Class Honours Graduates]2019
- Ian Ross Honours Scholarship [High-performing Honours Student] (\$5000)2019
- Honours Scholarship with the Australian Signal Directorate (\$8000)2019
- Summer Scholarship with the Australian National University (\$5000) × 32016 – 2018

Coding Proficiency

Programming	Python (Adv.), R (Inter.), C (Inter.), Julia (Basic), Coq (Basic), ML (Basic), Haskell (Basic), Rust (Basic)
Machine Learning	PyTorch (Adv.), scikit-learn (Adv.), Tensorflow (Inter.)
Other	AWS (Inter.), Bash (Adv.), LaTeX (Adv.), Git (Inter.)