

Alexander Soen

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Summary

I have a wide range of interests within machine learning, with a primary interest in utilizing information geometric tools and loss function theory. My current research focus involves exploring bounds for domain adaptation and exploring novel perspectives for learning with rejection / model cascades. I also have a strong interest in fairness and boosting algorithms, which I have 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 2026 March

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

Preprints (arXiv)

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

Work Experience and Projects

PhD Student

AUSTRALIAN NATIONAL UNIVERSITY

Canberra, Australia

2021 – 2026

- 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.

Student Researcher

GOOGLE

Sydney, Australia

2025

- 6 month internship at Google Sydney in the efficiency team.
- Worked on research in machine learning efficiency, including, topics such as speculative decoding and working on JAX code.

Student Trainee

RIKEN

Remote + Tokyo, Japan

2023 – 2025

- 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 [2].

PyBregMan - Co-creator

Remote + Tokyo, Japan

AUSTRALIAN NATIONAL UNIVERSITY / RIKEN

2023 – 2024

- 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 [15].

Applied Scientist Intern

Canberra, Australia

AMAZON

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 [4].
- 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

Sydney, Australia

UNIVERSITY OF TECHNOLOGY SYDNEY

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 [11, 3].

Knowledge Graphs – Research Assistant

Canberra, Australia

AUSTRALIAN NATIONAL UNIVERSITY

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

Canberra, Australia

AUSTRALIAN NATIONAL UNIVERSITY + AUSTRALIAN SIGNALS DIRECTORATE

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 [13].

Visualisation of Academic Influence – Research Assistant

Canberra, Australia

AUSTRALIAN NATIONAL UNIVERSITY

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 [14].

Theorem Provers – Summer Research

Canberra, Australia

AUSTRALIAN NATIONAL UNIVERSITY

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

Canberra, Australia

AUSTRALIAN NATIONAL UNIVERSITY (VARIOUS COURSES)

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 Program 2021
- 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) × 3 2016 – 2018