

# Alexander Soen

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## Summary

I am interested in a wide range of research topics. Previously I have worked on topics including formal methods / theorem provers, visualisation in academic influence, knowledge graphs, and universal approximation theorems. I am also interested in point process models. My primary focus is on utilising boosting algorithms, information geometric tools, and the theory of loss functions with a focus on fairness and privacy in machine learning.

## Education

### Doctor of Philosophy in Computer Science

THE AUSTRALIAN NATIONAL UNIVERSITY; CANBERRA, AUSTRALIA

Anticipated Graduation 2024 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] **Soen A**, Husain H, Nock R, “Fair Densities via Boosting the Sufficient Statistics of Exponential Families” *ICML 2023*
- [2] **Soen A**, Alabdulmohsin I, Koyejo S, Mansour Y, Moorosi N, Nock R, Sun K, Xie L, “Fair Wrapping for Black-box Predictions” *NeurIPS 2022*
- [3] Rizoju MA, **Soen A**, Li S, Calderon P, Dong L, Menon AK, Xie L, “Interval-censored Hawkes processes” *JMLR 2022*
- [4] **Soen A**, Sun K, “On the Variance of the Fisher Information for Deep Learning” *NeurIPS 2021*
- [5] **Soen A**, Mathews A, Grixti-Cheng D, Xie L, “UNIPoint: Universally Approximating Point Processes Intensities” *AAAI 2021*
- [6] Shin M, **Soen A**, Readshaw BT, Blackburn SM, Whitelaw M, Xie L, “Influence flowers of academic entities” *IEEE VAST 2019*

### Preprints

- [7] Calderon P, **Soen A**, Rizoju MA, “Linking Across Data Granularity: Fitting Multivariate Hawkes Processes to Partially Interval-Censored Data” *2111.02062*

## Work Experience

### Research Intern

RIKEN

Tokyo, Japan

2023 Nov – 2024 April

- 6 month internship at the RIKEN Imperfect Information Learning Team.
- Explore utilizing the theory of loss functions in machine learning to consider fairness with incomplete data.

### Applied Scientist Intern

AMAZON

Canberra, Australia

2023 – Pres.

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

### 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.
- Produced publications [1,2,4].

### 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 [3,7].

## 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 [5].

## 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 [6].

## 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

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### Teaching Assistant

Canberra, Australia

AUSTRALIAN NATIONAL UNIVERSITY (VARIOUS COURSES)

2017, 2020 – Pres.

- Taught courses ranging in topics from machine learning, data management, to logic (various conveners).
- Previously 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.

### AngelHack Sydney

DEVELOPER – TELENEXT

2016

- Developed TeleNex, a web application to assist mental health professionals that tracks a patient's emotions in real time.
- Won the UN Women's Code 4 Impact Prize at the Hackathon.

## Honors & Awards

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- NeurIPS Scholar Award (Registration + Accommodation Cover) 2022
- 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

## Coding Proficiency

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

## Other Contributions

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### Reviewer for Top Computer Science Conferences

- Reviewed various papers for a variety of top conferences, including, NeurIPS [2022, 2021]; ICML [2023, 2022, 2021]; ICLR [2022]; WWW [2021].

### Computer Science Student Association (Australian National University)

COMMITTEE MEMBER

2017

- Was a General Representative for the society, making decisions and planning events for students.
- Proposed and ran various events, including, study events for official course exams and installation events at the start of the academic semester.