Vilhelm Agdur

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Summary

I did my PhD in applied mathematics, defending a thesis on community detection methods in graphs on 19 September 2025.

Beyond research, I have spent my time teaching, supervising bachelor's theses, and coding various hobby projects. I first started programming when I was thirteen, and got interested in mathematics and statistics shortly thereafter - so I have been interested in both theory and applications for a long time.

Education

PhD **Uppsala University**, Applied Mathematics — Uppsala, Sweden
Sept 2020 – Sept 2025

Thesis on community detection problems in graphs, with several papers on various aspects of this.

- Position funded by the Wallenberg AI and Autonomous Systems Program (WASP)
- Coursework in artificial intelligence and software engineering.
- Defended thesis on 19 September 2025

MSc **Gothenburg University**, Mathematics — Gothenburg, Sweden
Sept 2015 – May 2020

Coursework spanning pure mathematics, statistics and machine learning with theses in probability.

Experience

Uppsala University, Course-Responsible Lecturer, Combinatorics — Uppsala, Sweden
Jan 2023 – Aug 2025

Course-responsible lecturer for the course in combinatorics three years in a row, from 2023 to 2025.

- Wrote entirely new lecture notes from scratch for the combinatorics course, making them available under Creative Commons licences, improving clarity and accessiblity of the course material for students.
- Set up a custom course website using GitHub Pages, enabling rapid updates to course contents and ensuring information is always up to date.
- Planned assignments, designed examinations, and managed all administrative tasks for the course, finding ways to minimize administrative overhead and keep students informed of the structure and expectations of the course.

Uppsala University, Course-Responsible Lecturer, Graph Theory — Uppsala, Sweden
Aug 2023 – Dec 2023

Course-responsible lecturer for graph theory course during fall semester 2023.

- Rewrote a new set of lecture notes, based on the past structure of the course, but with new figures and detailed explanations. Like for Combinatorics, these are available under Creative Commons licences.
- Designed examinations and produced a comprehensive report on exam results.

Uppsala University, Bachelor's Thesis Supervisor — Uppsala, Sweden
Sept 2020 – Aug 2025

Supervised two bachelor's theses, one on prediction of football betting markets, and one on treewidth and its algorithimic applications.

- Provided guidance on research methodology and mathematical content, helping students develop their own understanding and guiding them towards a successful thesis.

- Gave thorough feedback on writing and presentation, helping them improve their writing and presentation skills.
- Adviced students on what a future career in academia might look like, and how to prepare for it, acting as a mentor and supporting future growth.

Uppsala University, Teaching Assistant — Uppsala, Sweden
Sept 2020 – Jan 2023
Teaching assistant for basic statistics and probability courses.
- Helped students understand the material and answered questions.

Skills and Interests

Statistics/Data Science: Proficient in statistics, data science and graph algorithms

Machine learning: Knowledge of a variety of machine learning algorithms and techniques

R: Advanced proficiency in R

Databases: Basic knowledge of databases and database management systems, with experience using PostgreSQL and SQLite

Other programming languages: Have in the past used Python, C++, PHP, and Perl. Some experience with TypeScript/JavaScript and Rust

Software Engineering: Basics of git, CI/CD, and unit testing

Cloud Computing: Basic knowledge of cloud computing and cloud services

Philosophy: Particularly the intersection of moral philosophy and psychology/anthropology

Volunteering: Active volunteer involvement, both at Stadsmissionen's soup kitchen and at my local parish

Languages: English (fluent), Swedish (native), German and Italian (read well, speak poorly)

Data Processing & Visualisation: Various hobby projects, see the projects section below or my portfolio website linked above

Publications

Universal lower bound for community structure of sparse graphs — July 2023
Vilhelm Agdur, Nina Kamčev, Fiona Skerman
arxiv.org/abs/2307.07271

Classification of overlapping community detection methods in hypergraphs — May 2025
Vilhelm Agdur
arxiv.org/abs/2404.03332

Approximating temporal modularity on graphs of small underlying treewidth — June 2025
Vilhelm Agdur, Jessica Enright, Laura Larios-Jones, Kitty Meeks, Fiona Skerman, Ella Yates
arxiv.org/abs/2507.17541

Honors

- Best Student Paper award at ALGOWIN 2025 for "Approximating temporal modularity on graphs of small underlying treewidth"
- Presented "Universal lower bound for community structure of sparse graphs" at NetSci 2023
- Presented "Classification of overlapping community detection methods in hypergraphs" at PCC 2024

Projects

AI-enabled paper import from arXiv to Notion — Sept 2024
Developed a tool that imports arXiv digest papers into a Notion database, enabling sorting and tagging to streamline reading lists. It includes an AI-based recommender algorithm to rank papers by similarity to past interests.

- Notion API integration
- Machine learning and recommender systems
- Data processing
- Repository: https://github.com/vagdur/arXivToNotion
- Plans include improving the recommender, automating daily runs via the cloud and integrating a RAG model for chat about stored papers.

Defence party registration website Sept 2024

Built a TypeScript-based registration page to collect RSVPs for a thesis defence party, allowing social network data to be used for seating arrangements.

- Web programming (TypeScript/JavaScript)
- Cloud hosting and infrastructure (Cloudflare)
- AI-assisted development
- Repository: https://github.com/vagdur/defence-party-page

Swedish candidates for the European Parliament June 2024

Collected and visualised survey data from Swedish public broadcaster SVT's EU election compass to provide deeper insights into candidate positions. Used principal component analysis to project responses and created an interactive visualisation.

- Data collection and cleaning
- Principal component analysis
- Data visualisation in R
- Project page: https://rpubs.com/vagdur/EUval2024
- Highlighted limitations of existing presentation of survey data and provided a richer, interactive alternative.

Statistical analyses for KEKS Mar 2025

Provided statistical consultancy to KEKS, a youth work organisation, analysing large datasets from their Logbook platform to uncover demographic effects on outcome variables using regression analysis.

- Data analysis and statistics
- Regression modelling
- Reporting and communication
- Investigated demographic variables' impact on perceived safety and contributed to a report published by KEKS.

SCBHandlerPlotter – plotting public statistics on maps Mar 2021

Developed a project to simplify accessing and mapping public statistics from Statistics Sweden, including a function to plot data on Swedish maps and examples of visual insights.

- Data visualisation and mapping
- R programming with unit testing
- Handling official statistics
- Repository: https://github.com/vagdur/SCBHandlerPlotter
- Demonstrated good coding practices and thorough unit test coverage.

Interactive support vector machine illustration June 2022

Created an interactive Shiny app to demonstrate how support vector machines work by applying different kernels to synthetic data and accompanying theory.

- Machine learning concepts (support vector machines)
- Interactive visualisation with R Shiny
- Demo: https://v-agdur.shinyapps.io/WASP-AIML-Assignment2/
- Went beyond course requirements to build an engaging interactive tool and shared the code on GitHub.