Alex Gabel
alex_gabel@hotmail.com
+31.687.596.590
a.gabel@uva.nl

github.com/alexgabel
linkedin.com/in/alex-gabel
Middenweg 113A-3
1098 AJ, Amsterdam

Work Experience

2025 –   **PARO ENGINEERING & PARO SOFTWARE**   **HEEMSKERK, NL**
Industrial AI/ML Engineer and Researcher: *Deep Learning for Automated Hydraulic Manifold Design*

Application of Deep Learning (e.g., Hierarchical attention-based model and Graph Attention Networks) trained on historical data for integration in in-house CAD software packages **HydroMan** & **HydroSym**.
- Trained models: Drilling location recommender system, hydraulic manifold size predictor and 2D-to-3D component placement prediction in Python (PyTorch and PyTorch Geometric).

Education and Academic Experience

2020 – 2025   **UNIVERSITY OF AMSTERDAM (UvA)**   **AMSTERDAM, NL**
PhD in **Artificial Intelligence** (Deep Learning and Dynamical Systems) at the Informatics Institute (IvI)
Topic: *Neural Networks as Dynamical Systems*.
Focus: **Neural symmetry detection and integration for physical systems and efficient Geometric DL**
Supervisors: Assis. Prof. Rick Quax (CSL, Prof. Peter Sloot) & Assoc. Prof. Efstratios Gavves (VIS Lab)

- **Teaching**: Deep Learning (Nov/Dec 2020) and Deep Learning 1 (Nov/Dec 2021/22). Complex Systems Simulation (May/June 2022/23) and guest lecturer (Self-Organized Criticality, Phase Transitions, and Applications to Deep Learning).
- **Supervision**: Daily supervision for 3 master's students. Topics: *Equivariance-learned layers*, *Masked Autoencoders for PDE Data*, and *Graph-based prediction of interactions in electricity grids & analyzing the importance of ego-nodes in GNNs*.
- Defense Committees: Have sat on defense committees for various bachelor/master's projects.

- Co-organizer of *Simulation-based Science* events (2021) at the Institute of Advanced Study (IAS)
- Co-chaired first edition of *Deep Thinking Hour* (2021/22, currently sponsored by ELLIS), a biweekly series of events focused on novel machine learning research. Hosted guest speakers from research labs at technology companies (such as DeepMind) and various renowned computer science departments.
- Currently giving a lecture series on *Differential Geometry for Deep Learning* for *DTH* hosted at UvA (Part I: Foundations, Part II: Core Concepts, Part III: Curvature, 2024/25)

- Invited as guest to the ML Journal club at Leiden University Astronomy Department to present work about *Neural Symmetry Detection for Dynamical Systems for Astronomical Data and PDEs* (Leiden, Apr 2023)
- Poster presentation at DUCOMS 2023 (Utrecht) and took part in the 2023 Scientific ML Workshop (CWI)
- Presentation on *Foundations of Foundation Models* for *GeekOut* at Accenture (Amsterdam, Oct 2024)

    List of Publications
- *Type-II Neural Symmetry Detection with Lie Theory,* A.G., R. Quax, E. Gavves in *Scientific Reports (Springer Nature), September 2025*
- *Data-driven Lie Point Symmetry Detection for Continuous Dynamical Systems*, A.G., R. Quax, E. Gavves, in *Machine Learning: Science and Technology* (IOP Journal), February 2024
[DOI 10.1088/2632-2153/ad2629]
- *Learning Lie Group Symmetry Transformations with Neural Networks*, A.G.*, V. Klein*, R. Valperga*, J. S. W. Lamb, K. Webster, R. Quax, E. Gavves at ICML 2023 (Honolulu, July 2023), published in *Proceedings of 2nd Annual Workshop on Topology, Algebra, and Geometry in Machine Learning* (TAG-ML), PMLR 221:50-59, 2023. [arXiv:2307.01583] (*equal contribution)
- *Neural Symmetry Detection for Learning Neural Network Constraints* accepted to HiLD (High-dimensional Learning Dynamics Workshop: The Emergence of Structure and Reasoning) at ICML 2024
- Paper on constructing weight constraints for NNs using matrix powers under review

2019 – 2020   **IMPERIAL COLLEGE LONDON**   **LONDON, UK**
MSc Artificial Intelligence (12 months), graduated with **Distinction**
Specializations: Reinforcement Learning, Probabilistic Inference, Deep Learning, Computational Optimization, Mathematics for Machine Learning (linear regression, feature extraction, SVM)

- Master's project: *Probabilistic Competitive Recurrent Networks* based on Restricted Boltzmann Machines (supervised by Prof. Jorge Lobo and in collaboration with Prof. Nava Rubin)
  Investigated RBMs with label populations instead of single units, ideally for multiclass prediction.
- Software engineering group project in Agile: *A data mining system for Twitter-based event summarization and sentiment analysis* (supervised by Dr. Oana Cocarascu)
- Student representative – represented the cohort in the Staff Student Committee
- In charge of organizing weekly Artificial Intelligence reading group events and lunch talks

2018 – 2019	**UNIVERSITEIT ANTWERPEN (UNIVERSITY OF ANTWERP)**	**ANTWERP, BELGIUM**

MSc Film Studies and Visual Culture, graduated with **Distinction**
- Thesis: *The Role of Artificial Intelligence in Visual Culture – Tool or Source?* (supervised by Prof. Favero)
  Proposed "participation spectrum" to analyze AI's role in visual media as either a tool, source, or absent.
- Represented cohort at the 2019 Cannes and London Film Festivals

2014 – 2018	**OXFORD UNIVERSITY**	**OXFORD, UK**

- Master's degree in **Physics** (*MPhys*, years 1 through 3), grade: **First Class**
  Transfer accepted: "Master Course in Mathematical and Theoretical Physics" (*MMathPhys*, Part C, year 4)
- Graduated Master of **Mathematical and Theoretical Physics**, grade: Pass (Merits equivalent of 65-70%).
  Specializations: Advanced QFT, Groups and Representations, Topological Quantum Mechanics, CFT, Introduction to AdS/CFT, General Relativity II, String Theory I & II, Differential Geometry.
- Final year project: *Applications of Resurgence in Theoretical Physics* (supervised by Prof. Candelas)

Awards & Memberships:
- Practical Commendations (for excellency in first, second, and third year lab work)
- **Physics Prize** from the Department of Physics for practical work in the second year (2015-2016)
- Awarded the **Gibbs Prize** in 2017 for exemplary practical work across the master's course in Physics
- Received "scholar" status at Keble College for academic performance including a scholarship award
- Student representative in Joint Consultative Committee (2017-2018) and Keble College (2015-2016)

Computing   Skills in (scientific) programming, data analysis, and machine learning, including but not limited to:
- Proficient in **Python** and various Machine Learning APIs (scikit-learn, Keras, JAX, and PyTorch)
- Advanced skills in symbolic, numerical, and graphical scientific programming (Mathematica & MATLAB)
- Experience with C++, JavaScript, and Prolog
- Familiarity with software engineering paradigm "Agile" (including its various methodologies) and Git
- Microsoft Office suite proficiency (Word, Excel, Outlook and PowerPoint)
- Experience with scientific document processing software LaTeX

Extracurricular

2020 –	**OXFORD & CAMBRIDGE SOCIETY OF THE NETHERLANDS (ALUMNI)**	**AMSTERDAM, NL**
2017 – 2018	**KEBLE COLLEGE BOAT CLUB (ROWING CLUB)**	**OXFORD, UK**
Summer 2017	**UTRECHT SUMMER SCHOOL (UTRECHT UNIVERSITY)**	**UTRECHT, NETHERLANDS**

Theoretical Physics, research project on "Topological Quantum Matter"

2016 – 2018	**OXFORD UNIVERSITY BELGIAN AND LUXEMBOURGISH SOCIETY**	**OXFORD, UK**

Committee Member: Events Officer (2016-2017), Treasurer (2017-2018)

2017 – 2018	**OXFORD UNIVERSITY AMATEUR BOXING CLUB**	**OXFORD, UK**

Committee Member: Vice-President (2017-2018), Acting President (March - July 2018)
Organized two major events with a total count of over 1000 attendees
("Town vs Gown" at the Oxford Union and Varsity at the Oxford Town Hall)

2010 – 2014	**NATIONAL OLYMPIADS**	**FLANDERS, BELGIUM**

Mathematics & Chemistry Olympiad finalist (2014)

Languages   English and Dutch: *Native*. French and Hebrew: *Fluent*. German: *Advanced*. Spanish & Italian: *Rudimentary*.