

# Katharina Limbeck

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LinkedIn



GitHub



Homepage

## Profile

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Mathematician + statistician with expertise in machine learning + bioinformatics. Skilled in computational and data-driven research. Striving towards foundational machine learning research with meaningful interdisciplinary applications to biomedical data.

**Research Interest:** geometric and topological machine learning, deep learning, representation learning, graph learning, bioinformatics, scRNA data analysis

## Education

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**Technical University of Munich and Helmholtz Munich**

10/2022 - 09/2026

*Ph.D. in Mathematics and Machine Learning*

Advisors: Prof. Bastian Rieck, Prof. Fabian Theis

Thesis: Multi-Scale Representation Learning for Graph and Single Cell Data

**Mila - Quebec Artificial Intelligence Institute**

03/2025 - 05/2025

*Visiting Researcher*

Advisor: Prof. Guy Wolf

**University of Glasgow**

09/2017 - 06/2022

*Master in Science (MSci) in Mathematics and Statistics*

*First-Class Honours (GPA 19/22)*

## Publications

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Authors are usually ordered according to their contribution to a paper. Equal contributions are indicated using <sup>†</sup>, while joint supervision is denoted using <sup>‡</sup>.

1. **K. Limbeck**<sup>†</sup>, L. Mezrag<sup>†</sup>, G. Wolf<sup>‡</sup>, and B. Rieck<sup>‡</sup>: *Geometry-Aware Edge Pooling for Graph Neural Networks*, Advances in Neural Information Processing Systems, Volume 38, 2025 (in press)
2. **K. Limbeck**, L. Mezrag<sup>†</sup>, G. Wolf<sup>‡</sup>, and B. Rieck<sup>‡</sup>: *Geometry-Aware Edge Pooling for Graph Neural Networks*, ECML PKDD Workshop on Mining and Learning with Graphs, 2025
3. **K. Limbeck**, R. Andreeva, R. Sarkar, and B. Rieck: *Metric Space Magnitude for Evaluating the Diversity of Latent Representations*, Advances in Neural Information Processing Systems, Volume 37, pp. 123911–123953, 2024
4. **K. Limbeck**, and B. Rieck: *Detecting Spatial Dependence in Transcriptomics Data using Vectorised Persistence Diagrams*, Research in Computational Topology 3, Association for Women in Mathematics Springer Series, 2024 (in press)
5. R. Andreeva, **K. Limbeck**, B. Rieck<sup>‡</sup>, and R. Sarkar<sup>‡</sup>: *Metric Space Magnitude and Generalisation in Neural Networks*, Proceedings of the 2nd Annual Workshop on Topology, Algebra, and Geometry in Machine Learning (TAG-ML), Number 221, pp. 242–253, 2023

## Honours and Awards

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- Top reviewer (top 10%) at NeurIPS 2025

- Oral presentation (top 26% of accepted submissions) at MLG 2025
- Oral presentation (top 6 submissions) at the Munich Health Foundation Model Symposium 2024
- NeurIPS 2024 travel grant
- TDA Week 2023 travel grant
- Best undergraduate poster, London Mathematical Society's Women in Mathematics Day 2021
- Dougall Prize for the most distinguished students in the Ordinary class of Mathematics 2019
- Study abroad scholarship by the Lower Austrian Government 2018

## Research Talks

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- **ECML PKDD Workshop on Mining and Learning with Graphs (MLG)** Porto, 09/2025  
Contributed talk on "*Geometry-Aware Graph Pooling for Graph Neural Networks*"
- **Applied Geometry, Algebra, and Topology (AGATE) Seminar** Edinburgh, 03/2025  
Invited talk on "*Studying the Shape of Spatial Omics Data*"
- **Helmholtz HPC Retreat** Herrsching, 01/2025  
Invited talk on "*Metric Space Magnitude for Evaluating the Diversity of Latent Representations*"
- **Doctoral Seminar, Department of Applied Mathematics, Seville University** Online, 11/2024  
Invited talk on "*Metric Space Magnitude for Evaluating the Diversity of Latent Representations*"
- **BIMSA Topology Seminar** Online, 11/2024  
Invited talk on "*Metric Space Magnitude for Evaluating the Diversity of Latent Representations*"
- **KSMB-SMB 2024** Seoul, 06/2024  
Invited talk on "*Magnitude for Studying Cancer Heterogeneity*"
- **Magnitude Workshop at ETH Zürich** Online, 04/2024  
Invited talk on "*Metric Space Magnitude in Machine Learning*"
- **Munich Health Foundation Model Symposium** Munich, 04/2024  
Contributed talk on "*Metric Space Magnitude for Evaluating the Diversity of Latent Representations*"
- **Young Topologist Meeting 2023** EPFL Lausanne, 07/2023  
Contributed talk on "*Studying the Shape of Spatial Omics Data using TDA*"
- **Helmholtz Pioneer Campus PhD/Postdoc Seminar** Munich, 06/2023  
Invited talk on "*Studying the Shape of Spatial Omics Data using TDA*"

## Professional Experience

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- Statistics and Mathematics Tutor, University of Glasgow** 09/2020 - 08/2022
- Assisted with undergraduate statistics for around six hours per week. Led weekly tutorial sessions, demonstrated programming in R, answered questions during help sessions, and graded assignments.
  - Taught entry-level mathematics as part of a widening participation summer program.
- Data Science Intern, Accenture, Vienna** 06/2021 - 08/2021
- Applied statistical and machine learning methods in Python to solve business problems from various industries. Presented results, and communicated with clients.
- Research Intern in Statistics, Lancaster University** 07/2020 - 09/2020
- Summer research at the Center for Doctoral Training in Statistics and Operational Research. Investigated arc routing problems and solved statistical problems using R and C#.

## Services to the Community

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- Program committee for MLG 2025, ECML PKDD Workshop on Mining and Learning with Graphs
- Workshop reviewer for NeurReps 2025, TAG-DS 2025, MLG 2025, and NeurReps 2024
- Conference reviewer for ICLR 2025, and NeurIPS 2025 (top reviewer)
- Reviewer for SIAM Journal on Applied Mathematics
- Supervision of a Master student for the TUM seminar "*Advanced Topics in Graph Learning*"
- Mentor of a Fulbright research student from 09/2024 to 08/2025
- Co-organiser of the Theis Lab Retreat 2024 with more than 50 attendees

## Skills

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- **Software:** Python, R, C#, Unix, Bash, Git, HPC Computing, SLURM, Latex
- **Languages:** German (native), English (fluent)