LUKAS FESSER

1010 Massachusetts Ave., Cambridge, MA 02138
lukas_fesser@g.harvard.edu

EDUCATION

Harvard University
- PhD in Applied Mathematics. *2024-28*
- MSc in Computer Science.

University of Oxford
- MSc in Mathematics, *with Distinction.* *2021-22*

Yale-NUS College
- BSc in Mathematics and Computer Science, *Summa cum Laude.* *2017-21*

RESEARCH INTERESTS

Geometric Deep Learning: Graph and topological neural networks, topology and geometry-based encodings, methods for understanding and improving generalization and extrapolation capabilities.

AI for Healthcare: LLMs for medicine, biomedical knowledge graphs, drug interaction prediction.

EXPERIENCE

Avelios Medical, Munich, Germany
- Machine Learning Engineer. *06/2024 - 09/2024*
- Developed ML-based workflow recommendation systems for clinical practitioners. Trained vision models on dermatological datasets for disease classification. Finetuned open-source LLMs on medical data to improve summarization and classification capabilities, particularly on non-English datasets.

Harvard Department of Economics, Cambridge, MA.
- Pre-doctoral Fellow in Machine Learning *07/2022 - 06/2024*
- Worked with Prof. Melissa Dell on deep learning models for economics, including vision, NLP, and graph-based models. Analyzed large economic datasets using network analysis and statistical modeling.

TECHNICAL SKILLS

Programming Languages:	Python, C/ C++, R, Matlab, OCaml
ML Libraries:	PyTorch, TensorFlow, Sklearn
Other Software & Tools:	AWS, Microsoft Azure, CUDA, LaTeX, Git

PUBLICATIONS & PAPERS UNDER REVIEW

[9] Performance Heterogeneity in Message-passing and Transformer-based Graph Neural Networks
Lukas Fesser *and Melanie Weber. "Graph-level Heterogeneity in Message-passing and Transformer-based Graph Neural Networks", under Review at International Conference on Learning Representations (ICLR) 2025.*

[8] Balancing Fairness and Accuracy in Graph Learning via Fairness-constrained Rewiring
Jason Wang, **Lukas Fesser***, and Melanie Weber. "Balancing Fairness and Accuracy in Graph Learning via Fairness-Constrained Rewiring", under Review at Learning on Graphs (LoG) 2024.*

[7] Unitary Convolutions for Learning on Graphs and Groups
*Bobak Kiani, **Lukas Fesser**, and Melanie Weber. "Unitary Convolutions for Learning on Graphs and Groups", Neural Information Processing Systems (NeurIPS) 2024. **Spotlight**. Arxiv version.*

[6] Understanding and Mitigating Extrapolation Failures in Physics-informed Neural Networks
Lukas Fesser, Richard Qiu*, and Luca D'Amico-Wong*. "Understanding and Mitigating Extrapolation Failures in Physics-informed Neural Networks", under Review. Arxiv version.*

[5] Scalable Polyhedral Robustness Verification for Scene-Text Recognition
*Daqian Shao, **Lukas Fesser**, and Marta Kwiatkowska. "Scalable Polyhedral Robustness Verification for Scene-Text Recognition", under Review. Arxiv version.*

[4] Augmentations of Forman's Ricci Curvature and their Applications in Community Detection
Lukas Fesser, Sergio Serrano*, Karel Devriendt, Melanie Weber, and Renaud Lambiotte. "Augmentations of Forman's Ricci Curvature and their Applications in Community Detection", Journal of Physics: Complexity, 2024. Arxiv version.*

[3] Effective Structural Encodings via Local Curvature Profiles
***Lukas Fesser** and Melanie Weber. "Effective Structural Encodings via Local Curvature Profiles", International Conference on Learning Representations (ICLR) 2024. Arxiv version.*

[2] Mitigating Over-smoothing and Over-squashing using Augmentations of Forman-Ricci Curvature
***Lukas Fesser** and Melanie Weber. "Mitigating Over-smoothing and Over-squashing using Augmentations of Forman-Ricci Curvature", Learning on Graphs (LOG) 2023. Arxiv version.*

[1] Tightness of Bernoulli Gibbsian line ensembles
Evgeni Dimitrov, Xiang Fang*, **Lukas Fesser***, Christian Serio*, Carson Teitler*, and Weitao Zhu*. "Tightness of Bernoulli Gibbsian line ensembles", Electronic Journal of Probability 2021. Journal version. Extended Arxiv version.*

SELECTED HONORS

- Kempner Institute Graduate Fellowship *2024*
- Trinity College Academic Excellence Award *2022*
- Trinity College Graduate Fellowship *2021*
- Yale-NUS Academic Merit Scholarship *2017*

ONGOING PROJECTS

On the Role of Initialization and Encodings in Attention-based Graph Neural Networks
with Bobak Kiani and Melanie Weber.

Extrapolation and Generalization Capabilities in Knowledge Graph Foundation Models
with Marinka Zitnik.

Structural and Positional Encodings for Hypergraph Neural Networks
with Raphael Pellegrin and Melanie Weber.

LANGUAGE SKILLS

Fluent:	German (native), English, French
Conversational:	Spanish, Mandarin Chinese