

PREFACE TO GRAM: THE SECOND WORKSHOP ON GEOMETRY-GROUNDED REPRESENTATION LEARNING AND GENERATIVE MODELING

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MOTIVATION

This volume collects the contributions to the second edition of the GRaM, the workshop on *Geometry-grounded Representation Learning and Generative Modeling*. This workshop grew out of a shared observation: many real-world datasets carry geometric structure, yet most machine learning methods ignore it and treat their inputs as plain vectors. GRaM is built on the opposite principle, *grounding in geometry* — an approach is geometrically grounded when it respects the geometric structure of its problem domain and supports geometric reasoning. Building on the first edition (Vadgama et al., 2024), we introduced a theme for this year: *scale and simplicity*. As models scale, does geometric structure remain useful, or should we discard geometric inductive biases in favor of simpler architectures that scale with data.

In our call, we invited contributions across four directions: *preserving data geometry* (symmetries, geometric representation systems, latent space); *inducing geometric structure* (geometric priors, non-Euclidean generative models, metric-preserving embeddings); *geometry in theoretical analysis* (of data and latent spaces, loss landscapes, and unifying frameworks); and *scale and simplicity* itself, where geometry pays off at scale, where it becomes redundant, and reporting of limitations and negative results.

GRAM AT ICLR 2026

The first edition of GRaM took place at ICML 2024 in Vienna, Austria, and its proceedings were published as Volume 251 of the Proceedings of Machine Learning Research (Vadgama et al., 2024). This second edition (Pouplin et al., 2026) was held on Sunday, 26 April 2026, at ICLR in Rio de Janeiro, Brazil, in the Riocentro Convention Center. The present volume collects the contributions of GRaM 2026.

CALL FOR PAPERS, BLOGPOSTS AND COMPETITIONS

The workshop accepted submissions in three tracks: papers, blog posts, and a competition.

1. **Papers**, peer-reviewed double-blind through OpenReview and due on 5 February 2026, with notifications on 1 March and camera-ready versions on 11 March 2026. Of **133** submissions, **24** are published through the proceedings track through this volume in collaboration with PMLR, and **52** as tiny papers, available on OpenReview.¹
2. **Blog posts**: expository posts that explain published work or key ideas in geometric deep learning and generative modeling. **11** posts were accepted and are collected on a dedicated site.²
3. **Competition**: a benchmark challenge on transient airflow prediction over three-dimensional geometries, which drew **22** submissions.³ It is described in its own section below and reported in full elsewhere in this volume.

¹Accepted papers and proceedings: openreview.net/group?id=ICLR.cc/2026/Workshop/GRAM

²gram-blogposts.github.io

³gram-competition.github.io

		Generative mod.	Repres. learning	Molecular / 3D	LLMs / Found. mod.	Optim. / Training	Theory / Express.	Scaling / Effic.	Induct. / Architect.	Others
		10%	18%	11%	10%	16%	7%	13%	13%	2%
Graph theory	15%	3	3	6	1	6	3	7	5	·
Group theory / Equivariance	19%	5	7	7	3	7	5	6	10	·
Differential geometry	17%	9	6	2	4	8	2	1	3	·
Topology / TDA	8%	1	·	2	1	3	1	1	1	1
Hyperbolic / Non-Euclidean	6%	1	4	·	2	·	1	2	4	·
Optimal transport	4%	·	1	1	2	3	·	2	·	·
Linear algebra / Spectral	15%	2	8	·	5	6	2	5	3	1
Information theory / Dim.	8%	2	5	1	1	3	1	3	1	·
Empirical / Structured data	8%	1	3	2	3	4	·	1	2	1

Figure 1: Distribution of the accepted papers across mathematical themes (rows) and machine-learning application areas (columns). A paper may carry multiple labels.

The accepted papers span a broad range of mathematical themes — group theory and equivariance, differential geometry, graph theory, spectral and linear-algebraic methods, topology, optimal transport, and hyperbolic geometry — applied across representation learning, generative modeling, molecular and 3D domains, optimization and training, foundation models, theory, and scaling.

COMPETITION

We organized a benchmark competition on transient, three-dimensional airflow prediction, where geometry is unavoidable and high-fidelity simulation is expensive. Together with BeyondMath, we released *Warped-IFW*, a dataset of warped variants of the open-source Imperial Front Wing, and posed a single task: given an initial window of a velocity field, predict the rest of the flow. The challenge drew 22 valid submissions spanning a broad range of architectures, and awarded a prize to the best-performing entry. A report is published in this volume to credit every submission and presents a post-competition meta-analysis.

The competition was chaired by Gavin Seegoolam and Julian Suk. The dataset, code, and leaderboard are available online.⁴

PROGRAM

GRaM 2026 ran as a full-day workshop. The program featured five invited talks, five contributed talks selected from the accepted papers, a panel discussion, and two poster sessions in which all accepted works were presented.

⁴Competition: gram-competition.github.io; code: github.com/gram-competition/iclr-2026; dataset: huggingface.co/datasets/gram-competition/warped-ifw.

INVITED TALKS

1. *Parameter symmetries, singularities, and group equivariance* — Kathlén Kohn, KTH Royal Institute of Technology.
2. *A Geometric View of Deep Generative Models* — Gabriel Loaiza-Ganem, Layer 6 AI.
3. *From Geometry to Topology: The Shape of Learning* — Anthea Monod, Imperial College London.
4. *Graph Foundational Models* — Maya Bechler-Speicher, Meta.
5. *Flow Map Language Models* — Nicholas Boffi, Carnegie Mellon University.

CONTRIBUTED TALKS

Five papers were selected as the outstanding contributions of the workshop and presented as contributed talks. From the proceedings track:

1. *The Affine Divergence: Aligning Activation Updates Beyond Normalisation* — George Bird (University of Manchester).
2. *Algebraic priors for approximately equivariant networks* — Riccardo Ali, Pietro Liò, Jamie Vicary (University of Cambridge).

From the tiny paper track:

3. *The Geometry of Spectral Gradient Descent: Layerwise Criteria for SignSGD vs SpecSGD* — Laura Gomezjurado Gonzalez, Mahdi Ghaznavi, Hiroki Naganuma, Ioannis Mitliagkas (Stanford University).
4. *mHC-lite: You Don't Need 20 Sinkhorn–Knopp Iterations* — Yongyi Yang, Jianyang Gao (University of Michigan–Ann Arbor).
5. *Riemannian Metric Matching for Scalable Geometric Modelling of Distributions* — Jacob Bamberger, Adam Gosztolai, Pierre Vandergheynst, Michael M. Bronstein, Iolo Jones (University of Oxford).

PANEL DISCUSSION

The panel, titled *About scale, simplicity and geometry*, brought together Alexander Tong (AITHYRA), Gabriel Loaiza-Ganem (Layer 6 AI), Max Welling (CuspAI and University of Amsterdam), Michael Bronstein (University of Oxford and AITHYRA), and Kathlén Kohn (KTH). It was moderated by Erik Bekkers.

PROGRAM COMMITTEE

We are deeply grateful to our eleven area chairs, who supervised the reviewing process and led the selection of contributed talks: Elizabeth Baker, Erik Bekkers, Samuel Fadel, Sékou-Oumar Kaba, Hannah Lawrence, Alison Pouplin, Behrooz Tahmasebi, Shubhendu Trivedi, Sharvaree Vadgama, Robin Walters, and Bo Zhao. We thank just as warmly our program committee of reviewers, whose careful and timely work made the paper selection possible:

Eslam Abdelaleem	Max Beier	Alba Carballo-Castro	Seonglae Cho
Mohamed Abdelrazek	Thomas Besnier	Martin Carrasco	Edmond Cunningham
Riccardo Ali	George Bird	Guillermo Ricardo	César Miguel Valdez
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Samuel G. Fadel	Anthony Kobanda	Siba Smarak Panigrahi	Aurelio Sulser
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Axel Flinth	Nikita Kostin	Laksh Patel	Behrooz Tahmasebi
Kenji Fukumizu	Najwa Laabid	Lekha Patel	XuJiang Tang
Alejandro	Aarav Lala	Saku Peltonen	Ana Luiza Tenorio
García-Castellanos	Michal Lewandowski	Miguel Alcocer Pérez	Federica Valeau
Johanna Marie	Haorui Li	Marcos M. Raimundo	Hong-Yi Wang
Gegenfurtner	Zichao Li	Arnav Raj	Ishaan Watts
Gaurav Rohit Ghosal	Hansen Lillemark	Sahar Rajabi	Ting-Ruen Wei
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Tobias Hölpe	Behnaz Moradijamei	Tanush Ajay Shastry	Peter Zaika
Vasily Ilin	Sayak Mukherjee	Zebang Shen	Leo Zhang
Chuyi Jiang	Hiroki Naganuma	Yongquan Shi	Xu Zhang
Marimuthu Kalimuthu	Khang Ngo	Zakhar Shumaylov	Bo Zhao
Asif Khan	Duc Toan Nguyen	Geri Skenderi	Yize Zhao
Jinwoo Kim	Vedanth M. Nilabh	Hangke Sui	Zhenjie Zhao

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ACKNOWLEDGEMENTS

We are profoundly grateful to the ICLR 2026 organizing team, whose work in hosting the conference and coordinating its workshops made this event possible, and to the workshop organizers and volunteers whose behind-the-scenes effort kept the day running smoothly from the first talk to the last poster. Most especially, we are immensely grateful to the team at *SlidesLive*, whose consistently outstanding work — at this conference and at every conference — ensured that every technical detail, from live-streaming to recording, worked flawlessly. Their care, professionalism and kindness are a large part of why our speakers and audience, in person and online alike, enjoyed such a seamless experience, and we cannot thank them enough.

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