

Dr. Tolga Birdal

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Department of Computing ♦ Imperial College London

circle-group.github.io | tolgabirdal.github.io

scholar.google.com/citations?user=_Bxd5ggAAAAJ

Academic Positions

- 2026–Present **Associate Professor**, UKRI Future Leaders Fellow & AI Speaker, Imperial College London, UK
2022–2026 **Assistant Professor (Lecturer)**, UKRI Future Leaders Fellow & AI Speaker, Imperial College London, UK
2019–2021 **PostDoc.**, Geometric Computing Group, Stanford University, Stanford CA
2014–2018 **Ph.D.**, Chair of Computer Aided Medical Procedures, TU Munich, Germany
Doctoral thesis: *Geometric Methods for 3D Reconstruction from Large Point Clouds*
2008–2011 **M.Sc.**, Computational Science & Engineering, TU Munich, Germany
Master's thesis: *3D Deformable Surface Recovery Using RGBD Cameras*
2004–2008 **B.Sc.**, Electronics Engineering, Sabancı University, Turkey

Industrial Positions and Entrepreneurship

- 2011–2022 **Consultant** for numerous startups including Shape, Fantasma, Carbon, Parcelist and Hover
2014–2018 **Doktorand**, Siemens Corporate Technology Munich, Germany
2011–2014 **Co-Founder/CEO**, Gravi Information Technologies Ltd. Istanbul, Turkey
2008–2011 **Co-Founder/CTO**, Befunky Inc. (befunky.com), Portland CA [**Acquired by** Tiny Capital in 2022 (>\$19M)]

Funding (£ 3.75M in total: £ 2.5M as PI, £ 1.3M as co-PI)

- 2026 **UKRI 300,000 GPU hours on Isambard AI Supercomputer** [PI, Est. £ 750K] for Topological Foundation Models
2024 **UKRI Future Leaders Fellowship** [PI, £ 1.6M] for UNTOLD: Unifying Foundations for Topological Deep Learning
2024 **Amazon AWS Cloud Credit Awards** [PI, £ 42,765] for Topological deep learning
2024 **Royal Society Research Grant** [PI, £ 70,000] for TODDLE: Topological deep learning
2023 **Meta (Facebook) Research Award** [PI, \$ 50,000] for perception of hand interactions in 2D and 3D scenes
2023 **D-Wave Quantum Cloud Service Gift** [PI, £ 3,600] for training neural networks on quantum computers
2022 **EPSRC Grant (EP/X011364/1)** [Co-PI, £ 1M] for GNOMON: Deep non-Euclidean Generative Models
2022 **Google Cloud Research Credit** [PI, \$ 17,000] for building 3D generative models
2022 **Google University Gift** [PI, \$ 10,000] for characterizing the geometry of latent spaces of generative models
2021 **US Navy Office of Naval Research Grant** [Co-PI, \$ 125,000] for modeling uncertainty in self-navigation
2019 **Google Daydream University Research Gift** [Co-PI, \$ 80,000] for semantic point cloud understanding

Awards

- 2026 **Outstanding Area Chair**, in CVPR and ECCV
2020 **Outstanding Reviewer**, in NeurIPS, CVPR and ECCV
2019 **Best Paper Finalist**, Conference on Computer Vision and Pattern Recognition (CVPR)
2017 **Best Student Paper Award**, ICCV Workshop on Multiview Relationships in 3D Data (MVR3D)
2016 **Young Professional Award** by European Machine Vision Association (EMVA) for my Ph.D. work

Selected Keynotes & Invited Talks (out of a pool of >30 talks, excluding contributed conference presentations)

- Keynotes
Conference on Signal Processing and Communications Applications (SIU) (Istanbul, TR)
CERN Steam Academy (Geneva, SW)
Workshop on Topological Deep Learning (Fribourg, SW)
ICERM Workshop on Foundations of Computational Geometry and Topology (Providence, USA)
CaLISTA Geometry and Machine Learning Conference (Vienna, AU)
International Conference on Applied Quantum Methods in Computational Science (Aachen, DE)
Geometry and Machine Learning Conference (Paris, FR)
London Geometry and Machine Learning Summer School (London, UK)
ELLIS Algebraic Vision & Machine Learning Workshop 2024
Workshop on Scene Graphs and Graph Representation Learning (**ICCV**, Hawaii)
Workshops on 3D Compositional Vision, Deep Learning & Geometric Computing, Shape
Recovery from Partial Textured 3D Scans (**all CVPRs**)
International Workshop on Recovering 6D Object Pose (**ECCV**)
Talks in Industry
Autodesk ('24, '19), Intel ('23), Twitter ('22), Huawei ('21), MagicLeap ('21), DLR ('21), Google ('19)
Talks in Academia
Uni. Manchester ('24), Oxford ('22, '24), Uni. Bristol ('23), Uni. Maryland ('22), KAUST ('22),
École des Ponts ('21), NYU ('21), University of Amsterdam ('21), Telecom Paristech ('20), HKU ('24)

Educational Activities

- Teaching **Non-Euclidean Methods in Machine Learning** at Imperial College London, UK (nemlcourse.github.io), Stanford University, CA (cs468.stanford.edu) and Bosphorus University, Istanbul (CMPE58L01)
Computer Graphics at Imperial College London, UK Module Link
- Supervision **15 Ph.D. students** (4 completed, 11 ongoing), **24 masters students** (19 completed, 5 ongoing)
- Outreach Mentor at MIT **Summer Geometry Institute** (sgi.mit.edu)
 Board Member at **London Geometry & Machine Learning** Summer School (logml.ai)
 Regular teachings on AI/ML at **Nesin Mathematics Village**, **Science Village** and **Arkhé Project**

Academic Services

- Ex-Associate editor Journal of Real-Time Image Processing, and The Visual Computer
- Publication chair 3D Vision (3DV) 2025
- Area chair CVPR (h-440) 24–26, ICML (h- 272) 25, ICCV (h- 291) 23, ECCV (h-206) 24, 3DV 24
- Program committee >20 times at T-PAMI, IJCV, NeurIPS, ICML, ICLR, CVPR, ICCV, ECCV, ICLR, SIGGRAPH, 3DV, BMVC
- Organizations **ECCV'26 Workshop** on Geometric Intelligence: From Vision to Scientific Discovery
CVPR'24, CVPR'25, CVPR'26 Workshops on Urban Scene Modeling (usm3d.github.io)
CVPR'24 Workshop on Topological Deep Learning for Computer Vision (tdl4cv.github.io)
CVPR'23 / ECCV'24 Workshops on Quantum Computer Vision & Machine Learning (qcvml.github.io)
CVPR 2020 Tutorial on Synchronization and Cycle Consistency (synchinvision.github.io)

Selected Publications (drawn from a larger pool of >80 publications, >45 of which are lead/senior-authored)

A curated list, which garnered > 5500 citations with an h-index of 33 (as per Google Scholar) (* equal contribution):

- ◇ Theodore Papamarkou, **Tolga Birdal**, Mustafa Hajij, Karthikeyan N. Ramamurthy, Michael T. Schaub & Ghada Zamzmi: *Topological Deep Learning: Going Beyond Graph Data*, (Book under preparation). [TDL book webpage]
- ◇ Zhengdi Yu, Simone Foti, Linguang Zhang, Amy Zhao, Cem Keskin, Stefanos Zafeiriou **Tolga Birdal**: *Geometric Neural Distance Fields for Learning Human Motion Priors*, CVPR 2026 [spotlight] [webpage]
- ◇ Jebastin Nadar, Simone Foti & **Tolga Birdal**: *PoseD-Flow: Versatile and Guided Flow Matching Model of Human Pose*, CVPR 2026 [spotlight] [webpage]
- ◇ Hippolyte Verninas, Caner Korkmaz, Stefanos Zafeiriou, **Tolga Birdal*** & Simone Foti*: *Parallelised Differentiable Straightest Geodesics for 3D Meshes*, CVPR 2026 [webpage]
- ◇ Ed Stevinson, Lucas Prieto, Melih Barsbey & **Tolga Birdal**: *Adversarial Attacks Leverage Interference Between Features in Superposition*, ICML 2026 [webpage]
- ◇ Lucas Prieto, Ed Stevinson, Melih Barsbey, **Tolga Birdal*** & Pedro AM Mediano*: *From data statistics to feature geometry: How correlations shape superposition*, ICLR 2026
- ◇ Melih Barsbey, Antônio H. Ribeiro, Umut Şimşekli & **Tolga Birdal**: *On the Interaction of Compressibility and Adversarial Robustness*, ICLR 2026
- ◇ Gabriel Nobis, Maximilian Springenberg, ..., Wojciech Samek* & **Tolga Birdal***, *Fractional Diffusion Bridge Models*, NeurIPS 2025 [code]
- ◇ Mustafa Hajij, Lennart Bastian, ..., Theodore Papamarkou & **Tolga Birdal**, *Copresheaf Topological Neural Networks: A Generalized Deep Learning Framework*, NeurIPS 2025
- ◇ Lennart Bastian, Mohammad Rashed, Nassir Navab & **Tolga Birdal**: *Forecasting Continuous Non-Conservative Dynamical Systems in SO(3)*, ICCV 2025 [oral presentation] [webpage]
- ◇ Caner Korkmaz, Brighton Nuwagira, Barış Coşkunuzer & **Tolga Birdal**: *CuMPerLay: Learning Cubical Multiparameter Persistence Vectorizations*, ICCV 2025 [webpage]
- ◇ Melih Barsbey, Stefanos Zafeiriou & **Tolga Birdal**: *Large Learning Rates Simultaneously Achieve Robustness to Spurious Correlations and Compressibility*, ICCV 2025
- ◇ Zhengdi Yu, Stefanos Zafeiriou & **Tolga Birdal**: *Dyn-HaMR: Recovering 4D Interacting Hand Motion from a Dynamic Camera*, CVPR 2025 [spotlight] [webpage]
- ◇ Nathan Mankovich, Ignacio Santamaria, Gustau Camps-Valls & **Tolga Birdal**: *A Flag Decomposition for Hierarchical Datasets*, CVPR 2025
- ◇ Lucas Prieto, Melih Barsbey, Pedro A. M. Mediano & **Tolga Birdal**: *Grokking at the Edge of Numerical Stability*, ICLR 2025 [code]
- ◇ Karthik Prakhyia, **Tolga Birdal** & Alp Yurtsever: *Convex Formulations for Training Two-Layer ReLU Neural Networks*, ICLR 2025 [code]
- ◇ Rayna Andreeva, Benjamin Duipus, Umut Simsekli & **Tolga Birdal**: *Topological generalization bounds for discrete-time stochastic optimization algorithms*, NeurIPS 2024 [code]
- ◇ Simone Foti, Stefanos Zafeiriou & **Tolga Birdal**: *UV-free Texture Generation with Denoising and Geodesic Heat Diffusions*, NeurIPS 2024 [web]
- ◇ Gabriel Nobis, Maximilian Springenberg, ..., **Tolga Birdal** et al.: *Generative Fractional Diffusion Models*, NeurIPS 2024 [code]
- ◇ Theo Papamarkou, **Tolga Birdal** et al.: *Topological Deep Learning is the New Frontier for Relational Learning*, ICML 2024
- ◇ Rembert Daems, Manfred Opper, Guillaume Crevecoeur & **Tolga Birdal**: *Variational Inference for SDEs Driven by Fractional Noise*, ICLR 2024 [spotlight] [webpage]

- ◇ Yannan He, Garvita Tiwari, **Tolga Birdal**, Garvita Tiwari & Gerard Pons-Moll: *NRDF: Neural Riemannian Distance Fields for Learning Articulated Pose Priors*, CVPR 2024 [spotlight] [webpage]
- ◇ Nathan Mankovich, Gustau Camps-Valls & **Tolga Birdal**: *Fun with Flags: Robust Principal Directions via Flag Manifolds*, CVPR 2024 [code]
- ◇ Jan-Nico Zaech, Martin Danelljan, **Tolga Birdal**, Luc Van Gool: *Probabilistic Sampling of Balanced K-Means using Adiabatic Quantum Computing*, CVPR 2024
- ◇ Maximilian Krahn, Michele Sasdelli, Fengyi Yang, Vlad Golyanik, Juho Kannala, Tat-Jun Chin, **Tolga Birdal**: *Projected Stochastic Gradient Descent with Quantum Annealed Binary Gradients*, BMVC 2024 [webpage]
- ◇ Zhiying Leng, **Tolga Birdal**, Xiaohui Liang, Federico Tombari: *HyperSDFusion: Bridging Hierarchical Structures in Language and Geometry for Enhanced 3D Text2Shape Generation*, CVPR 2024
- ◇ Nathan Mankovich & **Tolga Birdal**: *Chordal Averaging on Flag Manifolds and Its Applications*, ICCV 2023 [oral presentation] [code]
- ◇ Alp Yurtsever, **Tolga Birdal**, Vlad Golyanik: *Q-FW: A Hybrid Classical-Quantum Frank-Wolfe for Quadratic Binary Optimization*, ECCV 2022
- ◇ Jiahui Huang, **Tolga Birdal**, Zan Gojcic, Leo Guibas & Shi-Min Hu: *Multiway Non-rigid Point Cloud Registration via Learned Functional Map Synchronization*, T-PAMI 2022 [webpage]
- ◇ Yongheng Zhao, Guangchi Fang, Yulan Guo, Leo Guibas, Federico Tombari & **Tolga Birdal**: *3DPointCaps++: Learning 3D Representations with Capsule Networks*, IJCV 2022 [webpage]
- ◇ Haowen Deng, Mai Bui, Nassir Navab, Leo Guibas, Slobodan Ilic & **Tolga Birdal**: *Deep Bingham Networks: Dealing with Uncertainty and Ambiguity in Pose Estimation*, IJCV 2022 [webpage]
- ◇ Mikaela A. Uy, Yen-yu Chang, Minhyuk Sung, Purvi Goel, Joseph Lambourne, **Tolga Birdal** & Leo Guibas: *Point2Cyl: Reverse Engineering 3D Objects From Point Clouds to Extrusion Cylinders*, CVPR 2022 [webpage]
- ◇ Jiayi Chen, Yingda Yin, **Tolga Birdal**, Baoquan Chen, Leo Guibas & He Wang: *Projective Manifold Gradient Layer for Deep Rotation Regression*, CVPR 2022 [code]
- ◇ **Tolga Birdal**, Aaron Lou, Leo Guibas & Umut Simsekli: *Intrinsic Dimension, Persistent Homology and Generalization in Neural Networks*, NeurIPS 2021 [code]
- ◇ **Tolga Birdal**, Vlad Golyanik, Christian Theobalt & Leo Guibas: *Quantum Permutation Synchronization*, CVPR 2021 [webpage]
- ◇ Davis Rempe, **Tolga Birdal**, Aaron Hertzmann, Jimei Yang, Srinath Sridhar & Leo Guibas: *HuMoR: 3D Human Motion Model for Robust Pose Estimation*, ICCV 2021 [oral presentation] [webpage]
- ◇ **Tolga Birdal**, Vlad Golyanik, Christian Theobalt & Leo Guibas: *Quantum Permutation Synchronization*, CVPR 2021 [webpage]
- ◇ Zan Gojcic, Or Litany, Andreas Wieser, Leo Guibas & **Tolga Birdal**: *Weakly Supervised Learning of Rigid 3D Scene Flow*, CVPR 2021 [oral presentation] [webpage]
- ◇ Jiahui Huang, He Wang, **Tolga Birdal**, Minhyuk Sung, Federica Arrigoni, Shi-Min Hu & Leo Guibas: *MultiBodySync: Multi-Body Segmentation and Motion Estimation via 3D Scan Synchronization*, CVPR 2021 [oral]
- ◇ Davis Rempe, **Tolga Birdal**, Yongheng Zhao, Zan Gojcic, Srinath Sridhar & Leo Guibas: *CaSPR: Learning Canonical Spatiotemporal Point Cloud Representations*, NeurIPS 2020 [spotlight] [webpage]
- ◇ **Tolga Birdal**, Michael Arbel, Umut Simsekli & Leo Guibas: *Synchronizing Probability Measures on Rotations via Optimal Transport*, CVPR 2020 [webpage]
- ◇ **Tolga Birdal***, Yongheng Zhao*, Jan Eric Lenssen, Emanuele Menegatti, Leo Guibas & Federico Tombari: *Quaternion Equivariant Capsule Networks for 3D Point Clouds*, ECCV 2020 [oral] [code]
- ◇ Mikaela Uy, Jingwei Huang, Minhyuk Sung, **Tolga Birdal** & Leo Guibas: *Deformation-Aware 3D Model Embedding and Retrieval*, ECCV 2020 [webpage]
- ◇ **Tolga Birdal** & Umut Simsekli: *Probabilistic Permutation Synchronization using the Riemannian Structure of the Birkhoff Polytope*, CVPR 2019 [best paper finalist] [webpage]
- ◇ Haowen Deng, **Tolga Birdal** & Slobodan Ilic: *3D Local Features for Direct Pairwise Registration*, CVPR 2019
- ◇ **Tolga Birdal***, Yongheng Zhang*, Haowen Deng & Federico Tombari: *3D Point Capsule Networks*, CVPR 2019
- ◇ **Tolga Birdal**, Benjamin Busam, Nassir Navab, Slobodan Ilic & Peter Sturm: *Generic Primitive Detection in Point Clouds Using Novel Minimal Quadric Fits*, T-PAMI 2019 [code]
- ◇ **Tolga Birdal**, Umut Simsekli, Onur Eken & Slobodan Ilic: *Bayesian Pose Graph Optimization via Bingham Distributions and Tempered Geodesic MCMC*, NeurIPS 2018
- ◇ Haowen Deng, **Tolga Birdal** & Slobodan Ilic: *PPF-Foldnet: Unsupervised Learning of Rotation Invariant 3D Local Descriptors*, ECCV 2018
- ◇ Haowen Deng, **Tolga Birdal** & Slobodan Ilic: *PPFNet: Global Context Aware Local Features for Robust 3D Point Matching*, CVPR 2018 [oral]

Patents

- ◇ J. Langerman, **Tolga Birdal**: *Systems and methods of predicting three dimensional reconstructions of a building* [WO2024102469A1], with Hover Inc., CA. 2024.
- ◇ C. Stearns, ..., **Tolga Birdal**, ...: *Systems and Methods for Multi-Object Tracking* [US Patent 18/202,632], with TRI, CA. 2023.
- ◇ H. Deng, **Tolga Birdal**, Slobodan Ilic: *An apparatus and a method for performing a data driven pairwise registration of three-dimensional point clouds* [US 2022/0084221], with Siemens AG, Germany.
- ◇ **Tolga Birdal**, J. Dobryden, S. Ilic: *Marking Device* [US 2/713,176, WO2018077535A1], with Siemens AG.
- ◇ **Tolga Birdal**, M. Ozkanoglu, T. Tatar: *Method and system for generating online cartoon outputs* [US Patent 9/483,237], with BeFunky, USA.