

# Nathaël Da Costa

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## Education

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### University of Tübingen

PHD IN COMPUTER SCIENCE

A Differential Geometric Viewpoint on Probabilistic Deep Learning

Tübingen, DE

September 2023 - Ongoing

### University of Cambridge

MMATH IN PURE MATHEMATICS (PART III OF THE MATHEMATICAL TRIPOS)

With Merit.

Cambridge, UK

October 2021 - June 2022

### University of Cambridge

BA IN MATHEMATICS (MATHEMATICAL TRIPOS)

First Class, ranked 38th/222.

Cambridge, UK

October 2018 - June 2021

### European School of Luxembourg

EUROPEAN BACCALAUREATE, 92%

98% in Mathematics and Advanced Mathematics.

Kirchberg, LU

April 2008 - July 2018

## Experience

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### Nanyang Technological University

RESEARCH ASSOCIATE

Research on kernel methods on manifolds.

Singapore, SG

January 2023 - August 2023

### Dreams AI

MACHINE LEARNING INTERN

Studied the geometry of the space of SPD matrices.

Hong Kong, HK

December 2019 - January 2020

### MM Flowers

DATA SCIENTIST, CAMBRIDGE MATHEMATICS PLACEMENT

Used Bayesian networks to learn from data.

Cambridge, UK

June 2019 - August 2019

### Oxford Summer Courses

MATHEMATICS TUTOR

Taught mathematics to students from 14 to 20 years old.

Cambridge, UK

June 2021 - August 2021

## Papers

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### JOURNAL PUBLICATIONS

#### Invariant kernels on Riemannian symmetric spaces: a harmonic-analytic approach

[Nathaël Da Costa](#), Cyrus Mostajeran, Juan-Pablo Ortega, Salem Said, 2023, arXiv:2310.19270.

#### Geometric Learning with Positively Decomposable Kernels

[Nathaël Da Costa](#), Cyrus Mostajeran, Juan-Pablo Ortega, Salem Said, 2023, arXiv:2310.13821.

#### Differential Geometry with Extreme Eigenvalues in the Positive Semidefinite Cone

Cyrus Mostajeran, [Nathaël Da Costa](#), Graham Van Goffrier, Rodolphe Sepulchre, 2023, *SIAM Journal on Matrix Analysis and Applications*, 1089—1113, 2024, Society for Industrial and Applied Mathematics.

### CONFERENCE PROCEEDINGS

#### Geometric statistics with subspace structure preservation for SPD matrices

Cyrus Mostajeran, [Nathaël Da Costa](#), Graham Van Goffrier, Rodolphe Sepulchre, 2024, arXiv:2407.03382.

#### The Gaussian Kernel on the Circle and Spaces that Admit Isometric Embeddings of the Circle

[Nathaël Da Costa](#), Cyrus Mostajeran, Juan-Pablo Ortega, *Geometric Science of Information*, 426–435, 2023, Springer Nature Switzerland.

### PREPRINTS

#### Sample Path Regularity of Gaussian Processes from the Covariance Kernel

## Talks

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2025	<b>Constructive Disintegrations and their Modes</b> , Fundamentals of Statistical Machine Learning	London, UK
2025	<b>Closed Form Last Layer Optimization</b> , Methods of Machine Learning Group	Tübingen, Germany
2025	<b>Overconfidence in Classification</b> , Methods of Machine Learning Group	Tübingen, Germany
2025	<b>Rethinking Approximate Gaussian Inference in Classification</b> , Workshop on Overparametrization, Regularization, and Uncertainty in Machine Learning.	Oberwolfach, Germany
2024	<b>Invariant Kernels on Homogeneous Spaces</b> , International Symposium on Mathematical Theory of Networks and Systems	Cambridge, UK
2024	<b>Sample Path Regularity of Gaussian Processes</b> , Probabilistic Numerics Workshop	London, UK
2024	<b>Weight Space Symmetries of ReLU Networks</b> , Methods of Machine Learning Group	Tübingen, DE
2024	<b>Gaussian Processes: Theory and Practice</b> , Cambridge Image Analysis Group	Cambridge, UK
2024	<b>Sample Path Regularity of Gaussian Processes</b> , Methods of Machine Learning Group	Tübingen, DE
2023	<b>Kernel Methods on Manifolds</b> , Emergent Algorithmic Intelligence Workshop	Mainz, DE
2023	<b>Kernel Methods on Manifolds</b> , Non-autonomous Dynamics in Complex Systems Workshop	Dresden, DE
2023	<b>The Gaussian Kernel on the Circle</b> , International Conference on Geometric Science of Information	Saint-Malo, FR
2023	<b>Differential Geometry with Extreme Eigenvalues in the Positive Semidefinite Cone</b> , International Congress on Industrial and Applied Mathematics	Tokyo, JP
2019	<b>Predicting the Lifetime of Flowers</b> , Cambridge Mathematics Placements	Cambridge, UK

## Scholarships

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2018-2022	<b>CEDIES</b> , Luxembourg Scholarship for academic achievement (approx. 30,000€).	Luxembourg, LU
2019-2022	<b>Churchill College Prize Scholarship</b> , Prize for excellent exam results (awarded in 2019, 2020, 2021, 2022).	Cambridge, UK

## Competitions

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2018	<b>Honorable Mention</b> , 59th International Mathematical Olympiad (IMO).	Cluj Napoca, RO
2018	<b>Participation</b> , 49th International Physics Olympiad (IPhO).	Lisbon, PT
2018	<b>Participation</b> , 10th Benelux Mathematical Olympiad (BxMO).	Mersch, LU