

Karthik Viswanathan

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Education

University of Amsterdam

PhD in Physics

Amsterdam

2021 – 2025

Thesis: From Language Models to Cosmic Structures: A Geometric Perspective

Advisors: Dr. Matteo Biagetti and Dr. Jan Pieter van der Schaar

University of Amsterdam

MSc in Physics and Astronomy (Theoretical Physics), cum laude

Amsterdam

2019 – 2021

Thesis: Exploring the Spectral Theory/Topological Strings duality

Advisor: Dr. Marcel Vonk

GPA: 8.7/10

Indian Institute of Technology Madras

B.Tech in Engineering Physics

Chennai

2013 – 2017

Thesis: Real Space Renormalization and Applications to Machine Learning

Advisor: Dr. Ashwin Joy

GPA: 8.29/10

Publications

TopoFisher: Learning Topological Summary Statistics by Maximizing Fisher Information

Matteo Biagetti, Mathieu Carrière, Francesco Conti, Enrico Maria Ferrari, Sven Heydenreich, Karthik Viswanathan

Under review [[paper](#), [code](#)]

A Transformer Architecture Alteration to Incentivise Externalised Reasoning

Elizabeth Pavlova*, Mariia Koroliuk*, Karthik Viswanathan*, Cameron Tice, Edward Young, Puria Radmard

Under review [[paper](#), [code](#)]

Probing Geometry of Next Token Prediction Using Cumulant Expansion of Softmax Entropy

Karthik Viswanathan, Sang Eon Park

ICML 2025: Workshop on High-dimensional Learning Dynamics [[paper](#), [code](#)]

Persistent Topological Features in Large Language Models

Yuri Gardinazzi*, Karthik Viswanathan*, Giada Panerai, Alessio Ansuini, Alberto Cazzaniga, Matteo Biagetti

ICML 2025 (Poster) [[paper](#), [code](#)]

The Geometry of Tokens in Internal Representations of Large Language Models

Karthik Viswanathan, Yuri Gardinazzi, Giada Panerai, Alberto Cazzaniga, Matteo Biagetti

Under review [[paper](#), [code](#)]

Cosmology with persistent homology: A Fisher forecast

Jacky Yip, Matteo Biagetti, Alex Cole, Karthik Viswanathan, Gary Shiu

Journal of Cosmology and Astroparticle Physics (JCAP), Vol. 2024, Issue 09 [[paper](#), [code](#)]

Academic Activities

ML Alignment & Theory Scholars Program (MATS 9.0)

Mentors: Adam Shai & Paul Riechers (Simplex AI Safety)

Do Alignment Pretraining if you want your Linear Probes to Work Better [[poster](#)]

Berkeley

Jan – Mar 2026

Mentorship for Alignment Research Students (MARS 3.0)

Mentors: Puria Radmard, Cameron Tice & Edward Young (Geodesic Research)

Architectures for Increased Externalisation of Reasoning [[blogpost](#), [code](#)]

Cambridge

Jul – Sep 2025

Berkeley Research Academy

Research Mentor

How Many Attention Heads Compute a Boolean Function? A Formally Verified Analysis [[blogpost](#), [code](#)]

Remote

Jun 2026 – present

Workshop: Interpretability in LLMs using Geometric and Statistical methods

Organized by Karthik Viswanathan, Jan Pieter van der Schaar

Amsterdam

May 2025

Reviewer:

- Physical Review Letters
- Principled Design for Trustworthy AI (ICLR 2026 Workshop)
- Mechanistic Interpretability Workshop (ICML 2026 Workshop)

Professional Experience

Goldman Sachs

Surveillance Analyst

Developed ML models for anomaly detection in financial data

Manager: Prof. Howard Karloff

Bangalore

2017 – 2019

Goldman Sachs

Summer Intern

Implemented fast Personalized PageRank in a MapReduce framework

Mentor: Dr. Koushik Balasubramanian

Bangalore

2016

Awards & Distinctions

Sander Bais Prize for Academic Merit

Institute for Theoretical Physics Amsterdam

For exceptional academic performance in the master's program

Amsterdam

2020

Honorable Mention

ACM ICPC World Finals

Represented India in the international collegiate programming contest.

Marrakech

2015

Participant

International Olympiad in Informatics Training Camp

Selected after ranking in top 25 in the Indian National Olympiad in Informatics

Bangalore

2013

Organization & Mentoring

AREA Science Park, Trieste

Master Student Supervisor

2024

Student: Giada Panerai

Thesis: Zig-Zag Persistence in Neural Networks Representations

University of Amsterdam

Master Student Mentor

2023

Student: Sibilla Bouche

Thesis: The persistence of non-Gaussian features: a Neural Ratio Estimation approach

University of Amsterdam

Master Student Supervisor

2023

Student: Sliem el Ela

Thesis: From Primordials to Persistence: A Dual Exploration of Multiparameter Topology and Cosmic Origins

University of Amsterdam

Journal Club Organizer

2022

Cosmology Journal Club

Research Visits

2024: AREA Science Park, Trieste, Italy

September 16 – October 4

2024: AREA Science Park, Trieste, Italy

February 15 – April 27

Technical Skills

Programming: PyTorch, TensorFlow, Hadoop, MapReduce, Mathematica

HPC Resources: LUMI consortium, Snellius supercomputer

Teaching

University of Amsterdam

Teaching Assistant

MSc Physics Program

2020 – 2024

Courses: Topological Data Analysis: a Physics Perspective, Advanced Cosmology, ML for Physics and Astronomy, QFT in Curved Spacetimes, General Relativity

References

Dr. Matteo Biagetti

AREA Science Park, Trieste

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Dr. Alberto Cazzaniga

AREA Science Park, Trieste

alberto.cazzaniga@areasciencepark.it

Dr. Jan Pieter van der Schaar

University of Amsterdam

j.p.vanderschaar@uva.nl

Hannes Whittingham

Meridian Cambridge

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