

Elchanan Solomon

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I am a mathematician working in applied topology and geometry. I'm interested in stability and inverse properties of topological transforms, connections between applied topology and metric geometry, optimization and learning with topological invariants, and their applications to data science and machine learning.

CURRENT POSITION

Duke University

Phillip Griffiths Assistant Research Professor in Mathematics

Durham, NC

2019-2022

EDUCATION

Brown University

Ph.D. in Mathematics

Providence, RI

2013-2019

UCLA

B.S. and M.A. in Mathematics, Regents Scholar

Los Angeles, CA

2010-2013

PUBLICATIONS & PREPRINTS

Improving Metric Dimensionality Reduction with Distributed Topology

(joint with Alex Wagner and Paul Bendich), arXiv:2106.07613

2021

From Geometry to Topology: Inverse Theorems for Distributed Persistence

(joint with Alex Wagner and Paul Bendich), arXiv:2101.12288

2021

A Fast and Robust Method for Global Topological Functional Optimization

(joint with Alex Wagner and Paul Bendich), AISTATS 2021: 109-117

2021

Geometric Fusion via Joint Delay Embeddings

(joint with Paul Bendich), FUSION 2020:1-8

2020

- Won 2nd runner up in the general category of the Fusion 2020 Best Paper Award.

Intrinsic Topological Transforms via the Distance Kernel Embedding

(joint with Clément Maria and Steve Oudot), SoCG 2020: 56:1-56:15

2019

Inverse Problems in Topological Persistence

(joint with Steve Oudot), Abel Symposia, Springer, 2020

2018

Barcode Embeddings for Metric Graphs

(joint with Steve Oudot), Algebraic & Geometric Topology

2017

Relaxing the Integral Test: A Challenge for the Advanced Calculus Student

(joint with Paul Carter), College Mathematics Journal.

2017

PUBLICLY AVAILABLE CODE

Code for implementing the DIPOLE dimensionality reduction algorithm

Based on the paper *Improving Metric Dimensionality Reduction with Distributed Topology*.

2021

Code for implementing topological optimization via STUMP algorithm

Based on the paper *A Fast and Robust Method for Global Topological Functional Optimization*.

2020

Code for implementing joint delay embeddings

Based on the paper *Geometric Fusion via Joint Delay Embeddings*.

2020

Demo code for smooth Euler Characteristic Transform

Written for *TRIPODS Summer Bootcamp on Topology and Machine Learning*.

2018

SELECTED TALKS & PRESENTATIONS

Special Session on Statistics and Machine Learning using Topology and Geometry Joint Math Meetings (JMM), Seattle	2022
Topological Data Analysis Workshop Institute for Mathematical and Statistical Innovation (IMSI), Online	2021
AISTATS: Artificial Intelligence and Statistics Online	2021
Applied Topology in Albany Seminar Online	2021
Symposium on Computational Geometry (SOCG) Online	2020
23rd International Conference on Information Fusion Online	2020

CONFERENCES AND SEMINARS ORGANIZED

Applied Algebraic Topology Research Network (AATRn) (co-organizer with Henry Adams, Sara Kališnik, Teresa Heiss, and Hana Dal Poz Kouřimská)	2020-
Brown Applied Topology and Geometry Seminar (co-organized with Melissa McGuirl)	2018-2019
TRIPODS Summer Bootcamp: Topology and Machine Learning (ICERM) (on the organizing committee)	2018

TEACHING

Duke: Math 466 (Math of Machine Learning), Math 216 (Linear Algebra and Differential Equations).
Duke Kunshan University: Stats 302 (Principles of Machine Learning), Math 202 (Linear Algebra).
ICERM: TA for Summer@ICERM REU in Applied Topology.
Brown: Math 1620 (Mathematical Statistics and Data Science), Math 200 (Multivariable Calculus), DATA 1010 TA (Data Science Probability and Statistics), Math 520 (Linear Algebra), Summer@Brown Combinatorics TA, Math 202 (Linear Algebra), Math 90 TA (Calculus), Math 2410 TA (Algebraic Topology).
UCLA: Docent at UCLA Math Circle.

MENTORING

Duke: Capstone Project Manager for Duke Masters in Data Science (MIDS).
Brown: Mentor for two students in the Directed Reading Program (Algebraic Topology, Differential Topology). Sponsor for Undergraduate Independent Study in Model Theory.

SKILLS

Coding: Python (including numpy, scipy, matplotlib, pandas, tensorflow, gudhi) and L^AT_EX. Past experience with C++, Java, and MATLAB.
Languages: English (native), Hebrew (fluent), Spanish (proficient), Catalan (proficient), French (intermediate), Yiddish (intermediate), Mandarin (intermediate), Russian (elementary).