

Darrick Lee

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Education

- current **Ph.D.** Applied Mathematics and Computational Sciences, University of Pennsylvania
Advisor: Prof. Rob Ghrist
Expected Completion: May 2021
- 2018 **M.A.** Applied Mathematics and Computational Sciences, University of Pennsylvania
- 2016 **B.A.Sc.** Engineering Physics (Electrical Option), University of British Columbia
Minor: Honors Mathematics

Research Interests

applied algebraic topology, path signatures, time series analysis, machine learning

Publications and Preprints

5. **D. Lee**, R. Ghrist, *Path signatures on Lie groups*, (arXiv:2007.06633) (submitted)
4. C. Giusti, **D. Lee**, *Iterated integrals and population time series analysis*, Proceedings of the Abel Symposium, 2020. (arXiv:1811.03558)
3. D. Bhaskar, **D. Lee**, H. Knútsdóttir, C. Tan, M. Zhang, P. Dean, C. Roskelley, L. Edelstein-Keshet, *A methodology for morphological feature extraction and unsupervised cell classification*. (biorXiv:623793v1) (under review)
2. **D. Lee** and A. Schnyder, *Structure of vortex-bound states in spin-singlet chiral superconductors*, Physical Review B. 93: 064522 (arXiv:1508.05331)
1. R. Froese, **D. Lee**, C. Sadel, W. Spitzer and G. Stolz, *Localization for transversally periodic random potentials on binary trees*, Journal of Spectral Theory. 6: 557-600 (arXiv:1408.3961)

Awards and Honors

- 2018 - 2021 NSERC Postgraduate Scholarship - Doctoral (PGS-D3)
- 2018 Good Teaching Award, Department of Mathematics, University of Pennsylvania
- 2016 - 2021 Benjamin Franklin Fellowship, University of Pennsylvania
- 2016 - 2017 Fulbright Canada Student Award
- 2014, 2015 NSERC Undergraduate Research Award

Research Visits

- May-Jul 2020 Research Visitor at University of Oxford (under Prof. Vidit Nanda)
Cancelled due to COVID-19: Began research collaboration online with Profs. Vidit Nanda and Harald Oberhauser at Oxford and Prof. Chad Giusti at the University of Delaware (Mar 2020 - present)

Talks

- Sept 2020 Path Signatures on Lie Groups (invited, online)
Geometry and Topology Seminar, North Carolina State University
- Jan 2020 Path Signatures and Kernel Methods (invited)
UF Topological Data Analysis Conference, University of Florida
- Nov 2019 Iterated Integrals and Time-Varying Persistence Diagrams (invited)
Applied Topology Seminar, University at Albany SUNY
- Nov 2019 Iterated Integrals and Time-Varying Persistence Diagrams (invited)
Data Science and Applied Topology Seminar, CUNY Graduate Center
- Nov 2019 Cohomology and Paradox
Mathematics Graduate Student Seminar, University of Pennsylvania
- July 2019 Iterated Integrals and Time Series Analysis
Young Topologists' Meeting, EPFL
- May 2019 Iterated Integrals and Time Series Analysis
Midwest Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning, Ohio State University
- Oct 2018 Path Signatures and Topological Time Series Analysis (invited)
Topology and Biology Symposium, University of Pennsylvania
- Apr 2018 Higher Categories
Mathematics Graduate Student Seminar, University of Pennsylvania
- Oct 2017 Topological Limitations of Single-Layer Perceptron Networks
Mathematics Graduate Student Seminar, University of Pennsylvania
- May 2015 Vortex Bound States in Chiral d-wave Superconductors
XVI Meeting of the NW Section of the American Physical Society, Washington State University

Posters

- Aug 2020 Path Signatures on Lie Groups
Geometry of curves in time series and shape analysis, MPI for Mathematics in the Sciences, Leipzig, Germany (online due to COVID-19)
- Dec 2018 Path Signatures and Topological Time Series Analysis
Canadian Mathematics Society Winter Meeting, Vancouver, BC
- Aug 2017 Clique Topology of the Stochastic Block Model
Applied Algebraic Topology 2017, Sapporo, Japan
- Jun 2016 Understanding Collective Cell Migration
Frontiers in Biophysics 2016, Simon Fraser University

Conferences Upcoming/Attended

- July 2019 Young Topologists' Meeting, *Lausanne, Switzerland*
- July 2019 SIAM Conference on Applied Algebraic Geometry, *Bern, Switzerland*
- May 2019 Midwest Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning, *Columbus, OH*
- May 2019 Structure in the Micro-world, *Columbus, OH*
- Jan 2019 Joint Math Meetings, *Baltimore, MD*
- Dec 2018 Canadian Mathematics Society Winter Meeting, *Vancouver, BC*
- Sep 2018 AMS Fall Eastern Sectional Meeting, *Newark, DE*
- Aug 2018 IMA Tutorial on Multiparameter Persistence, *Minneapolis, MN*
- May 2018 IMA Bridging Sheaves and Statistics, *Minneapolis, MN*
- Aug 2017 Applied Algebraic Topology 2017, *Sapporo, Japan*

Teaching Experience

Co-Instructor - University of Pennsylvania

- Aug 2020 Pre-Freshman Program
An intensive 4-week program for incoming freshman at Penn, many from low-income and/or first generation backgrounds. Alternated between teaching two classes: single variable calculus and multivariable calculus. The course was online due to COVID-19.

Teaching Assistant - University of Pennsylvania

- Spring 2018 MATH 241: Calculus IV (Partial Differential Equations)
- Fall 2017 MATH 360: Advanced Calculus (Analysis)

Lab Teaching Assistant - University of British Columbia

- Spring 2016 APSC 101: Introduction to Engineering II
- Fall 2015 APSC 100: Introduction to Engineering I

Grader - University of British Columbia

- Fall 2015 MATH 102: Differential Calculus with Applications to Life Sciences
- Spring 2015 MATH 103: Integral Calculus with Applications to Life Sciences
- Spring 2014 MATH 101: Integral Calculus with Applications to Engineering
- Summer 2013 MATH 220: Introduction to Mathematical Proof
- Fall 2012 MATH 307: Applied Linear Algebra

Employment

- 05-08/2016 USRA Student, University of British Columbia Math Department (Vancouver, BC)
- 05-08/2015 USRA Student, Université du Québec à Montréal Math Department (Montreal, QC)
- 05-12/2014 Research Intern, Max Planck Institute for Solid State Physics (Stuttgart, Germany)
- 01-04/2013 Modeling and Simulations Intern, Robert Bosch GmbH (Stuttgart, Germany)

Academic Activities

Undergraduate Mentorship

- Fall 2020 Directed Reading Program: Causal Inference in Machine Learning (Sam Rosenberg)
- Summer 2020 Independent Study: Stochastic Calculus (Sam Rosenberg)
- Spring 2020 Directed Reading Program: Time Series Analysis (Sam Rosenberg)

Seminar Organization

- 2020-present Organizer: Graduate Student Applied Topology Seminar
- Spring 2019 Co-organizer: Simplicial Homotopy Theory Seminar
- 2017 - 2018 Organizer: Graduate Student Applied Topology Seminar

Outreach and Service

- 2018-present Master TA, University of Pennsylvania
Helped train, observe and select teaching assistants for the department of mathematics
- 2018, 2019 Volunteer, University of Pennsylvania Math Festival
Built and presented topology demonstrations (configurations of linkages of different dimensions)
- Summer 2017 Summer Discovery Camp Volunteer, Franklin Institute Science Museum
Planned and presented 7 science activities for summer campers entering grades 7-9