

RESEARCH INTERESTS

Data Science Theory and Methods: statistical signal processing, machine learning on high-dimensional data with structures (graphs, low-dimensional manifolds, sparsity), non-convex optimization, multi-task learning

Applications: health informatics, biomedical signal processing, health disparity, science of science, civic data

CURRENT ACADEMIC POSITION

University of California, Los Angeles

Los Angeles, CA

Hedrick Assistant Adjunct Professor, Department of Mathematics

July 2021 – June 2024

- Faculty mentors: Andrea L Bertozzi, Jacob G Foster, Stan J Osher
- Combined network analysis and natural language processing to bring together traditionally disjointed scientific fields in diverse intelligence [C3, W1, J4, P2].
- Developed deep learning models for large-scale biomedical time series data: EEG [W2] and non-semantic speech signal including coughing [P1, P3].
- Solving non-convex optimization problems for data with structures and constraints, such as Stiefel manifolds [M1] and probability distributions [M2].

EDUCATION

Carnegie Mellon University

Pittsburgh, PA

PhD in Electrical and Computer Engineering

Aug. 2017 – June 2021

- **Thesis:** “Better Inference with Graph Regularization”
- Committee: Yuejie Chi (advisor), Jelena Kovačević (co-advisor), José MF Moura, Andrea L Bertozzi
- Applied graph regularization to trend filtering [J1, C1], matrix factorization [J2, C2], and federated multi-task learning [C4, M3] for more accurate and faster inference on graph-structured data.
- Collected and analyzed a large pediatric clinical sleep studies dataset [J3] with Nationwide Children’s Hospital.

MS in Machine Learning

Aug. 2020 – June 2021

- GPA: 3.9/4.0

Massachusetts Institute of Technology

Cambridge, MA

MEng in Electrical Engineering and Computer Science, concentration in AI

June 2016 – June 2017

- **Thesis:** “Building Improved Risk Stratification Models for Patients Post Non ST-Segment Elevation Acute Coronary Syndrome Using Ambulatory ECG Data”
- Advisor: Collin M Stultz
- GPA: 5.0/5.0

BS in Electrical Engineering and Computer Science, minor in Math

Aug. 2012 – June 2016

- GPA: 4.8/5.0

HONORS AND AWARDS

UChicago Rising Stars in Data Science

2022

UCLA Institute for Digital Research and Education (IDRE) Postdoctoral Fellowship (\$5000)

2022-2023

AMS-Simons Travel Grant (\$5000)

2022-2024

Rising Stars in Computational and Data Sciences (UT Austin, SNL, LLNL)	2022
IEEE BigData Cup Challenges IARAI Science4cast Special Prize (€2000)	2021
CMU ECE Outstanding Woman in Engineering Award	2021
CRA-WP Grad Cohort for Women	2021
CMU ECE Outstanding Teaching Assistant Award	2020
CMU David H. Barakat and LaVerne Owen-Barakat CIT Dean’s Fellowship	2020
CMU Carolyn Comer Graduate Student Involvement Awards	2020
Best Poster Prize at February Fourier Talks	2019
CMU CIT Dean’s Fellowship	2017-2018
MIT SuperUROP (Advanced Undergrad Research Opportunities Program) Angle EECS scholar	2015-2016
2nd Prize at MIT Assistive Technology Hackathon	2015
2nd Prize at MIT IAP Web Programming Competition, Rookie Division (\$1000)	2013
Early Cum Laude at Phillips Exeter Academy (top 5% of graduating class)	2012

Travel Awards

AMS MRC Funding for Joint Mathematics Meeting (JMM)	2023
AMS MRC Collaboration Travel Grant	2022
SIAM Early Career Travel Award for SIAM Math for Data Science	2022
Travel Award for IEEE BigData through IARAI	2021
Travel Award for NeurIPS through AI for Science: Mind the Gaps workshop	2021
IEEE SPS Professional Development grant for IEEE SPS ICASSP PROGRESS workshop	2021
Travel Support for CRA-WP Grad Cohort for Women	2021
CMU GSA/Provost Office Conference Funding for SIAM Math for Data Science	2020
Travel Support for SIAM TX-LA 2nd Annual Meeting	2019
CMU ECE Department Travel Support for Grace Hopper Celebration (GHC)	2019
Travel Support for Women in Data Science and Mathematics (WiSDM)	2019
CMU GSA/Provost Office Conference Funding for ICASSP	2019

PREVIOUS EXPERIENCES

Graduate Researcher, Yuejie Chi Group, CMU ECE	June 2018 – June 2021
Graduate Researcher, Jelena Kovačević Group, CMU ECE	Oct. 2017 – June 2021
Research Assistant, Computational Cardiovascular Research Group, MIT RLE/IMES	Sept. 2015 – June 2017
Software Engineer Intern, SPARCS Servers Team, Oracle America, Inc.	Summer 2015
Software Engineering Intern, DevTools Team, Medidata Solutions	Summer 2014
Undergraduate Researcher, Affective Computing Group, MIT Media Lab	Jan. – May 2014
Research Intern, Brain Science Institute, Korea Institute of Science and Technology	Summer 2012

PUBLICATIONS

Google scholar: <https://scholar.google.com/citations?user=AJhx0YgAAAAJ&hl=en>
 (* = equal contribution, † = alphabetical ordering)

Journal Articles

- J4. L Cheng, JG Foster and H Lee, “[A Simple, Interpretable Method to Identify Surprising Topic Shifts in Scientific Fields](#),” in *Frontiers in Research Metrics and Analytics*, 7:1001754, 2022. [Undergrad Honor’s Thesis Mentor]

- J3. **H Lee**, B Li, S DeForte, ML Splaingard, Y Huang, Y Chi and SL Linwood. “[A Large Collection of Real-world Pediatric Sleep Studies](#),” in Nature Scientific Data, vol. 9, no. 1, pp. 421, 2022.
- J2. J Qin, **H Lee**, JT Chi, L Drumetz, J Chanussot, Y Lou and AL Bertozzi, “[Blind Hyperspectral Unmixing Based on Graph Total Variation Regularization](#),” in IEEE Transactions on Geoscience and Remote Sensing, vol. 59, no. 4, pp. 3338-3351, 2021.
- J1. R Varma*, **H Lee***, J Kovačević and Y Chi, “[Vector-Valued Graph Trend Filtering With Non-Convex Penalties](#),” in IEEE Transactions on Signal and Information Processing over Networks, vol. 6, pp. 48-62, 2020.

Conference Proceedings

- C4. **H Lee**, AL Bertozzi, J Kovačević and Y Chi, “[Privacy-Preserving Federated Multi-Task Linear Regression: A One-Shot Linear Mixing Approach Inspired by Graph Regularization](#),” in 2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 5947-5951, 2022.
- C3. **H Lee**, R Sonthalia and JG Foster, “[Dynamic Embedding-based Methods for Link Prediction in Machine Learning Semantic Network](#)”, 2021 IEEE International Conference on Big Data (Big Data), pp. 5801-5808, 2021.
- C2. J Qin, **H Lee**, JT Chi, J Chanussot, Y Lou and AL Bertozzi, “[Fast Blind Hyperspectral Unmixing based on Graph Laplacian](#),” The 10th Workshop on Hyperspectral Image and Signal Processing (WHISPERS), pp. 1-5, 2019.
- C1. R Varma*, **H Lee***, Y Chi and J Kovačević, “[Improving Graph Trend Filtering with Non-Convex Penalties](#),” in 2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 5391-5395, 2019.

Peer-Reviewed Workshop Papers

- W2. **H Lee** and A Saeed, “[Automatic Sleep Scoring from Large-scale Multi-channel Pediatric EEG](#),” Workshop on Learning from Time Series for Health, NeurIPS, 2022.
- W1. L Cheng*, G Ganesan*, W He*, D Silverston*, **H Lee** and JG Foster, “[Joint Content-Context Analysis of Scientific Publications: Identifying Opportunities for Collaboration in Cognitive Science](#),” AI for Science: Mind the Gaps, NeurIPS, 2021. [[REU Mentor](#)]

Preprints under Review

- P3. **H Lee**, A Saeed and AL Bertozzi, “[Active Learning of Non-semantic Speech Tasks with Pretrained Models](#),” 2022.
- P2. M Krenn [and 15 others, including **H Lee**[†]], “[Predicting the Future of AI with AI: High-Quality Link Prediction in an Exponentially Growing Knowledge Network](#),” 2022.
- P1. **H Lee** and A Saeed, “[Distilled Non-Semantic Speech Embeddings with Binary Neural Networks for Low-Resource Devices](#),” 2022.

Manuscripts in Preparation

- M4. RAC Edmonds[†], S Glenn[†], **H Lee**[†] and S Villar[†], “Power Analysis of a Statistical Test to Quantify Gerrymandering.”

- M3. **H Lee**, AL Bertozzi, J Kovačević and Y Chi, “Graph Regularization for Privacy-Preserving Multi-Task Learning.”
- M2. K Craig[†], K Elamvazhuthi[†] and **H Lee**[†], “Blob Method for Optimal Transport.”
- M1. A Lee[†], **H Lee**[†], J Perea[†], N Schonsheck[†] and M Weinstein[†], “Equivariant Dimensionality Reduction in Stiefel Manifolds.”

TEACHING

UCLA Math/Programming in Computing

PIC 16B Python with Applications II, Instructor of Record Winter 2023, Spring 2022
 PIC 16A Python with Applications I, Instructor of Record Fall 2022, Winter 2022

CMU ECE

18-202 Mathematical Foundations of Electrical Engineering, Grad TA Spring 2020, Spring 2019

MIT EECS

6.0001 Introduction to Computer Science Programming in Python, Grad TA Fall 2016
 6.0002 Introduction to Computational Thinking and Data Science, Grad TA Fall 2016
 6.042 Mathematics for Computer Science, Undergrad TA Fall 2015
 6.03 Introduction to EECS via Medical Technology, Lab Assistant Spring 2015
 6.149 Introduction to Programming Using Python, Lab Assistant Winter 2015
 6.006 Introduction to Algorithms, Grader Spring 2014

MIT China Educational Technology Initiative

Taught math, biology, Python and English at universities in China and Taiwan Summer 2013

PRESENTATIONS, TALKS, AND LECTURES

Learning on graphs and networks

Electrical and Computer Engineering Colloquium, University of Delaware, January 2023. [[Invited](#)]
 Computer Science and Engineering Colloquium, University of South Florida, January 2023. [[Invited](#)]
 Mathematics Colloquium, Emory University, January 2023. [[Invited](#)]
 Electrical Engineering Colloquium, Colorado School of Mines, January 2023. [[Invited](#)]
 Computer Science Colloquium, Wesleyan University, December 2022. [[Invited](#)]

Quantifying the stability of gerrymandering (with Ranthony Edmonds, Susan Glenn, Soledad Villar)

Tree seminar (Moon Duchin group meeting), virtual, October 2022.

Understanding scientific fields with network analysis and topic modeling

UCLA IDRE Early Career Researchers (ECR) Group, virtual, November 2022. [[Invited](#)]
 UChicago Rising Stars in Data Science, University of Chicago, November 2022. [[Invited](#)]
 Claremont Center for the Mathematical Sciences Applied Math Seminar, virtual, October 2022. [[Invited](#)]

Branching process model for female gender representation in the Mathematics Genealogy Project

NAM-SIAM Minisymposium on Quantitative Justice in JMM, Boston MA, January 2023. [[Invited](#)]

Behind the scenes: NCH Sleep DataBank

NSRR: Unlocking the Power of Sleep Data webinar, virtual, September 2022. [Invited]

Dynamic embedding-based methods for link prediction in machine learning semantic network
IAS 2022 WAM program: Mathematics in Machine Learning, virtual, May 2022. [Invited]
IEEE BigData, virtual, December 2021. [Invited]

Missed opportunities for collaboration in cognitive science (with Lu Cheng, Girish Ganesan, Will He, Danny Silverston)

CogSci 2022, Toronto Canada, July 2021.

AI for Science: Mind the Gaps workshop in NeurIPS, virtual, December 2021. (Poster)

Topics from spectral graph theory

Lecture at Rutgers Undergraduate Math Association, virtual, September 2021. [Invited]

A graph regularization inspired approach to distributed multitask learning

SIAM Conference on Mathematics of Data Science, San Diego CA, September 2022. [Invited]

ICASSP, virtual, May 2022. (Poster)

Rising Stars in Computational and Data Sciences, Albuquerque NM, April 2022. [Invited]

Women in Machine Learning (WiML) workshop in NeurIPS, virtual, December 2021. (Poster)

Joint Affinity workshop in NeurIPS, virtual, December 2021. (Poster)

Institute for Mathematics and its Applications (IMA) workshop on Theory and Algorithms in Graph-based Learning, virtual, September 2020. (Poster)

Fast blind hyperspectral unmixing with graph regularization

SIAM Conference on Imaging Science, virtual, July 2020. [Invited]

Vector-valued graph trend filtering with nonconvex penalties

SIAM Conference on Mathematics of Data Science, canceled due to COVID-19 pandemic.

SIAM TX-LA 2nd Annual Meeting at Southern Methodist University, November 2019. [Invited]

Graph Signal Processing Workshop at University of Minnesota, June 2019.

ICASSP at Brighton UK, May 2019. (Poster)

February Fourier Talks at University of Maryland, College Park, February 2019. (Poster)

WORKSHOP ATTENDANCE

Research Collaboration Workshop, “Women in Data Science and Mathematics” at IPAM UCLA, August 2023.

Project: Active learning with graphs (**Research group co-leader** with AL Bertozzi)

Data Science and Social Justice: Networks, Policy, and Education at ICERM, June 2022.

Project: Network science and geospatial analysis for health disparity

Project: Branching process model for math genealogy

AMS MRC: Data Science at the Crossroads of Analysis, Geometry, and Topology at Java Center, NY, May 2022.

Project: Dimensionality reduction in Stiefel manifolds

Project: Stability of gerrymandered maps

CEILS STEM Education Research Journal Club at UCLA, Fall 2021.

CEILS Annual Faculty Workshop on Best Equitable Practices in Teaching at UCLA, Sept. 2021.

IEEE SPS PROGRESS Workshop at ICASSP 2021, virtual, June 2021.

Joint Mathematics Meetings (JMM), virtual, January 2021.

AMS Short Course on Mathematical and Computational Methods for Complex Social Systems.

Machine Learning for Healthcare, virtual, August 2020.

Grace Hopper Celebration (GHC) in Orlando, FL, October 2019.
 Women in Data Science and Mathematics (WiSDM) at ICERM, July 2019.
 Project: Graph regularization of high dimensional data.
 Women in Data Science (WiDS) Conference at CMU, March 2018.
 Medical Electronic Device Realization Center (MEDRC) Workshop at MIT, May 2017.

SERVICE

UCLA Women in Math (WIM) Undergraduate Mentorship Program	2021 – 2022
CMU EIS Seminar Committee	2019
MIT IEEE/ACM Student Chapter Board	2013 – 2016

Organizer

JMM AMS Special Session on “Data Science at the Crossroads of Analysis, Geometry, and Topology”	2023
SIAM MDS Minisymposium “Optimal Transport for Data Science”	2022

Session chair for Mathematics of Collective Intelligence Workshop at IPAM UCLA 2022

Reviewer for SIAM J. on Mathematics of Data Science (SIMODS), IEEE Trans. on Signal Processing (T-SP), IEEE Trans. on Signal and Information Processing over Networks (T-SIPN), IEEE Trans. on Information Theory (T-IT), IEEE Trans. on Pattern Analysis and Machine Intelligence (T-PAMI), IEEE Signal Processing Letters (SPL), IEEE Workshop on Machine Learning for Signal Processing (MLSP), ICML (2021), NeurIPS (2021, 2022), ICLR (2022, 2023), ICASSP (2023).

Memberships IEEE (SPS), SIAM (Data Science), ACM, AMS.

Research Mentorship

California Health Survey Analysis

Ryan Voda (UCLA Math BS, Spring 2022)

Samantha Wong (UCLA Cogsci BS, Spring 2022)

Predicting the Future of Machine Learning Topics

Joanne Qiu (UCLA Math BS, Spring 2022)

Genesis and Evolution of Scientific Fields (UCLA CAM REU)

Lu Cheng (UCLA Math/Stats BS Honors, Summer 2021 – Spring 2022)

Girish Ganesan (Rutgers CS/Math BS, Summer 2021)

William He (Northwestern Math BS, Summer 2021)

Daniel Silverston (Brown Math BS, Summer 2021)

Automatic Sleep Stage Classification from EEG

Peike Li (UCLA Cogsci BS, Spring 2022)

Yuanting Pan (UCLA Physics BS, Winter 2022 – Present)

Lei Xu (UCLA Math/Econ BS, Winter 2022 – Spring 2022)

Yiluo Qin (CMU ECE MS, Summer 2021)

Rama Mannava (CMU ECE BS, Fall 2019 – Spring 2020)

Jacob Hoffman (CMU ECE BS, Spring 2020)