

# UTHSAV CHITRA

Eric and Wendy Schmidt Center, Broad Institute of MIT and Harvard

<https://uthsavc.github.io>

## EDUCATION/ACADEMIC TRAINING

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### Broad Institute of MIT and Harvard

July 2024 - present

Postdoctoral fellow, Eric and Wendy Schmidt Center

### Princeton University, Princeton, New Jersey

Sept 2018 - May 2024

Ph.D., Computer Science

### Brown University, Providence, Rhode Island

Sept 2013 - May 2017

Sc.B. Mathematics, A.B. Computer Science, A.B. Applied Math

GPA: 4.0/4.0

## RESEARCH INTERESTS

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Computational genomics, machine learning, spatial biology, graphs and networks, genetic interactions.

## PUBLICATIONS

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\* denotes joint first authorship, † denotes joint corresponding authorship.

### Decoding the causal drivers of spatial cellular topology.

Prannav Shankar, Huan Liang, **Uthsav Chitra**<sup>†</sup>, Rohit Singh<sup>†</sup>.

In review at *RECOMB-seq 2025*.

### Anomaly Detection in Spatial Transcriptomics via Spatially Localized Density Comparison.

Gary Hu, Julian Gold, **Uthsav Chitra**, Sunay Joshi, Benjamin J. Raphael.

Accepted to *ISMB 2025*.

### GASTON-Mix: a unified model of spatial gradients and domains using spatial mixture-of-experts.

**Uthsav Chitra**, Shu Dan, Fenna Krienen, Benjamin J. Raphael.

Accepted to *ISMB 2025*.

### Spatial metabolic gradients in the liver and small intestine.

Laith Samarah, Clover Zheng, Xi Xing, Won Dong Lee, Amichay Afriat, **Uthsav Chitra**, Michael MacArthur, Wenyun Lu, Connor Jankowski, Cong Ma, Craig Hunter, Benjamin J. Raphael, Joshua Rabinowitz.

In review at *Nature*.

### Mapping the topography of spatial gene expression with interpretable deep learning.

**Uthsav Chitra**, Brian J. Arnold, Hirak Sarkar, Cong Ma, Sereno Lopez-Darwin, Kohei Sanno, Benjamin J. Raphael.

*Nature Methods* (2025). Accepted to *RECOMB 2024*.

### Resolving discrepancies between chimeric and multiplicative measures of higher-order epistasis.

**Uthsav Chitra**<sup>\*</sup>, Brian J. Arnold<sup>\*</sup>, Benjamin J. Raphael.

*Nature Communications* (2025).

### A latent variable model for evaluating mutual exclusivity between driver mutations in cancer.

Ahmed Shuaibi<sup>\*</sup>, **Uthsav Chitra**<sup>\*</sup>, Benjamin J. Raphael.

*RECOMB Satellite Workshop on Computational Cancer Biology (RECOMB-CCB)*, 2024. **Best Paper Award**.

### A count-based model for delineating cell-cell interactions in spatial transcriptomics data.

Hirak Sarkar<sup>\*</sup>, **Uthsav Chitra**<sup>\*</sup>, Julian Gold, Benjamin J. Raphael.

*Bioinformatics* (2024). Accepted to *ISMB 2024*.

### Belayer: Modeling discrete and continuous spatial variation in gene expression from spatially resolved transcriptomics.

Cong Ma<sup>\*</sup>, **Uthsav Chitra**<sup>\*</sup>, Shirley Zhang, Benjamin J. Raphael.

*Cell Systems* (2022). Accepted to *RECOMB 2022*.

**NetMix2: Unifying network propagation and altered subnetworks.**

**Uthsav Chitra\***, Tae Yoon Park\*, Benjamin J. Raphael.

*Journal of Computational Biology* (2022). Accepted to *RECOMB 2022*.

**Quantifying and Reducing Bias in Maximum Likelihood Estimation of Structured Anomalies.**

**Uthsav Chitra**, Kimberly Ding, Jasper C. H. Lee, Benjamin J. Raphael.

*International Conference on Machine Learning (ICML) 2021*.

**NetMix: A network-structured mixture model for reduced-bias estimation of altered subnetworks.**

Matthew A Reyna\*, **Uthsav Chitra\***, Rebecca Elyanow, Benjamin J. Raphael.

*Journal of Computational Biology* (2021). Accepted to *RECOMB 2020*.

**Analyzing the Impact of Filter Bubbles on Social Network Polarization.**

**Uthsav Chitra** and Christopher Musco.

*ACM International Web Search and Data Mining Conference (WSDM) 2020*.

Also appeared at KDD WISDOM 2019 workshop.

**Random Walks on Hypergraphs with Edge-Dependent Vertex Weights.**

**Uthsav Chitra** and Benjamin J. Raphael.

*International Conference on Machine Learning (ICML) 2019*.

**Committee Selection is More Similar Than You Think: Evidence from Avalanche and Stellar.**

Tarun Chitra and **Uthsav Chitra**.

*Manuscript, 2019*.

## HONORS AND AWARDS

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**Rising Stars in Data Science**, UChicago/UC San Diego/Stanford Data Science Institutes 2024

**Best Paper Award**, RECOMB Satellite Workshop on Computational Cancer Biology 2024

**Siebel Scholarship** 2022

- Award of \$35,000 given annually to 85 top graduate students worldwide in computer science, bioengineering, and business.

**Best Reviewer Award**, International Conference on Machine Learning (ICML) 2021, 2022

**NSF Graduate Research Fellowship** 2020

**Jerome Stein Memorial Award**, Brown University Applied Math Department 2017

- Given to the top two students who “show outstanding potential in an interdisciplinary area that involves applied mathematics.”

**Phi Beta Kappa**, Brown University (elected junior year, top 2% of class) 2016

**Top 200**, William Lowell Putnam Math Competition 2015

**First Place**, Brown University Hartshorn-Hypatia Math Examination 2013

**Semi-finalist**, Siemens Competition (research project in number theory) 2012

**USA Junior Math Olympiad Qualifier** 2011

## TEACHING

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**Instructor/Curriculum Developer**, Princeton Prison Teaching Initiative 2019-2023

- Taught college-accredited math classes at NJ state prisons.
- Developed and taught first-ever Java programming course for NJ state prisons.

**Teaching Assistant/Grader**, Brown University

- **MATH 1560**: Number Theory *Spring 2016, Spring 2017*
- **CSCI 1570**: Design and Analysis of Algorithms *Fall 2015, Fall 2016*
- **CSCI 1450**: Probability in Computing *Spring 2015*
- **CSCI 0530**: Linear Algebra for CS *Fall 2014*
- **MATH 1530**: Abstract Algebra *Spring 2014*

- Counselor**, Program in Mathematics for Young Scientists (PROMYS) *Summer 2014*
- Guided students through daily number theory problem sets, mentored a group project, and aided seminars in abstract algebra.
- Teaching Assistant**, Art of Problem Solving *2012-2016*
- Assisted online, real-time math classes in algebra, number theory, combinatorics, and geometry.

## TALKS

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- Machine learning for spatial and network biology** *November 2024*
- Rising Stars in Data Science, UC San Diego
- Modeling spatial gene expression with complex analysis and deep learning** *November 2024*
- Computational and Systems Biology (CSB) seminar, MIT
- Mapping the topography of spatial gene expression with interpretable deep learning.** *March 2025*
- Models, Inference, & Algorithms seminar, Broad Institute
- Conference on Research in Computational Molecular Biology (RECOMB) *May 2024*
- Single Cell Analyses, Cold Spring Harbor Laboratory (poster) *November 2023*
- Rutgers-Princeton Cancer Research Symposium (poster) *October 2023*
- NCI Junior Investigator (JI) Annual Meeting *August 2023*
- Belayer: Modeling discrete and continuous spatial variation in gene expression from spatially resolved transcriptomics**
- Wang Lab Meeting, Broad Institute *July 2023*
- NCI Spring School on Algorithmic Cancer Biology *March 2023*
- Algorithms for understanding the spatial and network organization of biological systems**
- Chen Lab, Broad Institute *July 2024*
- Campbell Lab, UToronto *April 2024*
- Final Public Oral (FPO, i.e. thesis defense), Princeton University *March 2024*
- Knowles/Azizi Lab, Columbia University *September 2023*
- Herbert Irving Comprehensive Cancer Center, Columbia University *September 2023*
- Pe'er Lab, MSKCC *August 2023*
- Modeling spatial variation in gene expression and copy number aberrations**
- Brigham Women's Hospital Advanced Biomedical Computation Series *March 2023*
- Leveraging network and spatial structure to model high-dimensional biological data**
- Sankararaman/Pimentel Labs, UCLA *April 2023*
- Pe'er Lab, Columbia *April 2023*
- Hormoz Lab, DFCI Data Science *February 2022*
- NetMix2: Unifying network propagation and altered subnetworks**
- Conference on Research in Computational Molecular Biology (RECOMB) *May 2022*
- NetMix: A network-structured mixture model for reduced-bias estimation of altered subnetworks**
- Conference on Research in Computational Molecular Biology (RECOMB) *June 2020*
- Algorithms for Analyzing Networks with Vertex Weights**
- Princeton University Generals Exam *May 2020*
- Analyzing the Impact of Filter Bubbles on Social Network Polarization**
- ACM International Web Search and Data Mining Conference (WSDM) *February 2020*
- KDD WISDOM Workshop *August 2019*
- Random Walks on Hypergraphs with Edge-Dependent Vertex Weights**
- SIAM Conference on Discrete Mathematics *June 2022*
- International Conference of Machine Learning (ICML) *June 2019*

## STUDENTS MENTORED

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| Claire Wu, MIT undergraduate   | <i>Fall 2024-present</i>      |
| Tanvi Haldiya, Princeton CS undergraduate  | <i>Fall 2023</i>              |
| Jairam Hathwar, Princeton CS undergraduate   | <i>Fall 2023</i>              |
| Kohei Sanno, Princeton CS undergraduate  | <i>2023-present</i>           |
| Clover Zheng, Princeton CS PhD student   | <i>2022-present</i>           |
| Sunay Joshi, Princeton Math undergraduate  | <i>2022-2024</i>              |
| Ahmed Shuaibi, Princeton QCB PhD student   | <i>2020-present</i>           |
| <ul style="list-style-type: none"><li>• Won <b>Best Paper Award</b> at RECOMB-CCB workshop.</li></ul>  |                               |
| Madelyne Xiao, Princeton CS PhD student  | <i>2022</i>                   |
| Kimberly Ding, Princeton CS undergrad  | <i>2019-2021</i>              |
| <ul style="list-style-type: none"><li>• Fall 2019: <i>Recommender Systems with Hypergraph Random Walks</i></li><li>• Spring 2020: <i>Maximum Likelihood Estimation of Structured Anomalies</i></li><li>• Senior Thesis 2020-2021: <i>Spatial-NetMix: Less Biased and More Flexible Anomaly Detection</i><ul style="list-style-type: none"><li>– Received the “<b>Outstanding Computer Science Senior Thesis Prize</b>”</li></ul></li></ul> |                               |
| Shirley Zhang, Princeton CS undergrad/alumni   | <i>Summer 2020, 2021-2022</i> |
| <ul style="list-style-type: none"><li>• Received an <b>NSF Graduate Research Fellowship</b></li></ul>  |                               |

## SERVICE/OUTREACH

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### Conference Reviewing

*Computational biology*: RECOMB 2020 poster session, RECOMB 2023, ISMB 2023, RECOMB 2024, ISMB 2024

*Machine learning*: ICML 2021 (**Top 10% Reviewer**), NeurIPS 2021, ICML 2022 (**Top 10% Reviewer**), ICML 2023, TMLR, ICML 2024 AccMLBio workshop.

### Program Committee

ISMB 2025.

### Journal Reviewing

Bioinformatics, Bioinformatics Advances, Frontiers in Big Data, Computational and Structural Biotechnology Journal.

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|---|------------------|
| Member, Princeton COS Graduate Student Committee      | <i>2022-2023</i> |
| Member, Princeton Graduate Engineering Council        | <i>2021-2023</i> |
| Member, Princeton COS Ad Hoc Committee                | <i>2021</i>      |
| Officer, Brown Math Departmental Undergraduate Group  | <i>2015-2017</i> |
| Mentor, Brown Matched Advising Program for Sophomores | <i>2016-2017</i> |

## WORK EXPERIENCE

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| <b>Software Engineer</b> , Facebook   | <i>2017-2018</i>   |
| <ul style="list-style-type: none"><li>• Built infrastructure, machine learning models, and data pipelines for improving ad quality.</li></ul> |                    |
| <b>Software Engineering Intern</b> , Facebook   | <i>Summer 2016</i> |
| <ul style="list-style-type: none"><li>• Reduced upload time for video ads by 20%.</li></ul>   |                    |

**Hobbies/interests**: **Bouldering**, biking, crosswords and other puzzles.