

NANCY RUONAN ZHANG

Ge Li and Ning Zhao Professor, Department of Statistics and Data Science

The Wharton School, University of Pennsylvania

Member, Abramson Cancer Center, Perelman School of Medicine, University of Pennsylvania

Member, Center for Cellular Immunotherapies, Perelman School of Medicine, University of Pennsylvania

Member, Graduate Group in Genomics and Computational Biology, University of Pennsylvania

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EMPLOYMENT HISTORY

Post-doctoral Fellow (Mentored by Terence Speed and Mary Wildermuth) Departments of Statistics and Plant Biology, University of California Berkeley	10.2005 - 07.2006
Assistant Professor Department of Statistics, Stanford University	09.2006 - 06.2011
Faculty Member Graduate Group in Genomics and Computational Biology University of Pennsylvania	09.2006 - 06.2011
Associate Professor Department of Statistics, The Wharton School, University of Pennsylvania	07.2011 – 06.2018
Professor Department of Statistics, The Wharton School, University of Pennsylvania	07.2018 - Current
Ge Li and Ning Zhao Professor Department of Statistics, The Wharton School, University of Pennsylvania	07.2019 - Current
Vice Dean Wharton Doctoral Programs, The Wharton School, University of Pennsylvania	07.2019 - Current
Faculty Member Abramson Cancer Center Perelman School of Medicine, University of Pennsylvania	07.2024 - Current

EDUCATION

Stanford University

Bachelor's in Mathematics	06.2001
Master's in Computer Science	06.2001
Doctor of Philosophy in Statistics	06.2005

Dissertation Title: *Change-point models and sequence alignments: Statistical problems of genomics*

CITIZENSHIP

United States

HONORS

National Defense Science and Engineering Graduate Fellowship	2002
New World Silver Medal for Best Doctoral Thesis in the Mathematical Sciences	2007
Stanford University Terman Fellowship	2006
Sloan Fellowship	2011
American Statistical Association Medallion Lectureship	2021
P.R. Krishnaiah Memorial Lectureship	2023

Frontiers of Science Award, International Congress of Basic Science

2024

PUBLICATIONS

PUBLISHED OR FORTHCOMING IN REFEREED JOURNALS

1. **Zhang NR**, Siegmund DO (2007) A modified Bayes information criterion with applications to the analysis of comparative genomic hybridization data, *Biometrics* 63, 22.
2. Chan HP, **Zhang NR** † (2007) Scan statistics with weighted observations, *Journal of the American Statistical Association*, 102, 595.
3. The ENCODE Project Consortium (2007) Identification and analysis of functional elements in 1% of the human genome by the ENCODE pilot project, *Nature* 447, 799.
4. **Zhang NR**, Wildermuth MC, Speed TP (2008) Transcription factor binding site prediction with multivariate gene expression data, *Annals of Applied Statistics* 2, 332.
5. Lai TL, Xing H, **Zhang NR** † (2008) Stochastic segmentation models for array-based comparative genomic hybridization data analysis, *Biostatistics* 9, 290.
6. **Zhang NR**, Senbabaoglu Y, Li J (2010) Joint estimation of DNA copy number from multiple platforms, *Bioinformatics* 26, 153.
7. Siegmund DO, Yakir B, **Zhang NR** † (2010) Tail approximations for maxima of random fields by likelihood ratio transformations, *Sequential Analysis* 29, 245.
8. **Zhang NR**, Siegmund DO, Ji H, Li J (2010) Detecting simultaneous changepoints in multiple sequences, *Biometrika* 97, 631.
9. Li F, **Zhang NR** † (2010) Bayesian variable selection in structured high-dimensional covariate spaces with applications in genomics, *Journal of the American Statistical Association* 105, 1202.
10. Bickel PJ, Boley N, Brown JB, Huang H, **Zhang NR** † (2010) Subsampling methods for genomic inference, *Annals of Applied Statistics* 4, 1660.
11. Chan HP ‡, **Zhang NR** ‡, Chen LHY (2010) Importance sampling of word patterns in DNA and protein sequences, *Journal of Computational Biology* 17, 1697.
12. Chen H, Xing H, **Zhang NR*** (2011) Estimation of parent specific DNA copy number in tumors using high-density genotyping arrays, *PLoS Computational Biology* 7, e1001060.
13. Siegmund DO, Yakir B, **Zhang NR** † (2011) Detecting simultaneous variant intervals in aligned sequences, *Annals of Applied Statistics* 5, 645.
14. Efron B and **Zhang NR** † (2011) False discovery rates and copy number variation, *Biometrika* 98, 251.
15. Natsoulis G, Bell JM, Xu H, Buenrostro JD, Ordonez H, Grimes S, Newburger D, Jensen M, Zahn JM, **Zhang N**, Ji HP (2011) A flexible approach for highly multiplexed candidate gene targeted resequencing, *PLoS One* 6, e21088.
16. Siegmund DO, **Zhang NR**, Yakir B (2011) False discovery rate for scanning statistics, *Biometrika* 98, 979.
17. Muralidharan O, Natsoulis G, Bell J, Newburger D, Xu H, Keta I, Ji H, **Zhang NR*** (2012) A cross-sample statistical model for SNP detection in short-read sequencing data, *Nucleic Acids Research* 40, e5.
18. Flaherty P, Natsoulis G, Muralidharan O, Winters M, Buenrostro J, Bell J, Brown S, Holodniy M, **Zhang N**, Ji HP (2012) Ultrasensitive detection of rare mutations using next-generation targeted resequencing, *Nucleic Acids Research* 40, e2.

* corresponding or co-corresponding author

† alphabetical order

‡ co-first authors

19. Shen J, **Zhang NR*** (2012) Change-point model on nonhomogeneous Poisson processes with application in copy number profiling by next-generation DNA sequencing, *Annals of Applied Statistics* 6, 476.
20. Muralidharan O, Natsoulis G, Bell J, Ji H, **Zhang NR*** (2012) Detecting mutations in mixed sample sequencing data using empirical Bayes, *Annals of Applied Statistics* 6, 1047.
21. **Zhang NR**, Siegmund DO (2012) Model selection for high dimensional, multi-sequence change-point problems, *Statistica Sinica* 22, 1507.
22. Sun Y, **Zhang NR** and Owen A (2012) Multiple hypothesis testing, adjusted for latent variables, with an application to the agemap gene expression data, *Annals of Applied Statistics* 6, 1664.
23. Chen H, **Zhang NR[‡]** (2013) Graph-based tests for two-sample comparisons of categorical data, *Statistica Sinica* 23, 1479.
24. Natsoulis G, **Zhang NR**, Welch K, Bell J, Ji HP (2013) Identification of insertion deletion mutations from deep targeted resequencing, *Journal of Data Mining in Genomics and Proteomics* 4, 132.
25. Nadauld LD, Garcia S, Natsoulis G, Bell JM, Miotke L, Hopmans ES, Xu H, Pai RK, Palm C, Regan JF, Chen H, Flaherty P, Ootani A, **Zhang NR**, Ford JM, Kuo CJ, Ji HP (2014) Metastatic tumor evolution and organoid modeling implicate TGFBR2 as a cancer driver in diffuse gastric cancer, *Genome Biology* 15,428.
26. Chen H, Bell JM, Zavala NA, Ji HP, **Zhang NR*** (2015) Allele-specific copy number profiling by next-generation DNA sequencing, *Nucleic Acids Research* 43, e23.
27. Jiang Y, Oldridge DA, Diskin SJ, **Zhang NR*** (2015) CODEX: a normalization and copy number variation detection method for whole exome sequencing, *Nucleic Acids Research* 43, e39.
28. Chen H, **Zhang NR[‡]** (2015) Graph-based change-point detection, *The Annals of Statistics* 43, 139.
29. Cushing A, Kamali A, Winters M, Hopmans ES, Bell JM, Grimes SM, Li CX, **Zhang NR**, Moss RB, Holodniy M, Ji H (2015) Emergence of hemagglutinin mutations during the course of influenza infection, *Scientific Reports* 5, 16178.
30. Peixoto LL, Wimmer ME, Poplawski SG, Tudor JC, Kenworthy CA, Liu S, Mizuno K, Garcia BA, **Zhang NR**, Giese K, Abel T (2015) Memory acquisition and retrieval impact different epigenetic processes that regulate gene expression, *BMC Genomics* 16, S5.
31. Yue M, Han X, De Masi L, Zhu C, Ma X, Zhang J, Wu R, Schmieder R, Kaushik RS, Fraser GP, Zhao S, McDermott PF, Weill FX, Mainil JG, Arze C, Fricke WF, Edwards RA, Brisson D, **Zhang NR**, Rankin SC, Schifferli DM (2015) Allelic variation contributes to bacterial host specificity, *Nature Communications* 6, 8754.
32. Wang X, Chen M, Yu X, Pornputtpong N, Chen H, **Zhang NR**, Powers RS, Krauthammer M (2016) Global copy number profiling of cancer genomes, *Bioinformatics*, 32, 926.
33. **Zhang NR**, Yakir B, Xia LC, Siegmund DO (2016) Scan statistics on Poisson random fields with applications in genomics, *Annals of Applied Statistics* 10, 726.
34. Xia LC, Sakshuwong S, Hopmans ES, Bell JM, Grimes SM, Siegmund DO, Ji HP, **Zhang NR*** (2016) A genome-wide approach for detecting novel insertion-deletion variants of mid-range size, *Nucleic Acids Research* 44, e126.
35. Jiang Y, Qiu Y, Minn AJ, **Zhang NR*** (2016) Assessing intratumor heterogeneity and tracking longitudinal and spatial clonal evolutionary history by next-generation sequencing, *Proceedings of the National Academy of Sciences* 113, E5528.

* corresponding or co-corresponding author

‡ alphabetical order

‡ co-first authors

36. Wang X, Chen H, **Zhang NR** (2017) DNA copy number profiling using single-cell sequencing, *Briefings in Bioinformatics*, bbx004, <https://doi.org/10.1093/bib/bbx004>.
37. Jiang Y, **Zhang NR***, Li M* (2017) SCALE: modeling allele-specific gene expression by single-cell RNA-sequencing, *Genome Biology* 18, 74.
38. Chen H, Jiang Y, Maxwell K, Nathanson K, **Zhang NR*** (2017) Allele-specific copy number estimation by whole exome sequencing, *Annals of Applied Statistics* 11, 1169.
39. Jia C, Hu Y, Kelly D, Kim J, Li M*, **Zhang NR*** (2017) Accounting for technical noise in differential expression analysis of single-cell RNA sequencing data, *Nucleic Acids Research*, 45, 10978.
40. Maxwell KN, Wubbenhorst B, Wenz BM, Sloover DD, Pluta J, Emery L, Barrett A, Kraya AA, Anastopoulos IN, Yu S, Jiang Y, Chen H, **Zhang NR**, Hackman N, D'Andrea K, Daber R, Morrissette JJ, Mitra N, Feldman M, Domchek SM, Nathanson KL (2017) BRCA locus-specific loss of heterozygosity in germline BRCA1 and BRCA2 carriers, *Nature Communications* 8, 319.
41. Xia LC, Bell JM, Wood-Bouwens C, Chen JJ, **Zhang NR***, Ji HP* (2017) Single molecule-based discovery of complex genomic rearrangements, *Nucleic Acids Research* 46, e19.
42. Garman B, Anastopoulos IN, Krepler C, Brafford P, Sproesser K, Jiang Y, Wubbenhorst B, Amaravadi R, Bennett J, Beqiri M, Elder D, Flaherty KT, Frederick DT, Gangadhar TC, Guarino M, Hoon D, Karakousis G, Liu Q, Mitra N, Petrelli NJ, Schuchter L, Shannan B, Sheilds CL, Wargo J, Wenz B, Wilson MA, Xiao M, Xu W, Xu X, Yin X, **Zhang NR**, Davies MA, Herlyn M, Nathanson KL (2017) Genetic and genomic characterization of 462 melanoma patient-derived xenografts, tumor biopsies and cell lines, *Cell Reports* 21, 1936.
43. Huang M, Wang J, Torre E, Dueck H, Shaffer S, Bonasio R, Murray J, Raj A, Li M, **Zhang NR*** (2018) SAVER: Gene expression recovery for single cell RNA sequencing, *Nature Methods* 15, 539.
44. Zhou Z, Wang W, Wang L-S, **Zhang NR*** (2018) Integrative DNA copy number detection and genotyping from sequencing and array-based platforms, *Bioinformatics* 34, 2349.
45. Wang X, Jiang Y, **Zhang NR**, Small D (2018) Sensitivity analysis and power for instrumental variable studies, *Biometrics* doi: 10.1111/biom.12873.
46. Urrutia E, Chen H, Zhou Z, **Zhang NR***, Jiang Y* (2018) Integrative pipeline for profiling DNA copy number and inferring tumor phylogeny, *Bioinformatics* 34, 2126.
47. Zhang H, **Zhang NR**, Li M, Reilly MP (2018) First giant steps towards a cell atlas of atherosclerosis, *Circulation Research* 122, 1632.
48. Wang J, Huang M, Torre E, Dueck H, Shaffer S, Murray J, Raj A, Li M, **Zhang NR*** (2018) Gene expression distribution deconvolution in single cell RNA sequencing, *Proceedings of the National Academy of Sciences* 115, E6437.
49. Jiang Y, Nathanson KL, **Zhang NR*** (2018) CODEX2: full-spectrum copy number variation detection by high-throughput DNA sequencing, accepted by *Genome Biology* 19, 202.
50. Wang X, Park J, Susztak K, **Zhang NR***, Li M* (2019) Bulk Tissue Cell Type Deconvolution with Multi-Subject Single-Cell Expression Reference, *Nature Communications* 10, 380.
51. Wang J, Agarwal D, Huang M, Hu G, Zhou Z, Ye C, **Zhang NR*** (2019) Data denoising with transfer learning in single-cell transcriptomics, *Nature Methods* 16, 875.
52. Benci JL et al. (2019) Opposing Functions of Interferon Coordinate Adaptive and Innate Immune Responses to Cancer Immune Checkpoint Blockade, *Cell* 178 (4), 933-948. e14.
53. Nguyen S et al. (2019) Elite control of HIV is associated with distinct functional and transcriptional signatures in lymphoid tissue CD8+ T cells, *Science Translational Medicine* 11(523).
54. Pauly D, Agarwal D, Dana N, Shafer N, Biber J, Wunderlich KA, Jabri Y, Straub T, **Zhang NR**, Gautam AK, Weber BHF, Hauck SF, Kim M, Curcio CA, Stambolian D, Li M, and Grosche A (2019) Cell-Type-

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‡ alphabetical order

‡ co-first authors

- Specific Complement Expression in the Healthy and Diseased Retina. *Cell Reports* 29, 2835-2848.e4
55. Agarwal D, **Zhang NR*** (2019) A rank-based semblance kernel on probability spaces, *Science Advances* 5 (12), eaau9630.
 56. Zhou Z, Xu B, Minn A, Zhang NR* (2020) Dendro: genetic heterogeneity profiling by single cell RNA sequencing, *Genome Biology* 21, 10. (R package: DENDRO)
 57. Zhou Z, Ye C, Wang J, **Zhang NR*** (2020) Surface protein imputation from single cell transcriptomes by deep neural networks, *Nature Communications* 11, Article number: 651
 58. Agarwal D, Wang J, **Zhang NR*** (2020) Data denoising and post-denoising corrections in single cell RNA sequencing, *Statistical Science* 35 (1), 112-128.
 59. Rozenblatt-Rosen et al. (2020) The Human Tumor Atlas Network (HTAN): charting tumor transitions across space and time at single-cell resolution. *Cell* 181, 236.
 60. Mukherjee S, Agarwal D, **Zhang NR** & Bhattacharya BB (2020) Distribution-Free Multisample Tests Based on Optimal Matchings with Applications to Single Cell Genomics, *Journal of the American Statistical Association*, DOI: 10.1080/01621459.2020.1791131.
 61. Wu C-Y, Lau BT, Kim H, Sathe A, Grimes SM, Ji HP, **Zhang NR*** (2021) Integrative single-cell analysis of allele-specific copy number alterations and chromatin accessibility in cancer. *Nature Biotechnology*, 39, 1259
 62. Navin NE, Rozenblatt-Rosen O, and **Zhang NR** (2021) New frontiers in single-cell genomics. *Genome Research*, 31, ix-x.
 63. Zhao Q, Wang J, Zhen M, **Zhang NR**, Hennessey S, Small DS and Rader DJ (2021) A Mendelian randomization study of the role of lipoprotein subfractions in coronary artery disease. *Elife* 10, e58361.
 64. Wang J, Zhao Q, Bowden J, Hemani G, Smith GD, Small DS, **Zhang NR** (2021) Causal inference for heritable phenotypic risk factors using heterogeneous genetic instruments. *PLoS Genetics* 17(6), e1009575.
 65. Cucolo L, ..., **Zhang NR**, Shi J and Minn AJ (2022). The interferon-stimulated gene RIPK1 regulates cancer cell intrinsic and extrinsic resistance to immune checkpoint blockade, *Immunity* 55, 671.
 66. Bibby J, Agarwal D, Freiwald T, Kunz N, Merle NS, West EE, Larochele A, Chinian F, Mukherjee S, Afzali B, Claudia K*, and **Zhang NR*** (2022). Systematic Single Cell Pathway Analysis (SCPA) reveals novel pathways engaged during early T cell activation. *Cell Reports* 41, 111697.
 67. Jiang Y, Harigaya Y, Zhang Z, Zhang H, Zang C, and **Zhang NR*** (2022) Nonparametric single-cell multiomic characterization of trio relationships between transcription factors, target genes, and cis-regulatory regions. *Cell Systems* 13, 737.
 68. Sathe A, ..., **Zhang NR**, Ji HP (2022) Colorectal cancer metastases in the liver establish immunosuppressive spatial networking between tumor associated SPP1+ macrophages and fibroblasts. *Clinical Cancer Research* OF1–OF1.
 69. Hickey JW, ..., **Zhang NR**, ... (2023) Organization of the human intestine at single-cell resolution. *Nature* 619 (7970), 572-584.
 70. Lin K and **Zhang NR*** (2023) Quantifying common and distinct information in single-cell multimodal data with Tilted Canonical Correlation Analysis. *Proceedings of the National Academy of Sciences*, 120 (32) e2303647120.
 71. Chen S, Zhu B, Huang S, Hickey JW, Lin KZ, Snyder M, Greenleaf WJ, Nolan GP, **Zhang NR***, Ma Z* (2024) Integration of spatial and single-cell data across modalities with weak linkage. *Nature Biotechnology* 42, 1096–1106

* corresponding or co-corresponding author

‡ alphabetical order

‡ co-first authors

72. Mason K, Sathe A, Hess P, Rong J, Wu C-Y, Furth E, Susztak K, Levinsohn J, Ji HP, **Zhang NR*** (2024) Niche-DE: niche differential gene expression analysis in spatial transcriptomics data identifies context-dependent cell-cell interactions. *Genome Biol* 25, 14.
73. Mathew D., ..., **Zhang NR**, ... (2024) Clinical and Immunological Responses to Combined JAK Inhibition and PD1 Blockade for Lung Cancer. *Science*, 384, 1303-1304.
74. Zhang Z, Mathew D, Lim T, Mason K, Martinez CM, Huang S, Wherry EJ, Susztak K, Minn AJ, Ma Z, **Zhang NR*** (2024) Signal recovery in single cell batch integration. *Nature Biotechnology*, published online Nov 24 2024.
75. Wu C-Y, Rong J, Sathe A, Hess PR, Lau BT, Grimes SM, Huang S, Ji HP, **Zhang NR*** (2025). Cancer subclone detection based on DNA copy number in single cell and spatial omic sequencing data. *Nature Methods*, to appear.
76. Yu W, Biyik-Sit R, Uzun Y, Chen C-H, Thadi A, Sussman JH, Pang M, Wu C-Y, Grossmann LD, Gao P, Wu DW, Yousey A, Zhang M, Turn CS, Zhang Z, Bandyopadhyay S, Huang J, Patel T, Chen C, Martinez D, Surrey LF, Hogarty MD, Bernt K, **Zhang NR**, Maris JM, Tan K (2025) Longitudinal single-cell multiomic atlas of high-risk neuroblastoma reveals chemotherapy-induced tumor microenvironment rewiring Clonal cell states link Barrett's esophagus and esophageal adenocarcinoma. *Nature Genetics*, to appear.
77. Klötzer KA, Abedini A, Balzer MS, Liang X, Levinsohn J, Ha E, Hogan JJ, Quinn G, Bloom RD, Schuller M, Eller K, **Zhang NR***, Susztak K*. (2025) Unraveling the Cellular Features of Kidney Disease in a Cross-Species Integrated Single-Cell Kidney Atlas via Pathway-Level Gene Expression Coordination with ScSpectra. *Nature Genetics*, to appear.
78. Li H, Wang D, Gao Q, Tan P, Wang Y, Cai X, Li A, Zhao Y, Thurman AL, Malekpour SA, Zhang Y, Sala R, Cipriano A, Wei C-L, Sebastiano V, Song C, **Zhang NR**, Au KF*. (2025) MiniQuant: long reads improve gene isoform quantification by reducing the data deconvolution error. *Nature Biotechnology*, to appear.
79. Fu Y, Kim H, Adams JI, Grimes SM, Huang S, Lau BT, Sathe A, Hess P, Ji HP, **Zhang NR*** (2024) Single cell and spatial alternative splicing analysis with long read sequencing. *Submitted*.
80. Gier RA, Hueros RA, Rong J, DeMarshall M, Karakasheva TA, Muir AB, Falk GW, **Zhang NR**, Shaffer SM*. (2024) Clonal cell states link Barrett's esophagus and esophageal adenocarcinoma. *Submitted*.

PUBLISHED BOOK CHAPTERS

81. Chan HP, Tu I-P, **Zhang NR** (2009) Boundary crossing probability computations in the analysis of scan statistics, in *Scan Statistics - Methods and Applications*. Birkhauser, Boston.
82. **Zhang NR** (2010) DNA copy number profiling in normal and tumor genomes, In *Frontiers in Computational and Systems Biology*, ed. Jianfeng Feng, Wenjiang Fu and Fengzhu Sun.

GRANT AWARDS

(*NSF* = National science foundation, *DMS* = Division of Mathematical Sciences, *NIH* = National Institutes of Health, *NHGRI* = National Human Genome Research Institute, *DoJ*=Department of Justice, *NIA* = National Institutes of Aging, *NCI* = National Cancer Institute, *NHLBI* = National Heart, Lung and Blood Institute)

Period	Agency, Mechanism	Role	Title	Direct Cost (\$)
2009 - 2012	NSF (DMS)	PI	Change-point Problems in Genomic Profiling	100,000

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‡ alphabetical order

‡ co-first authors

2010-2013	NSF (DMS)	co-PI	Statistical Methods for Threat Detection	711
7/6/11 - 6/30/17	NIH (NHGRI) R01	PI	Statistical Models and Analysis of Complex Variation in Clonal Mixtures	577,971
9/15/11 - 9/15/13	Alfred P. Sloan Foundation	PI	Statistical Methods for Genome Profiling	50,000
5/1/12 - 4/30/14	NIH (NHGRI) R01	PI (Subcontract)	Statistical Models for Genome Sequencing and Association	81,110
1/1/14 - 12/31/16	DoJ	PI (Subcontract)	Highly Parallel Analysis of Complex Genetic Mixtures	72,731
6/15/14 – 5/31/18	NIH (NIA) UF1	Co- Investigator	Consortium for Alzheimers Sequence Analysis (CASA)	11,063,917
4/15/16 – 2/28/21	NIH (NIA) U54	Co- Investigator	Coordinating Center for Genetics and Genomics of Alzheimers Disease (CGAD)	10,801,796
5/1/16 – 4/30/20	NSF (DMS)	Co-PI	Statistical Methods for High- Resolution Multiscale Analysis 3D DNA	948,742
9/30/16 – 6/30/21	NIH U54	Co- Investigator	Identifying Genes and Pathways that Impact Tau Toxicity in FTD	1,250,000
4/1/17 – 3/31/22	NIH (NIA) U24	Co- Investigator	The NIA Genetics of Alzheimer’s Disease Data Storage Site (NIAGADS)	4,802,337
8/1/17- 7/31/22	NIH (NCI) P01	Co- Investigator	Radiation and Checkpoint Blockade for Cancer Immune Therapy	8,795,373
9/1/17 – 8/31/21	NIH (NIGMS) R01	PI (Multiple PI Grant)	Statistical Methods for Single- Cell Transcriptomics	948,000
9/14/17 – 6/30/20	NIH (NHGRI) R01	PI (Multiple PI Grant)	Genomic and Cellular Variation from Single Molecules to Single Cells	917,539
7/1/18- 6/30/23	NIH (NHLBI) R01	Co- Investigator	Elucidation of Tissue-Specific Transcriptomic Profiles in Cardiometabolic Disease	2,222,228
9/01/18- 8/31/23	NIH (NCI) U2C	Data Analysis Unit Co-lead	Center for Pediatric Tumor Cell Atlas	13,553,635
7/1/23- 6/30/26	NSF (DMS)	PI	Statistical Methods for Design and Analysis of Clinical-scale Single Cell Studies	600,000
9/01/18- 8/31/23	NIH (NIGMS) R01	PI (Multiple PI Grant)	Multiomic single cell and spatial interrogation of mechanisms in cellular adaptation to stress	1,772,212
9/2024- 2025	NIH (NIA) R56	PI (Multiple PI Grant)	Multiomic methods for the characterization of cellular aging	250,000

COURSES TAUGHT

Stanford University STATISTICS 191 – Applied Statistics	2007, 2008
Stanford University STATISTICS 203 – Introduction to ANOVA	2009, 2010
Stanford University STATISTICS 205 – Nonparametric Statistics	2007, 2008
Stanford University STATISTICS 215 – Stochastics Processes with Applications in Biology	2008, 2009, 2010
Stanford University STATISTICS 345/GEN245 – Computational Algorithms in Statistical Genetics	2009
Stanford University STATISTICS 366 – Statistical Methods in Genetics	2010
Wharton School STAT 102 – Introductory to Business Statistics	2012, 2015
Wharton School STAT 431 – Introductory Statistics	2012
Wharton School STAT 471/701 – Intermediate Statistics	2013
Wharton School STAT 405/705 – Statistical Computing with R	2016, 2017, 2019

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‡ alphabetical order

⌘ co-first authors

Wharton School STAT 9915 – Advanced Topics in Biomedical Data Science 2025

MENTORING

I served (or am serving) as doctoral dissertation advisor for:

Yunting Sun (Joint with Art Owen), Department of Statistics, Stanford University (Joined Google Inc.)	2012
Jeremy Shen , Department of Statistics, Stanford University (Joined Two Sigma Investments.)	2012
Hao Chen (Joint with David Siegmund), Department of Statistics, Stanford University (Joined Department of Statistics as Assistant Professor, University of California Davis.)	2014
Yuchao Jiang , Graduate Program in Genomics and Computational Biology, University of Pennsylvania (Joined Departments of Biostatistics and Genetics as Assistant Professor, University of North Carolina.)	2017
Yang Jiang (Joint with Dylan Small) Department of Statistics, University of Pennsylvania	2017
Xuran Wang , Graduate Program in Applied Mathematics and Computational Sciences, University of Pennsylvania (Joined Carnegie Mellon University as Postdoctoral Researcher)	2019
Mo Huang , Department of Statistics, The Wharton School, University of Pennsylvania (Joined Merck Pharmaceuticals)	2020
Zilu Zhou , Graduate Program in Genomics and Computational Biology, University of Pennsylvania (Joined Google Research)	2020
Divyansh Agarwal , Graduate Program in Genomics and Computational Biology, University of Pennsylvania	2020
Chi-Yun Wu , Graduate Program in Genomics and Computational Biology, University of Pennsylvania	2022
Kaishu Mason , Department of Data Science, University of Pennsylvania	Current
Yuntian Fu , Graduate Program in Genomics and Computational Biology, University of Pennsylvania	Current
Zhaojun Zhang , Department of Statistics and Data Science, University of Pennsylvania	Current
Jiazhen Rong , Graduate Program in Genomics and Computational Biology, University of Pennsylvania	Current
Yuxuan Lin , Department of Statistics and Data Science, University of Pennsylvania	Current
Emilia Chen , Graduate Program in Genomics and Computational Biology, University of Pennsylvania	Current
Yilin Yang , Department of Statistics and Data Science, University of Pennsylvania	Current

I served (or am serving) as postdoc mentor for:

Charlie Xia (Joint with Hanlee Ji, joined Albert Einstein College of Medicine as Assistant Professor.)	2017
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‡ alphabetical order

‡ co-first authors

Jingshu Wang (Joined University of Chicago Department of Statistics as Assistant Professor.)	2019
Kevin Lin (Joined University of Washington Department of Biostatistics as Assistant Professor)	2023
Paul Hess	2024
Divij Mathews (co-mentor with Dr. John Wherry)	

I served (or am serving) as Master Thesis mentor for:

Jenea Adams	2024
Zhen Miao	Current
Alisha Aristel	Current

Since starting at Penn in 2011, I've served on the Thesis Advising Committees of:

Jun Chen , Graduate Group in Genomics and Computational Biology	2012
Jonathan Toung , Graduate Group in Genomics and Computational Biology	2013
Joseph Glassner , Graduate Group in Genomics and Computational Biology	2014
Vicky Wu , Department of Biostatistics, Epidemiology and Informatics	2014
Scott Sherrill-Mix , Graduate Group in Genomics and Computational Biology	2015
Hannah Dueck , Graduate Group in Genomics and Computational Biology	2015
Yih-Chii Hwang , Graduate Group in Genomics and Computational Biology	2015
Hyunseung Kang , Department of Statistics	2017
Ying Chen , Graduate Group in Genomics and Computational Biology	2017
Xiao Ji , Graduate Group in Genomics and Computational Biology	2017
Xinyao Ji , Department of Statistics	2017
Cheng Jia , Department of Biostatistics, Epidemiology and Informatics	2017
Yu Hu , Department of Biostatistics, Epidemiology and Informatics	2018
Gemma Moran , Department of Statistics	2019
Benjamin Emert , Graduate Group in Genomics and Computational Biology	2021
Katerina Gawronski , Graduate Group in Genomics and Computational Biology	2021
Gregory Way , Graduate Group in Genomics and Computational Biology	2019
Eric Sanford , Graduate Group in Genomics and Computational Biology	2021
Sammy Klasfeld , Graduate Group in Genomics and Computational Biology	2021
Jingya Qiu , Graduate Group in Genomics and Computational Biology	2022
Yang Xu , Graduate Group in Genomics and Computational Biology	2023
Jason Xu , Graduate Group in Genomics and Computational Biology	2023
Sagnik Nandy , Department of Statistics	2023
Kathy Huang , Graduate Group in Genomics and Computational Biology	Current
Michelle Lee , Graduate Group in Genomics and Computational Biology	Current
Zhen Miao , Graduate Group in Genomics and Computational Biology	Current
Matthew Lee , Graduate Group in Genomics and Computational Biology	Current
Alice Wang , Graduate Group in Genomics and Computational Biology	Current
Robert Hu , Graduate Group in Genomics and Computational Biology	Current
Zirui Fan , Department of Statistics and Data Science	Current

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SELECT NOTABLE SERVICE ACTIVITIES**NOTABLE EDITORIAL SERVICE**

Associate Editor, <i>Annals of Applied Statistics</i>	2015-2018
Editorial Board, <i>Briefings in Bioinformatics</i>	2017-2021
Guest Editor, <i>Genome Research Special Issue on Single Cell Biology</i>	2020-2021
Editor, <i>Foundations and Trends in Statistics</i>	2024-Current

GRANT REVIEW PANEL AND STUDY SECTIONS

National Science Foundation – National Institute of General Medical Sciences Joint Study Section	2011
National Institutes of Health – Genomics, Computational Biology and Technology (GCAT)	2012, 2015, 2017
National Institutes of Health – Advanced Genomic Technology Development Panel	2017
National Institutes of Health – Advanced Genomic Technology Development Panel	2021
National Institutes of Health – ASPA	2022
National Institutes of Health – BICAN	2022
National Institutes of Health – ZRG1 BST-J	2022
National Institutes of Health – HTAN, Pre-Cancer Atlas Research Centers	2024

Notable ACADEMIC SERVICE

Chair, American Statistical Association Section on Statistical Genetics and Genomics	2023-2024
Chair, Founder’s Award Committee, ASA SSGG	2023-2024

(At Stanford)

Masters student advisor, Department of Statistics	2010
Undergraduate advisor, Computational Mathematics Major	2007-2011
VPUE Undergraduate Summer Research Program Coordinator	2007

(At Penn)

Doctoral Program Co-Director, Department of Statistics, The Wharton School	2012-2017
Doctoral Program Advisory Committee, Graduate Group in Genomics and Computational Biology	2014-2019
Center for Neurodegeneration Faculty Search Committee	2016-2017
Director of Admissions, Department of Statistics, The Wharton School	2017-2019
Chair, Doctoral Coordinating Committee, Department of Statistics, The Wharton School	2023-current

DIVERSITY, EQUITY, and INCLUSION

Undergraduate Mentor, Leadership Alliance Program	2019
Founder, Wharton Directed Reading Program	2021
Co-Director, Bridge to Doctorate Program, Department of Statistics, The Wharton School	2023-current

SELECT INVITED TALKS (SINCE 2013)

* corresponding or co-corresponding author

‡ alphabetical order

⌘ co-first authors

Department of Statistics, Stanford University	2013
Department of Statistics, Harvard University	2013
IMS-China Meeting, Chengdu, China	2013
Department of Biostatistics, Johns Hopkins University	2014
ENAR Spring Meeting, Baltimore, MD	2014
iBright Conference, Houston, TX	2015
Department of Statistics, Georgia Institute of Technology	2016
Center for Statistics and Machine Learning, Princeton University	2016
Cornell Day of Statistics, Ithaca, NY	2016
ICSA Applied Statistics Symposium, Atlanta, GA	2016
Department of Biostatistics, Brown University	2016
Department of Statistics, Stanford University	2016
Graybill Conference, Fort Collins, CO	2017
Department of Biostatistics, University of Michigan	2017
ENAR Spring Meeting, Washington, DC	2017
Joint Statistical Meetings, Baltimore, MD	2017
ICSA Applied Statistics Symposium, Chicago, IL	2017
Department of Statistics, Pennsylvania State University	2017
Machine Learning Seminar Series, Duke University	2017
DahShu Virtual Journal Club	2017
Biostatistics Branch, National Cancer Institute	2018
ENAR Spring Meeting, Atlanta, GA	2018
Joint Statistical Meetings, Vancouver, Canada	2018
Department of Statistics, University of Chicago	2018
Department of Biostatistics, University of Washington	2018
Department of Statistics and Data Science, Carnegie Mellon University	2018
The Australian Bioinformatics and Computational Biology Society Annual Conference (keynote speaker)	2018
Department of Biostatistics, University of North Carolina	2019
Frontiers in Single-cell Technology, Applications and Data Analysis (Banff Workshop)	2019
New York University Genomics Symposium	2019
Mathematical Biosciences Institute, Ohio State University	2019
Institute for Advanced Studies (Missing Data Challenges in Computation, Statistics, and Applications), Princeton University	2020
Department of Statistics, Yale University	2020
Department of Statistics, Stanford University	2020
Department of Statistics, UC Berkeley	2020
Joint Statistical Meetings	2020
Gordon Conference on Single Cell Cancer Biology	2020
Keystone Symposia on Single Cell Biology	2021
American Society of Nephrology Kidney Week	2021
Medallion Lecture, Joint Statistical Meetings	2021
Bioinformatics Symposium (University of Pittsburgh)	2021
Moffitt Cancer Center Quantitative Science Grand Rounds	2021
NeurIPS Learning Meaningful Representations of Life Invited Talk	2021
Princeton Day of Statistics Invited Talk	2021

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‡ *alphabetical order*

‡ *co-first authors*

Department of Statistics and Biostatistics, University of Calgary	2021
Conference on Statistics and Data Science (Keynote Lecture)	2021
Gordon Research Conference in Single-cell Cancer Biology	2022
Simons Institute Conference - Statistics in the Big Data Era	2022
Penn Biomedical Data Science Seminar	2022
Joint Statistical Meetings, Washington D.C.	2022
BIRS Workshop in Deep Learning in Genomics	2022
NCI Joint Workshop on Computational Approaches to Immuno-Oncology	2022
Stanford University Department of Biomedical Data Science Seminar	2023
Johns Hopkins Department of Biostatistics Seminar	2023
University of Michigan Statistics Seminar	2023
Krishnaiah Lecture, Penn State Department of Statistics	2023
University of Michigan Biostatistics Seminar	2023
Keynote Lecture, 11 th International Conference on Intelligent Biology and Medicine	2023
Keynote Lecture, Bioconductor Conference	2023
Stanford Conference on Genetics, Structural Variants and DNA Repeats	2023
Mount Sinai Department of Genetics and Genomic Sciences	2023
Columbia University Department of Statistics	2023
Emory University Rollins School of Public Health Department of Biostatistics	2024
University of California, Los Angeles, Frontiers in Bioinformatics Series	2024
University of Southern California, Department of Statistics	2024
ENAR Spring Meeting, Baltimore, MD	2024
STATGEN 2024, Pittsburgh, PA	2024
National Institute on Aging Workshop on Heterogeneity of Aging: New Perspectives	2024
Joint Statistical Meetings, Portland OR	2024
Penn Big Data Conference	2024

SELECT SOFTWARE PACKAGES DEVELOPED BY MY GROUP

For single cell data analysis:

- TASC (Toolkit for noise modeling in single cell RNA-seq with spike-ins)
<https://github.com/scrna-seq/TASC>
- SCALE (Single cell allele-specific expression analysis)
<https://github.com/yuchaojiang/SCALE>
- DESCEND (Expression distribution deconvolution for single cell RNA-seq)
<https://github.com/jingshuw/descend>
- MUSIC (Bulk expression deconvolution with scRNA-seq reference)
<https://github.com/xuranw/MuSiC>
- DENDRO (Genetic heterogeneity profiling by scRNA-seq)
<https://github.com/zhouzilu/DENDRO>
- SAVER (Gene expression imputation and denoising for single cell RNA sequencing)
<https://github.com/mohuangx/SAVER>
- SAVER-X (SAVER harnessing external data)
<https://singlecell.wharton.upenn.edu/saver-x/>
- cTP-Net (Single cell Transcriptome to Protein prediction with deep neural network)

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<https://github.com/zhouzilu/cTPnet/>

Alleloscope (Allele-specific copy number estimation for scDNA and scATAC sequencing)

<https://github.com/seasoncloud/Alleloscope>

Clonalscope (Subclone detection in single cell and spatial sequencing)

<https://github.com/seasoncloud/Clonalscope>

SCPA (Single cell pathway analysis)

<https://jackbibby1.github.io/SCPA/>

CellANOVA (Cell State Space Analysis of Variance, Signal recovery for single cell batch integration)

<https://github.com/Janezjz/cellanova>

Niche-DE (Niche-differential expression analysis in spatial transcriptomic data)

<https://github.com/Kmason23/NicheDE>

For copy number profiling and tumor heterogeneity analysis using bulk sequencing:

CANOPY (Tumor phylogeny reconstruction by spatial and temporal bulk RNA sequencing)

<https://cran.r-project.org/web/packages/Canopy/>

MARATHON (Comprehensive pipeline for copy number profiling in normal and tumor samples)

<https://github.com/yuchaojiang/MARATHON>

SWAN (Structural variant profiling using paired-end genome sequencing data)

<https://bitbucket.org/charade/swan/overview>

CODEX/CODEX2 (statistical framework for full-spectrum CNV profiling in whole genome, whole exome, and targeted DNA sequencing)

<https://github.com/yuchaojiang/CODEX2>

iCNV (Integration across array and sequencing platforms for copy number detection)

<https://github.com/zhouzilu/iCNV>

FALCON (Allele-specific copy number estimation using whole genome sequencing data)

<https://cran.r-project.org/web/packages/falcon/index.html>

FALCON-X (Allele-specific copy number estimation using whole exome sequencing data)

<https://cran.r-project.org/web/packages/falconx/index.html>

General statistical tools:

SEMBLANCE (rank-semblance kernel for data compression, niche detection, and feature extraction)

<https://cran.r-project.org/web/packages/Semblance/index.html>

GSEG (Change-point detection for multivariate data through a similarity graph on the observations)

<https://cran.r-project.org/web/packages/gSeg/index.html>

GCAT (Two-sample tests for categorical data utilizing similarity information among the categories)

<https://cran.r-project.org/web/packages/gCat/index.html>

SEQCBS (Segmentation and Bayesian confidence interval calculation for matched case/control point processes)

<https://cran.r-project.org/web/packages/seqCBS/index.html>

LEAPP (Latent factor (“batch effect”) adjustment in multiple hypothesis testing)

<https://cran.r-project.org/web/packages/leapp/index.html>

MEMBERSHIPS (PAST AND CURRENT)

American Statistical Association

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