Jisu KIM

Curriculum Vitae

KIM, Jisu
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Department of Statistics. Seoul National University
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http://jkim82133.github.io/

Research Interests

Jisu Kim's research lies at the intersection of statistics, geometry, and topology, with particular emphasis on Topological Data Analysis (TDA). He develops statistical methodologies for analyzing geometric and topological structures in data, particularly through persistent homology. His work bridges the gap between statistical and topological frameworks by designing statistical tools tailored to topological contexts and vice versa. He is engaged in the theoretical foundations of statistical inference on manifolds, including estimation of intrinsic dimensionality and reach. He also explores applications of TDA to machine learning. He also contributes to the open source software, notably co-authoring the R package TDA for statistical topological data analysis.

Academic Positions

2023 Sep – Present **Assistant Professor**, *Department of Statistics, Seoul National University*, Seoul, Republic of Korea

2021 Jul – 2023 Mar **Non Permanent Researcher**, *DataShape, Inria Saclay and Laboratoire de Mathématiques d'Orsay, Université Paris-Saclay*, Orsay, France

2020 Mar – 2021 Jul **Non Permanent Researcher**, *DataShape, Inria Saclay*, Palaiseau, France

2018 Nov – 2020 Feb **PostDoc**, *DataShape, Inria Saclay*, Palaiseau, France

Education

2013 Aug – 2018 Dec **Ph.D. in Statistics & Machine Learning**, *Carnegie Mellon University*, Pittsburgh, United States of America
Advisor: Larry Wasserman and Alessandro Rinaldo
Thesis: Statistical Inference For Geometric Data [slides | paper]

2013 Aug – 2014 May **M.S. in Statistics**, *Carnegie Mellon University*, Pittsburgh, United States of America

2006 Mar – 2013 Aug **B.S. in Mathematics, Computer Science, Statistics**, *Seoul National University*, Seoul, Republic of Korea
Graduated Summa Cum Laude (first honors in College of Natural Science)

Papers

Jaehyeok Shin, Jisu Kim, Alessandro Rinaldo, Larry Wasserman, Persistent homology of density filtration on rips complex

Kwangho Kim, Jisu Kim, Barnabás Póczos, Distribution Regression in Semi-supervised Learning

2025 Kwangho Kim, Edward H. Kennedy, Jisu Kim, Larry Wasserman, Hierarchical and Density-based Causal Clustering
Published in Thirty-eighth Annual Conference on Neural Information Processing Systems (NeurIPS 2024).
[arXiv | NeurIPS]

2024 Young-soo Chung, Seungseok Kang, Jisu Kim, Sangbo Lee, Sangwoo Kim, CLEMENT: genomic decomposition and reconstruction of non-tumor subclones
Published in Nucleic Acids Research.
[NAR]

2024 Weichen Wu, Jisu Kim, Alessandro Rinaldo, On the estimation of persistence intensity functions and linear representations of persistence diagrams
Published in The 27th International Conference on Artificial Intelligence and Statistics (AISTATS 2024).
[arXiv | AISTATS]

2024 Pum Jun Kim, Yoojin Jang, Jisu Kim, Jaejun Yoo, TopP&R: Robust Support Estimation Approach for Evaluating Fidelity and Diversity in Generative Models
Published in Thirty-seventh Annual Conference on Neural Information Processing Systems (NeurIPS 2023).
[arXiv | NeurIPS]

2023 Changjo Yu, Sungkyu Jung, Jisu Kim, Significance of Modes in the Torus by Topological Data Analysis
Published in Stat, Volume 12, Issue 1.
[Stat]

2021 Hengrui Luo, Jisu Kim, Alice Patania, Mikael Vejdemo-Johansson, Topological Learning for Motion Data via Mixed Coordinates
Published in Workshop on Applications of Topological Data Analysis to "Big Data" from 2021 IEEE International Conference on Big Data (IEEE BigData 2021)

2021 Hengrui Luo, Alice Patania, Jisu Kim, Mikael Vejdemo-Johansson, Generalized Penalty for Circular Coordinate Representation
Published in Foundations of Data Science (FoDS)
[arXiv | FoDS | DOI | BibTeX]

2021 Kwangho Kim, Jisu Kim, Manzil Zaheer, Joon Sik Kim, Frédéric Chazal, Larry Wasserman, PLLay: Efficient Topological Layer based on Persistence Landscapes
Published in Advances in Neural Information Processing Systems 33 (NeurIPS 2020)
[arXiv |GitHub | BibTeX]

2020 Jisu Kim, Jaehyeok Shin, Frédéric Chazal, Alessandro Rinaldo, Larry Wasserman, Homotopy Reconstruction via the Cech Complex and the Vietoris-Rips Complex
Published in the 36th International Symposium on Computational Geometry (SoCG 2020)
[arXiv | HAL | DOI | BibTeX]

2019 Kwangho Kim, Jisu Kim, Alessandro Rinaldo, Frédéric Chazal, Time Series Featurization via Topological Data Analysis
[arXiv | BibTeX]

2019 Jisu Kim, Jaehyeok Shin, Alessandro Rinaldo, Larry Wasserman, Uniform Convergence Rate of the Kernel Density Estimator Adaptive to Intrinsic Volume Dimension
Published in Thirty-sixth International Conference on Machine Learning (ICML 2019).
[arXiv | HAL | PMLR | BibTeX]

2019 Eddie Aamari, Jisu Kim, Frédéric Chazal, Bertrand Michel, Alessandro Rinaldo, Larry Wasserman, Estimating the Reach of a Manifold
Published in Electronic Journal of Statistics, Volume 13, Number 1.
[arXiv | HAL | Electronic Journal of Statistics | BibTeX]

2019 Jisu Kim, Alessandro Rinaldo, Larry Wasserman, Minimax Rates for Estimating the Dimension of a Manifold
Published in Journal of Computational Geometry, Volume 10, Number 1.
[arXiv | Journal of Computational Geometry | BibTeX]

2018 Kwangho Kim, Jisu Kim, Edward H. Kennedy, Causal effects based on distributional distances
[arXiv | BibTeX]

2018 Kijung Shin, Jisu Kim, Bryan Hooi, Christos Faloutsos, Think before You Discard: Accurate Triangle Counting in Graph Streams with Deletions
Published in The European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases 2018 (ECML-PKDD 2018).
[paper | appendix | www (code and datasets) | BibTeX]

2017 Kijung Shin, Bryan Hooi, Jisu Kim, Christos Faloutsos, DenseAlert: Incremental Dense-Subtensor Detection in Tensor Streams
Published in The 23rd SIGKDD Conference on Knowledge Discovery and Data Mining.
[paper | appendix | www (code and datasets) | BibTeX]

2017 Kijung Shin, Bryan Hooi, Jisu Kim, Christos Faloutsos, D-Cube: Dense-Block Detection in Terabyte-Scale Tensors
Published in The 10th ACM International Conference on Web Search and Data Mining (WSDM 2017).
[paper | appendix | www (code and datasets) | BibTeX]

2017 Jisu Kim, Yen-Chi Chen, Sivaraman Balakrishnan, Alessandro Rinaldo, Larry Wasserman, Statistical Inference for Cluster Trees
Published in Advances in Neural Information Processing Systems 29 (NIPS 2016).
[arXiv | NIPS | BibTeX]

2014 Brittany T. Fasy, Jisu Kim, Fabrizio Lecci, Clement Maria, David L. Millman, Vincent Rouvreau, Introduction to the R package TDA.
[arXiv | BibTeX]

Talks

2025-10-24 **Topological data analysis for feature extraction and model evaluation**, *2025년 대한수학회 정기총회 및 가을 연구발표회*, Seoul, Republic of Korea
[abstract | slides]

2025-10-20 **Topological Data Analysis and Machine Learning**, *Kyushu University/Seoul National University - Statistics DS workshop 2025*, Seoul, Republic of Korea
[abstract | slides]

2025-10-06 **Statistical Inference for Topological Data Analysis**, *65th ISI World Statistics Congress*, Hague, Netherlands
[abstract | slides]

2025-08-08 **Topological Data Analysis for Feature Extraction and Model Evaluation** , *Topological Data Analysis and Industrial Mathematics: Bridging Theory and Applications (TDA+IM 2025)*, Fukuoka, Republic of Korea
[abstract | slides]

2025-07-12 **Statistical Inference for Topological Data Analysis**, *The 3rd Joint Conference on Statistics and Data Science in China (JCSDS 2025)*, Hangzhou, China
[slides]

2025-04-26 **Uniform Convergence of the Density Estimator Adaptive to Geometric Dimension**, *2025년 대한수학회 봄 연구발표회*, Daejeon, Republic of Korea
[abstract | slides]

2025-01-16 **위상 자료 분석(Topological Data Analysis)의 기계 학습(Machine Learning) 응용**, *제1회 통계인공지능연구회*, Seoul, Republic of Korea

2024-11-09 **위상 자료 분석(Topological Data Analysis) 소개**, *2024년 한국데이터정보과학회 추계학술발표회*, Daegu, Republic of Korea

2024-08-03 **PLLay: Efficient Topological Layer based on Persistence Landscapes**, *The 24th Korea-Japan Joint Workshop on Algorithms and Computation (WAAC 2024)*, Seoul, Republic of Korea
[slides]

2024-07-08 **Homotopy Reconstruction via the Cech Complex and the Vietoris-Rips Complex**, *Combinatorics and Topology Week at GIST*, Gwangju, Republic of Korea

2024-07-06 **R Package TDA를 이용한 위상 자료 분석(Topological Data Analysis)과 통계적 추정**, *2024년 한국통계학회 하계학술논문발표회*, Seoul, Republic of Korea

2024-07-06 **위상 자료 분석(Topological Data Analysis)의 통계적 추정**, *2024년 한국통계학회 하계학술논문발표회*, Seoul, Republic of Korea

2024-02-01 **Featurization and Evaluation using Topological Data Analysis**, *The 4th POSTECH MINDS Workshop on Topological Data Analysis and Machine Learning*, Pohang, Republic of Korea

2023-12-01 **위상학적 자료 분석(Topological Data Analysis)의 통계적 추정 및 기계학습에의 응용**, *2023년 한국통계학회 동계학술논문발표회*, Seoul, Republic of Korea

2023-11-04 **Featurization of Topological Data Analysis using Persistence Landscape and Circular coordinates**, *2023년 한국데이터정보과학회 추계학술발표회*, Kyeongsan, Republic of Korea

2022-08-11 **Featurization of Topological Data Analysis using Persistence Landscape and Circular coordinates**, *2022 Joint Statistical Meetings (JSM 2022)*, Washington, USA

2022-05-12 **Application of Topological Data Analysis to Transport Mode Recognition and Digital Rock Physics**, *DataShape, Inria Saclay*, Hyères, France

2021-12-15 **Topological Learning for Motion Data via Mixed Coordinates**, *Workshop: Applications of Topological Data Analysis to 'Big Data' in 2021 IEEE International Conference on Big Data (IEEE BigData 2021)*, Virtual

2021-11-06 **위상학적 자료 분석(Topological Data Analysis)의 통계적 추정**, *2021년도 한국통계학회창립 50주년 기념 추계학술논문발표회*, Virtual

2021-07-20 **Confidence band for Persistent Homology of KDEs**, *Bernoulli-IMS 10th World Congress in Probability and Statistics*, Virtual

2021-07-19 **Statistical Inference for Cluster Trees**, *Bernoulli-IMS 10th World Congress in Probability and Statistics*, Virtual

2020-09-30 **Statistical Inference For Geometric and Topological Data**, *Statistics and Data Science Seminar in Department of Mathematics, Statistics, and Computer Science, University of Illinois Chicago*, Virtual
[slides | abstract]

2020-08-06 **Confidence Band for Persistent Homology**, *Statistical Methods for Topological Data Analysis in 2020 Joint Statistical Meetings (JSM 2020)*, Virtual
[slides | abstract]

2020-06-25 **Homotopy Reconstruction via the Cech Complex and the Vietoris-Rips Complex**, *The 36th International Symposium on Computational Geometry (SoCG 2020)*, Virtual
[slides]

2020-01-09 **R Package TDA for Statistical Inference on Topological Data Analysis**, *TDA seminar, UCLA*, Los Angeles, USA
[slides | tutorial | code]

2019-10-18 **Persistent Homology of KDE filtration on Rips complex and Related Work**, *DataShape, Inria Saclay*, Hyères, France
[slides]

2019-06-11 **Uniform Convergence Rate of the Kernel Density Estimator Adaptive to Intrinsic Volume Dimension**, *Thirty-sixth International Conference on Machine Learning (ICML 2019)*, Long Beach, USA
[slides]

2019-05-18 **R Package TDA for Statistical Inference on Topological Data Analysis**, *NSF-CBMS Conference and Software Day on Topological Methods in Machine Learning and Artificial Intelligence*, Charleston, USA
[slides | tutorial | code]

2019-02-25 **R Package TDA for Statistical Inference on Topological Data Analysis**, *Recent Progresses in Data Analysis - Part I of II in SIAM Conference on Computational Science and Engineering*, Spokane, USA
[slides | tutorial | code | abstract]

2018-10-29 **Persistent homology of kenel density estimator filtration on Rips complex**, *Institut Henri Poincaré seminar*, Paris, France
[slides]

2018-10-11 **R Package TDA for Statistical Inference on Topological Data Analysis and Lessons from its Maintenance**, Pittsburgh, USA
[slides | tutorial | code]

2018-06-13 **R Package TDA for Topological Data Analysis**, *Educational Forum on the Teaching of Computational Geometry and Topology: Some History, Current Practice, and Future Trends in The 34th International Symposium on Computational Geometry (SoCG 2018)*, Budapest, Hungary
[slides | tutorial | code]

2018-03-10 **Estimating the Reach of a Manifold**, *42nd SIAM Southeastern Atlantic Sectional Conference*, Chapel Hill, USA

2017-12-09 **Introduction to the R package TDA**, *Synergies in Geometric Data Analysis in Advances in Neural Information Processing Systems 30 (NIPS 2017)*, Long Beach, USA
[slides | tutorial | code]

2017-05-08 **Statistical inference on persistent homology of density filtration on Rips complex**, *Topological Methods in Brain Network Analysis*, Banff, Canada
[slide | video]

2017-05-08 **R Package TDA for Statistical Inference on Topological Data Analysis**, *Topological Methods in Brain Network Analysis*, Banff, Canada
[slide | tutorial | code | video]

2017-01-04 **Statistical Inference on Topological Data Analysis**, *AMS Special Session on Statistical Methods in Computational Topology and Applications in 2017 Joint Mathematics Meetings*, Atlanta, USA
[slides | abstract]

2016-06-16 **R Package TDA for Statistical Inference on Topological Data Analysis**, *5th Mini Symposium on Computational Topology in The 32nd International Symposium on Computational Geometry*, Boston, USA
[slides | abstract]

2015-11-14 **Minimax Rate for Estimating the Dimension of a Manifold**, *Special Session on Topological Data Analysis: Computations, Statistics, and Applications in AMS Fall Eastern Sectional Meeting*, New Brunswick, USA
[slides | abstract]

2015-07-27 **Minimax Rate for Dimension Estimator**, *The 60th ISI World Statistics Congress*, Rio de Janeiro, Brazil
[slides]

2015-06-23 **Tutorial on the R Package TDA**, *The 4th Annual Minisymposium on Computational Topology in The 31st International Symposium on Computational Geometry*, Eindhoven, Netherlands
[slides | tutorial | code]

2015-05-28 **Minimax Rate for Estimating the Dimension of a Manifold**, *TopData in Inria Geometrica*, Palaiseau, France
[slides]

Posters

2024-12-12 **Hierarchical and Density-based Causal Clustering**, *Thirty-eighth Annual Conference on Neural Information Processing Systems (NeurIPS 2024)*, Vancouver, Canada
[NeurIPS]

2024-05-03 **On the estimation of persistence intensity functions and linear representations of persistence diagrams**, *The 27th International Conference on Artificial Intelligence and Statistics (AISTATS 2024)*, Valencia, Spain
[AISTATS]

2023-12-12 **Robust Manifold Estimation Approach for Evaluating Fidelity and Diversity**, *Thirty-seventh Annual Conference on Neural Information Processing Systems (NeurIPS 2023)*, New Orleans, USA
[NeurIPS]

2019-06-11 **Uniform Convergence Rate of the Kernel Density Estimator Adaptive to Intrinsic Volume Dimension**, *Thirty-sixth International Conference on Machine Learning (ICML 2019)*, Long Beach, USA
[poster]

2019-01-08 **Persistent homology of KDE filtration on Rips complex**, *Workshop on Applied Topology 2019*, Kyoto, Japan
[poster | abstract]

2017-07-30 **R Package TDA for Statistical Inference on Topological Data Analysis**, *Joint Statistical Meetings 2017*, Baltimore, USA
[poster | abstract]

2017-05-19 **Estimating the Reach of a Manifold**, *UC Davis RTG Statistical Sciences Symposium: Geometry, Statistics and Data Analysis*, Davis, USA
[poster]

2017-04-04 **R Package TDA: Statistical Tools for Topological Data Analysis**, *ASA Pittsburgh Chapter Spring Banquet*, Pittsburgh, USA
[poster]

2016-12-06 **Statistical Inference for Cluster Trees**, *Advances in Neural Information Processing Systems 29 (NIPS 2016)*, Barcelona, Spain
[poster]

2016-05-16 **Minimax Reach Estimator**, *Topology, Geometry, and Data Analysis Conference at OSU*, Columbus, USA

Software

R package TDA: Statistical Tools for Topological Data Analysis
- Authors: Brittany Terese Fasy, Jisu Kim, Fabrizio Lecci, Clément Maria, Vincent Rouvreau
- [CRAN | Reference Manual | Vignettes]

Teaching

2023 Fall – Present **Instructor**, *Seoul National University*, Seoul, Republic of Korea
- 326.519A 통계이론 1 (Theory of Statistics 1) [2025 Spring]
- M1399.000500 통계적 기계학습 (Statistical Machine Learning) [2025 Spring | 2024 Spring]
- M1399.000400 / M3309.005200 딥러닝의 통계적 이해 (Deep Learning: Statistical Perspective) [2024 Fall]
- M2480.001200 001 인공지능을 위한 이론과 모델링 (Theory and Modeling for A.I.) [2024 Fall | 2023 Fall]
- 321.621A 통계이론세미나 - 위상구조의 통계적 추정 (Seminar in Recent Development of Statistical Theories - Statistics on Topological Structure) [2023 Fall]

2013 Fall – 2018 Spring **TA**, *Carnegie Mellon University*, Pittsburgh, United States of America
- Advanced Probability Overview [2018 Spring]
- Advanced Statistical Theory I [2017 Fall, 2016 Fall]
- Statistical Machine Learning [2017 Spring, 2016 Spring, 2015 Spring]
- Introduction to Statistical Inference [2016 Summer]
- Intermediate Statistics [2015 Fall, 2014 Fall]
- Advanced Methods for Data Analysis [2014 Spring]
- Probability and Mathematical Statistics 1 [2013 Fall]

2008 Spring – 2012 Fall **Tutor**, *Seoul National University*, Seoul, Republic of Korea
- Basic calculus 2 [2012 Fall, 2008 Fall]
- Basic calculus 1 [2012 Spring, 2008 Spring]

Experience

2015 Summer **Intern**, *Inria Geometrica*, Palaiseau, France
advised by Frédéric Chazal and Bertrand Michel

2012 Winter **Undergraduate Research Internship Program**, *Seoul National University*, Seoul, Republic of Korea
advised by Yongdai Kim

2012 Summer, 2011 Winter **Undergraduate Research Internship Program**, *Seoul National University*, Seoul, Republic of Korea
advised by Seonhee Lim

2009 Sep – 2011 Jul **Sergeant**, *Republic of Korea Army*, Republic of Korea
specialty : Computer technician

2009 Jan – 2009 Jun **Analyzer**, *Allm*, Seoul, Republic of Korea

Awards and Honors

2019 Umesh Gavasakar Memorial Thesis Award, by Department of Statistics, Carnegie Mellon University

2013 – 2018 Samsung Scholarship (for Doctoral degree)

2017 TA of the Year Award, by Department of Statistics, Carnegie Mellon University

2017 Student of the year for 2017, by the American Statistical Association Pittsburgh Chapter

2016 α TA Award, by Machine Learning Department, Carnegie Mellon University

2013 Graduated first honors in College of Natural Sciences, Seoul National University

2012 Fall, 2012 Spring, 2011 Fall Dean's list, by Seoul National University

2006 – 2012 National Presidential Science Scholarship (for undergraduate) by Korean Student Aid Foundation

2011 1st prize, The 30th University Students Contests of Mathematics, by Korean Math Society

2011 2nd place, ACM-ICPC Asia-Daejeon Regional 2011

2008, 2007 Annual Honor Reward, by Seoul National University

2008 2nd prize, The 27th University Students Contests of Mathematics, by Korean Math Society

2005 Gold prize, 19th Korean Mathematical Olympiad, by Korean Math Society

Language

Natural language	Korean(native), English
Computer language	C++, R, Matlab, C, Ocaml, LATEX, Python, Scheme, SAS, Java, Fortran