

VIJAY KUMAR

POSTDOCTORAL RESEARCH SCIENTIST · COLUMBIA UNIVERSITY MAILMAN SCHOOL OF PUBLIC HEALTH

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Education

Ph.D., M.S. Mathematics (Statistics & Data Science Track)

2018 - 2023

Clarkson University

Potsdam, NY - USA

- Advisor: Dr. Sumona Mondal & Dr. Suresh Dhaniyala

Dissertation: Statistical Learning and Modeling of Low-Cost Air Quality Sensor Data and Epidemiological Analysis

M.S. Applied Data Science

2022 - 2023

Clarkson University

Potsdam, NY - USA

- Advisor: Dr. Boris Jukic

M.S. Applied Mathematics

2013- 2015

NED University of Engineering and Technology

Karachi, Pakistan

- Advisor: Dr. Muhammad Jamil

B.S. Mathematics

2009 - 2012

University of Sindh

Jamshoro, Pakistan

Professional Experience

Aug 2023 – **Postdoctoral Research Scientist, Columbia University**, Machine Learning & Data Science, New York, NY, USA

2022–2023 **Adjunct Instructor, Clarkson University**, Mathematics, Potsdam, NY, USA

2022–2023 **Coordinator, NSF MBioTS Summer REU, Clarkson University**, Mathematics, Potsdam, NY, USA

2018–2022 **Graduate Teaching Assistant, Clarkson University**, Mathematics, Potsdam, NY, USA

2016–2018 **Lecturer, SMI University**, Artificial Intelligence & Mathematical Sciences, Karachi, Pakistan

2013–2016 **Lecturer, NED University of Engineering and Technology**, Mathematics, Karachi, Pakistan

Publications

[†] equally contributing first author, * corresponding author; ⁺ mentored undergraduate or graduate student

PEER REVIEWED PUBLICATIONS

Vijay Kumar*, Shantanu Sur, Dinushani Senarathna, Supraja Gurajala, Suresh Dhaniyala, and Sumona Mondal*. Quantifying impact of correlated predictors on low-cost PM_{2.5} sensor data using KZ-filter. *Frontiers in Applied Mathematics and Statistics: Statistics*, November 2024.

Irfan Yaqoob⁺, **Vijay Kumar**, and Shafique Chaudhry. Machine Learning Calibration of Low-Cost Sensor PM_{2.5} data. *Proceedings in 2024 IEEE International Symposium on Systems Engineering (ISSE)*. October 2024.

Jaime Benavides, Sabah Usmani, **Vijay Kumar**, and Marianthi-Anna Kioumourtzoglou. Development of a Community Severe Index for urban areas in the United States: A case study in New York City. *Environment International*, February, (2024): 108526.

Vijay Kumar, Dinushani Senarathna, Supraja Gurajala, William Olsen, Shantanu Sur, Sumona Mondal, and Suresh Dhaniyala. Spectral Analysis Approach for Assessing Accuracy of a Low-Cost Air Quality Sensor Network Data. *Atmospheric Measurement Techniques*, 21 (2023): 5415427.

Mohammad Meysami, **Vijay Kumar**, Mckayah Pugh⁺, Samuel Thomas Lowery⁺, Shantanu Sur, Sumona Mondal, and James Martin Greene. Utilizing logistic regression to compare risk factors in disease modeling with imbalanced data: a case

study in vitamin D and cancer incidence. *Frontiers in Oncology*, 13 (2023): 1227842.

Chaipitakporn Chaya[†], Prashant Athavale[†], **Vijay Kumar**, Thevasha Sathiyakumar, Marko Budišić, Shantanu Sur, and Sumona Mondal. COVID-19 in the US during pre-vaccination period: Shifting impact of sociodemographic factors and air pollution. *Frontiers in Epidemiology* 2 (2022): 927189.

Partohaghighi Mohammad, **Vijay Kumar**, and Ali Akgül. Comparative study of the fractional-order crime system as a social epidemic of the USA scenario. *International Journal of Applied and Computational Mathematics* 8, no. 4 (2022): 190.

Mondal Sumona[†], Chaya Chaipitakporn^{†+}, **Vijay Kumar**, Bridget Wangler⁺, Supraja Gurajala, Suresh Dhaniyala, and Shantanu Sur. COVID-19 in New York state: Effects of demographics and air quality on infection and fatality. *Science of The Total Environment* 807 (2022): 150536.

Vijay Kumar[†], Prashant Athavale[†], Jeremy Clark⁺, Sumona Mondal, and Shantanu Sur. Differential impact of COVID-19 risk factors on ethnicities in the United States. *Frontiers in Public Health* 9 (2021): 743003.

Jamil, Muhammad, **Vijay Kumar**, Muhammad Zafarullah, and Azam Khan. Fractionalized magnetohydrodynamics (MHD) of the Maxwell fluid through porous cylinders. *Special Topics & Reviews in Porous Media: An International Journal* 12, no. 6 (2021).

IN REVIEW

Jaime Benavides, Carlos Carrillo-Gallegos, **Vijay Kumar**, Lawrence G. Chillrud, John Paisley, Brent Coull, Arlene Fiore, Marianthi-Anna Kioumourtzoglo. BNER - A collaborative workflow for air quality modeling and uncertainty characterization using the Bayesian Nonparametric Ensemble. *Journal of Environmental Management*, October 2024.

SUBMITTED

Vijay Kumar[†], Dinushani Senarathna[†], Supraja Gurajala, Suresh Dhaniyala, Shantanu Sur, and Sumona Mondal. Correction models for estimation of PM_{2.5} from low-cost sensor data: Effects of distance and sensor numbers. *International Journal of Data Science and Analytics*, November 2024.

IN PREPARATION

Vijay Kumar, Jaime Benavides, Carlos Carrillo-Gallegos, Lawrence G. Chillrud, John Paisley, Brent Coull, Arlene Fiore, Marianthi-Anna Kioumourtzoglo. Bayesian Nonparametric Ensemble (BNE), Machine Learning algorithm for US-wide predictions of high spatiotemporal 1x1 km daily PM_{2.5} concentrations.

Vijay Kumar, Xiao Wu, Marianthi-Anna Kioumourtzoglo. A simulation study analyzing the impact of differential exposure measurement error of air pollution on preterm birth

Sheida Habibi⁺, Ajay Kumar⁺, Thevasha Sathiyakumar, Shantanu Sur, Sumona Mondal, and **Vijay Kumar**^{*}. Pre- and post-lockdown NO₂ and mobility trends in high-populated U.S. counties.

Vijay Kumar, Garima Raheja, Daniel M Westervelt, Marianthi-Anna Kioumourtzoglo. Bayesian Correction model for low-cost sensor PM_{2.5} smoke data

PRE-PRINTS

Vijay Kumar, Dinushani Senarathna, Supraja Gurajala, William Olsen, Shantanu Sur, Sumona Mondal, and Suresh Dhaniyala. Understanding the source components captured by the Purple Air Network. *ChemRxiv: Earth, Space, and Environmental Chemistry*, January, 2023.

Mondal Sumona, Chaya Chaipitakporn, **Vijay Kumar**, Bridget Wangler, Supraja Gurajala, Suresh Dhaniyala, and Shantanu Sur. COVID-19 in New York state: Effects of demographics and air quality on infection and fatality. *medRxiv*, February, 2021.

Professional Development

WORKSHOPS & TRAININGS

- Participant at the workshop on *Data-driven Modeling and Prediction of Rare and Extreme Events*. November 2024. Data Science Institute, University of Chicago, Chicago, IL, USA.

- Presenter and participant at the workshop on *SPATIAL DATA SCIENCE FOR THE ENVIRONMENT*. October 2024. Mesa Lab at NCAR, Boulder, CO, USA.
- Participant at the workshop on the *Industrialization of SciML*. March 2024. Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, Providence, RI, USA.
- Presenter and participant at the workshop on *EnviBayes Workshop on Complex Environmental Data*. September 2022. Colorado State University, Fort Collins, CO, USA.
- Participant at the *Intermediate Webinar: Satellite Data for Air Quality Environmental Justice and Equity Applications*. August 2023. NASA Applied Remote Sensing Training (ARSET) program, and Health and Air Quality Applied Science Team (HAQAST), USA.
- Participant at the workshop on *Ensemble Learning with Bayesian Additive Regression Trees*. June 2023. Medical College of Wisconsin (MCW), Milwaukee, WI, USA.
- Participant at the workshop on *Using UST Finder in Identifying UST Locations, Impacts on Drinking Water Supplies, and Climate Change Impacts*. April 2023. U.S. EPA's Tools & Resources Webinar Series, USA.
- Participant at workshop on *Clarkson University's Graduate Leadership Development Program*. February - April, 2022. Clarkson University, Potsdam, NY, USA.
- Participant at the workshop on *Clarkson – SRIHR-ICMR Indo-US Training Workshop on Low-Cost Air Quality Sensors and Related Data Analytics*. August 2019. Clarkson University, Potsdam, NY, USA.
- Participant at workshop on *Scientific Writing*. February 2016. University of Karachi, Karachi, Pakistan.

Presentations

* presenting author; + mentored undergraduate or graduate student

INVITED TALKS

March 2024, *Data Science Approach to Monitoring and Exposure Analysis of Air Pollution*, David A Walsh Arts and Science Seminar, Clarkson University, Potsdam, NY, USA.

February 2024, *Panelist for Balancing Act: Climate Mitigation and Adaption*, Conference on Climate Crisis in Pakistan, PSA Columbia University, New York, NY, USA.

October 2022, *Session Co-Chair during Session 11 of the Instrumentation and Methods (IIM)*, 40th Annual Conference by American Association for Aerosol Research (AAAR), Raleigh, NC, USA.

SELECTED PRESENTATIONS (ORAL & POSTER)

Vijay Kumar, Jaime Benavides, Carlos Carrillo-Gallegos, Arlene Fiore, John Paisley, Marianthi-Anna Kioumourtzoglou. Oct 2024. Bayesian Nonparametric Ensemble (BNE) algorithm for predictions of high spatiotemporal PM_{2.5} concentrations. 15th Annual Machine Learning Symposium, New York Academy of Medicine, NY, USA

Vijay Kumar, Xiao Wu, Marianthi-Anna Kioumourtzoglou. August 2024. A simulation study analyzing the impact of differential exposure measurement error of air pollution on preterm birth. 36th Annual Conference of the International Society for Environmental Epidemiology (ISEE), Santiago, Chile.

Vijay Kumar, Jaime Benavides, Carlos Carrillo-Gallegos, Arlene Fiore, John Paisley, Marianthi-Anna Kioumourtzoglou. June 2024. Bayesian Nonparametric Ensemble (BNE) models for Air Quality predictions. Health and Air Quality Applied Science Team (HAQAST) meeting, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA.

Vijay Kumar, Xiao Wu, Marianthi-Anna Kioumourtzoglou. May 2024. A simulation study analyzing the impact of differential exposure measurement error of air pollution on preterm birth, 2024 Postdoctoral Research Symposium, Columbia University New York, NY, USA.

Vijay Kumar, Jaime Benavides, Carlos Carrillo-Gallegos, Arlene Fiore, John Paisley, Marianthi-Anna Kioumourtzoglou. April 2024. Bayesian Nonparametric Ensemble (BNE) algorithm for predictions of high spatiotemporal PM_{2.5} concentrations. Data Science Day 2024, Columbia University, New York, NY, USA.

Olivia Varricchione⁺, Alexander Heywood⁺, **Vijay Kumar**. July 2023. Adverse effects as a predictor of tumor response in maintenance therapy of advanced lung cancer by Pemetrexed and Bevacizumab, Clarkson University, Research, and Projects Showcase (RAPS), Potsdam, NY, USA.

Vijay Kumar, Dinushani, Senarathna, Supraja, Gurajala, William Olsen, Shantanu Sur, Sumona Mondal, Suresh Dhaniyala. April 2023. Spectral analysis approach for assessing the accuracy of low-cost air quality sensor network data. Probability and Statistics Day, University of Maryland, Baltimore County, MD, USA.

Vijay Kumar, Dinushani, Senarathna, Supraja, Gurajala, Shantanu Sur, Sumona Mondal, Suresh Dhaniyala. October 2022. Understanding the source components captured by the Purple Air Network. 40th Annual Conference by American Association for Aerosol Research, Raleigh, NC, USA.

Samuel Lowery ⁺⁺, McKayah Pugh⁺, **Vijay Kumar**. July 2022. A statistical analysis of the effect of vitamin D on cancer incidence and mortality, Clarkson University, Research, and Projects Showcase, Potsdam-NY, USA.

Dawit Gebremichael⁺⁺, **Vijay Kumar**, Prashant Athavale, Shantanu Sur, Sumona Mondal. March 2022. Ethnic Differences in COVID-19 infection and mortality rates during the second wave in the United States. Mathematics Conference and Competition of Northern New York (MCCNNY), Clarkson University, Potsdam, NY, USA.

Vijay Kumar, Prashant Athavale, Jeremy Clark⁺, Shantanu Sur, Sumona Mondal. March 2022. Differential Impact of COVID-19 Risk Factors on Ethnicities in the United States. Mathematics Conference and Competition of Northern New York (MCCNNY), Clarkson University, Potsdam, NY, USA.

Vijay Kumar, Dinushani Senarathna, Suresh Dhaniyala, Shantanu Sur, Supraja Gurajala, Sumona Mondal. October 2021. Spatiotemporal Analysis of PM_{2.5} in Chicago using Data from EPA and Low-Cost Sensor Network, 39th Annual Virtual Conference by American Association for Aerosol Research, USA.

Dinushani Senarathna, **Vijay Kumar**, Suresh Dhaniyala, Shantanu Sur, Supraja Gurajala, Sumona Mondal. October 2021. Performance of Correction Models for Accurate PM_{2.5} Estimation from Low-Cost Air Quality Sensor Data, 39th Annual Virtual Conference by American Association for Aerosol Research, USA.

Isaac Kiiza⁺⁺, Dawit Gebremichael⁺, **Vijay Kumar**, Prashant Athavale, Shantanu Sur, Sumona Mondal. April 2021. COVID-19 among various ethnic groups in the United States: Differential impact of risk factors. Research and Project Showcase (RAPS) at Clarkson University, NY, USA.

Vijay Kumar, Bridget Wangler, Chaya Chaipitakporn, Shantanu Sur, Supraja Gurajala, Suresh Dhaniyala, Sumona Mondal. October 2020. Infection vs Fatality of COVID-19 in New York State: Effect of Demographics and Poor Air Quality, 38th Annual Virtual Conference by American Association for Aerosol Research, USA.

Vijay Kumar, Vitt Patel, Dr. Shantanu Sur, Dr. Suresh Dhaniyala, Dr. Supraja Gurajala, Dr. Sumona Mondal. April 2019, Air Quality prediction using LUR Model: Parameter Reduction and Optimization, 13th Annual Probability & Statistics Day, University of Maryland, Baltimore County, MD, USA.

Vijay Kumar, Muhammad Jamil, December 2015. Effect of MHD on fractionalized Maxwell fluid between coaxial cylinders, NED University of Engineering and Technology, First International Conference on Chemical and Material Processing, Karachi Pakistan.

Awards, Fellowships, & Grants

RESEARCH GRANTS

2024 **NSF ACCESS Accelerate Allocation**, National Science Foundation, 750,000
ACCESS Credits to access NSF-funded Supercomputers

Role: PI

TRAVEL GRANTS

Nov 2024	NSF funded Travel Grant , Data Science Institute, University of Chicago
Oct 2024	NSF funded Travel Grant , National Center for Atmospheric Research, Boulder, Colorado
March 2024	NSF funded Travel Grant , Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University
Oct 2023	NSF funded Travel Grant , Colorado State University, Fort Collins
Aug 2023	Student Travel Grant , American Statistical Association
Aug 2023	Graduate Student Travel Grant , Clarkson University
Oct 2022	Student Travel Grant , American Aerosol Association for Aerosol Research
Oct 2021	Student Grant , American Aerosol Association for Aerosol Research
Oct 2020	Student Grant , American Aerosol Association for Aerosol Research

AWARDS

2023	Phalanx Leadership Award , Phalanx, Highest Honorary Society, Clarkson University
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FELLOWSHIPS/SCHOLARSHIPS

2016	Postgraduate Fellowship , SISSA, Trieste, Italy
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Mentoring

GRADUATE STUDENTS

Spring 2024-	Irfan Yaqoob , Ph.D. student in Computer Science	<i>Clarkson University</i>
2023-2024	Sheida Habibi , MS student in Applied Data Science, David D. Reh School of Business	<i>Clarkson University</i>
2023-2024	Indu Dharavath , MS student in Applied Data Science, David D. Reh School of Business	<i>Clarkson University</i>

UNDERGRADUATE STUDENTS

Summer 2023	Olivia Varricchione , Undergraduate in Mathematics, NSF MBioTS REU	<i>Clarkson University</i>
Summer 2023	Alexander Heywood , Undergraduate in Biology, NSF MBioTS REU	<i>Clarkson University</i>
Summer 2023	Anant Bansal , The Clarkson School	<i>Clarkson University</i>
Summer 2022	McKayah Pugh , Undergraduate in Mathematics, NSF MBioTS REU	<i>Clarkson University</i>
Summer 2022	Samuel Lowery , Undergraduate in Mathematics, NSF MBioTS REU	<i>Clarkson University</i>
2021-2022	Dawit Gebremichael , McNair Scholar	<i>Clarkson University</i>
2021-2022	Isaac Kiiza , McNair Scholar	<i>Clarkson University</i>
2020-2021	Jeremy Clark , Undergraduate in Computer Science	<i>Clarkson University</i>
2019-2020	Bridget Wangler , Undergraduate in Engineering & Management	<i>Clarkson University</i>

Services & Outreach

REVIEWER

- Journal of Atmospheric Environment
- International Society for Environmental Epidemiology (ISEE) - 2024

SERVICE AND OUTREACH

2022-2023	Pakistani Student Association , Founding Member & President	<i>Clarkson University</i>
2018	Science Fair , Volunteer Judge	<i>SUNY Potsdam</i>

Teaching Experience

Fall 2022 - Spring 2023	Basic Calculus , Instructor	Clarkson University
Fall 2021 - Spring 2022	Probability and Statistics , Teaching Assistant	Clarkson University
Spring 2021	Calculus II , Teaching Assistant	Clarkson University
Fall 2020	Calculus I , Teaching Assistant	Clarkson University
Spring 2020	Fourier Series and Boundary Value Problems , Teaching Assistant	Clarkson University
Fall 2019	Advance Engineering Mathematics , Teaching Assistant	Clarkson University
Fall 2017 – 2018	Statistical Tools, MS classes , Instructor	SMI University
Spring 2017 – 2018	Business Mathematics , Instructor	SMI University
Fall 2017 - Spring 2018	Inferential Statistics , Instructor	SMI University
Fall 2016 - Spring 2017	Descriptive Statistics , Instructor	SMI University
Fall 2016 - Spring 2018	General Mathematics , Instructor	SMI University
Fall 2016	Mathematical Methods II , Instructor	SMI University
Fall 2016	Calculus & Analytical Geometry , Instructor	SMI University
Spring 2016	Numerical Methods Labs , Instructor	NED University
Spring 2016	Probability and Statistics , Instructor	NED University
Fall 2015	Calculus & Complex Variables and Fourier Analysis , Instructor	NED University
Spring 2015	Calculus & Mathematics for Architects , Instructor	NED University
Fall 2014	Calculus & Differential Equations , Instructor	NED University
Spring 2014	Calculus , Instructor	NED University

Professional Memberships

- Inducted Member-2023, Phalanx, Highest Honorary Society, Clarkson University
- American Statistical Association (ASA)
- Society for Industrial and Applied Mathematics (SIAM)
- American Mathematical Society (AMS)
- The American Association for Aerosol Research (AAAR)
- International Society for Environmental Epidemiology (ISEE)

Research Interest

METHODS & THEORY

- Machine Learning
- Data Science
- Statistics

APPLICATION AREAS

- Spatio-temporal Data
- Heath Data Science
- Environmental Epidemiology

Skills

SOFT SKILLS

- Interdisciplinary Collaboration
- Project Management
- Adaptability

TECHNICAL

- R, Matlab, Python
- SQL, GIS, Tableau
- Linux, High Performance Computing