VIJAY KUMAR, Ph.D.

Postdoctoral Research Scientist · Columbia University Mailman School of Public Health

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Education

Ph.D., MS 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

MS Applied Data Science *2022 - 2023*
Clarkson University *Potsdam, NY - USA*
- Advisor: Dr. Boris Jukic

MS Applied Mathematics *2013- 2015*
NED University of Engineering and Technology *Karachi, Pakistan*
- Advisor: Dr. Muhammad Jamil

BS Mathematics *2009 - 2012*
University of Sindh *Jamshoro, Pakistan*

Professional Experience

August 2023-	**Postdoctoral Research Scientist**, Environmental Health Sciences, Columbia University, New York, NY, USA
2022-2023	**Graduate Student Coordinator, NSF MBioTS Summer REU**, Mathematics, Clarkson University, Potsdam, NY, USA
2022-2023	**Adjunct Instructor**, Mathematics, Clarkson University, Potsdam, NY, USA
2018-2022	**Graduate Teaching Assistant**, Mathematics, Clarkson University, Potsdam, NY, USA
2016-2018	**Lecturer**, Artificial Intelligence & Mathematical Sciences, SMI University, Karachi, Pakistan
2013-2016	**Lecturer**, Mathematics, NED University of Engineering and Technology, Karachi, Pakistan

Awards, Fellowships, & Grants

TRAVEL GRANTS

2024	**NSF funded Travel Grant**, American Statistical Association, Mesa Lab at NCAR, Boulder Colorado
2024	**NSF funded Travel Grant**, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University
2023	**NSF funded Travel Grant**, Colorado State University, Fort Collins
2023	**Student Travel Grant**, American Statistical Association
2023	**Graduate Student Travel Grant**, Clarkson University
2022	**Student Travel Grant**, American Aerosol Association for Aerosol Research
2021	**Student Grant**, American Aerosol Association for Aerosol Research
2020	**Student Grant**, American Aerosol Association for Aerosol Research

AWARDS

2023	**Phalanx Leadership Award**, Phalanx, Highest Honorary Society, Clarkson University

FELLOWSHIPS/SCHOLARSHIPS

2016	**Postgraduate Fellowship**, SISSA, Trieste, Italy	

Mentoring

Graduate Students

2024-	**Irfan Yaqoob**, Ph.D. student in Computer Science	*Clarkson University*
2023-2024	**Sheida Habibi**, MS student in Applied Data Science, David D. Reh School of Business	*Clarkson University*
2023-2024	**Indu Dharavath**, MS student in Appied Data Science, David D. Reh School of Business	*Clarkson University*

Undergraduate Students

Summer 2023	**Olivia Varricchione**, Undergraduate in Mathematics, NSF MBioTS REU	*Clarkson University*
Summer 2023	**Alexander Heywood**, Undergraduate in Biology, NSF MBioTS REU	*Clarkson University*
Summer 2022	**McKayah Pugh**, Undergraduate in Mathematics, NSF MBioTS REU	*Clarkson University*
Summer 2022	**Samuel Lowery**, Undergraduate in Mathematics, NSF MBioTS REU	*Clarkson University*
2021-2022	**Dawit Gebremichael**, Undergraduate in Mathematics	*Clarkson University*
2021-2022	**Isaac Kiiza**, Undergraduate in Mathematics	*Clarkson University*
2020-2021	**Jeremy Clark**, Undergraduate in Computer Science	*Clarkson University*
2019-2020	**Bridget Wangler**, Undergraduate in Engineering & Management	*Clarkson University*

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	*Clarkson University*
2018	**Science Fair**, Volunteer Judge	*SUNY Potsdam*

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 2018 - Spring 2019	**Department of Mathematics**, Graduate Assistant	*Clarkson University*
Spring 2017 - Spring 2018	**Business Mathematics**, Instructor	*SMI University*
Fall 2016 - Spring 2018	**Inferential Statistics**, Instructor	*SMI University*
Fall 2016	**Calculus I**, 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 Development

Workshops & Trainings

- Presenter and participant at workshop on *SPATIAL DATA SCIENCE FOR THE ENVIRONMENT*. October 2024. Mesa Lab at NCAR, Boulder, CO, USA.
- Participant at 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 workshop on *EnviBayes Workshop on Complex Environmental Data.* September 202. Colorado State University, Fort Colins, CO, USA.
- Participant at *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 workshop on *Ensemble Learning with Bayesian Additive Regression Trees.* June 2023. Medical College of Wisconsin (MCW), Milwaukee, WI, USA.
- Participant at 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 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.

Publications

† *equally contributing first author,* * *corresponding author*

Peer Reviewed Publications

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).

Jaime Benavides, Sabah Usmani, **Vijay Kumar**, and Marianthi-Anna Kioumourtzoglou. Development of a Community Severance 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

Vijay Kumar*, Shantanu Sur, Dinushani Senarathna, Supraja Gurajala, Suresh Dhaniyala, and Sumona Mondal*. Quantifying impact of correlated predictors on low-cost air quality sensor data using KZ-filter. Frontiers in Applied Mathematics and Statistics: Mathematics of Computation and Data Science, January, 2024.

In Preparation

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

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 NO_2 and mobility trends in high-populated U.S. counties.

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.

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 (11IM)*, 40th Annual Conference by American Aerosol Association for Aerosol Research, Raleigh, NC, USA.

Contributed Presentations

Vijay Kumar, Xiao Wu, Marianthi-Anna Kioumourtzoglo. 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 Epidemiolog (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 Aerosol 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.

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 Aerosol 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 Aerosol Association for Aerosol Research, 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 Aerosol 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 Univerity of Engineering and Technology, First International Conference on Chemical and Material Processing, Karachi Pakistan.

Professional Memberships

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

Research Interest

Methods & Theory

- Machine Learning: Bayesian & Scientific
- Spatiotemporal Modeling
- Causal Inference
- Time Series Analysis

Application Areas

- Air Quality Modeling
- Environmental Epidemiology

References

1. **Name:** Marianthi-Anna Kioumourtzoglou, ScD (**PI**)
   Position: Associate Professor and Director of Ph.D. Program
   Institute: Department of Environmental Health Sciences, Columbia University, New York, NY, USA
   Office Address: 722 West 168th Street, New York, NY, USA - 10032
   Academic Website: https://www.publichealth.columbia.edu/profile/marianthi-anna-kioumourtzoglou
   Email: mk3961@cumc.columbia.edu

2. **Name:** John W Paisley, Ph.D. (**Co-PI**)
   Position: Associate Professor
   Institute: Department of Electrical Engineering, Columbia University, New York, NY, USA
   Office Address: 500 W. 120th St., Mudd 1310, New York, NY, USA - 10027
   Academic Website: https://www.columbia.edu/ jwp2128/
   Email: jwp2128@columbia.edu

3. **Name:** Daniel M. Westervelt, Ph.D. (**Collaborator**)
   Position: Associate Professor
   Institute: Lamont Associate Research Professor, Ocean and Climate Physics, Lamont-Doherty Earth Observatory (LDEO), Columbia Climate School, Columbia University, New York, NY, USA
   Office Address: 61 Route 9W, Palisades, NY 10964, USA
   Academic Website: https://www.ldeo.columbia.edu/ danielmw/
   Email: danielmw@ldeo.columbia.edu

4. **Name:** Arlene Fiore, Ph.D. (**Collaborator**)
   Position: Peter H. Stone and Paola Malanotte Stone Professor
   Institute: Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA
   Office Address: 77 Massachusetts Avenue, 54-1312, Cambridge, MA, USA - 02139
   Academic Website: https://www.teampaccc.mit.edu/
   Email: amfiore@mit.edu

5. **Name:** Sumona Mondal, Ph.D. (**Ph.D. Advisor**)
   Position: Professor of Statistics
   Institute: Department of Mathematics Clarkson, University, Potsdam, USA
   Office Address: 8 Clarkson Avenue, Potsdam, NY, USA - 13699
   Academic Website: https://sumonamondal.github.io/
   Email: smondal@clarkson.edu

6. **Name:** Suresh Dhaniyala, Ph.D. (**Ph.D. Advisor**)
   Position: Bayard D. Clarkson Distinguished Professor / Co-Director of CAARES
   Institute: Department of Mechanical & Aerospace Engineering, Clarkson University, Potsdam, USA
   Office Address: 8 Clarkson Avenue, Potsdam, NY, USA - 13699
   Academic Website: https://www.clarkson.edu/people/suresh-dhaniyala
   Email: sdhaniya@clarkson.edu