Abhishek Anand

Lamont-Doherty Earth Observatory, Palisades, NY 10964

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Current Position

Columbia University New York City, NY

Postdoctoral Research Scientist, Lamont-Doherty Earth Observatory *November 2024-Present*

- Leveraging remote sensing air pollution datasets (from NASA and European satellite fleets) and low-cost ground-based sensors to build machine learning algorithms for estimating highly accurate particulate pollutant concentrations and health exposures in sub-Saharan Africa.

Education

Carnegie Mellon University Pittsburgh, PA

Doctor of Philosophy in Mechanical Engineering *May 2024*

Dissertation: "Low-cost Techniques to Measure and Predict Air Pollution Exposure"
Advisor: Prof. Albert Presto
GPA: 4.0/4.0

Hong Kong University of Science and Technology Hong Kong

Master of Philosophy, Environmental Science, Policy and Management *August 2020*

GPA: 4.03/4.3

Hong Kong University of Science and Technology Hong Kong

Master of Science, Environmental Engineering and Management *May 2017*

GPA: 4.12/4.3; Program rank: 1 (Class strength: 90 students)

Indian Institute of Technology Delhi New Delhi, India

Bachelor of Technology in Civil Engineering *May 2015*

GPA: 3.72/4.0 (WES Official Evaluation)

Research Experience

Carnegie Mellon University Pittsburgh, PA

Postdoctoral Research Associate, Prof. Albert Presto *May 2024-August 2024*

- Analyzed large datasets from instruments at the Pittsburgh site of Atmospheric Science and Chemistry mEasurement NeTwork (ASCENT), a network for high-time-resolution and long-term measurement in the U.S. for characterization of aerosol chemical composition.

Carnegie Mellon University Pittsburgh, PA

Ph.D. Student, Prof. Albert Presto *August 2020-May 2024*

- Leveraged existing beta attenuation monitors (BAMs) to measure hourly black carbon using image processing to help identify emission sources and evidence-based policymaking in Africa.
- Developed a deep learning-based $PM_{2.5}$ forecast model for Pittsburgh using air pollution and meteorological covariates from NASA's GEOS-CF model and aerosol optical depth from MODIS satellite instrument. We used a low-cost sensor network $PM_{2.5}$ data as ground truth.

Hong Kong University of Science and Technology Hong Kong

M.Phil. Student, Prof. Zhi Ning *August 2018- July 2020*

- Technology development and validation of a remote and compact drone-based sniffer sensor system to identify high emitting ships by measuring their fuel sulfur content (FSC). FSC values were calculated using ship plume SO_2 and CO_2measurements from the sensor systems.

Hong Kong University of Science and Technology Hong Kong

Research Assistantship, Prof. Zhi Ning *June 2018-August 2018*

- Impact of cross-sensitivity and environmental factors on performance of low-cost gaseous pollutant sensors. The sensors included Alphasense electrochemical gas sensors (CO, NO, NO_2, O_3 and SO_2) and NDIR (Non-Dispersive Infrared) CO_2 sensors.

Hong Kong University of Science and Technology Hong Kong
Research Assistantship, Prof. Guang-Hao Chen *June 2017-May 2018*
- Mitigating sulfide interference for accurate BOD and COD estimation of brackish wastewater.

Hong Kong University of Science and Technology Hong Kong
M.Sc. Student, Prof. Irene Man Chi Lo *August 2016-May 2017*
- Synthesis of visible-light-driven magnetic titanium oxide (TiO_2) - based nanophotocatalysts for degradation of persistent organic pollutants in wastewater.

Indian Institute of Technology Delhi New Delhi, India
Research Assistantship, Prof. Saroj Kanta Mishra *June 2015-July 2016*
- Analytical study of effects of geographical locations and sizes of mountains on the Indian Monsoon by simulating an Aqua planet on Community Atmosphere Model (v3.0).

Publications

- **Anand, A.**, Farimani, A. B., Presto, A., et al. Forecasting $PM_{2.5}$ in Pittsburgh: A deep learning approach using GEOS-CF outputs and MODIS AOD. (*Under Preparation*)
- Owusu-Tawiah, V., Annor, T., Muthee, C., Keller, C. A., **Anand, A.**, et al. Evaluation and bias correction of GEOS-CF model for $PM_{2.5}$ predictions in sub-Saharan Africa using machine learning. (*Under review in *Atmospheric Chemistry and Physics**)
- **Anand, A.**, Touré, N. D. E., Bahino, J., Gnamien, S., Hughes, A. F., Arku, R. E., ... & Presto, A. A. Low-cost hourly black carbon measurements at multiple cities in Africa. *Environmental Science & Technology*. 2024.
- Wei, P., Hao, S., Shi, Y., **Anand, A.**, et al. Combining Google traffic map with deep learning model to predict street-level traffic-related air pollutants in a complex urban environment. *Environment International*. 2024.
- **Anand, A.**, Kompalli, S., Ajiboye, E., & Presto, A. A. Estimation of hourly black carbon aerosol concentrations from glass fiber filter tapes using image reflectance-based method. *Environmental Science: Atmosphere*. 2023.
- Wei, P., Brimblecombe, P., Yang, F., **Anand, A.**, et al. Determination of local traffic emission and non-local background source contribution to on-road air pollution using fixed-route mobile air sensor network. *Environmental Pollution*. 2021.
- Wei, P., Sun, L., **Anand, A.**, Zhang, Q., et al. Development and evaluation of a robust temperature sensitive algorithm for long term NO_2 gas sensor network data correction. *Atmospheric Environment*. 2020.
- **Anand, A.**, Wei, P., et al. Protocol development for real-time ship fuel sulfur content determination using drone-based plume sniffing microsensor system. *Science of The Total Environment*. 2020.

Fellowships and Awards

- US Student Travel Grant recipient for AAAR 2023 conference 2023
- Philip and Marsha Dowd Fellowship, College of Engineering, CMU 2022-2023
- Milton Shaw Ph.D. Research Award, Department of Mechanical Engineering, CMU 2022
- Postgraduate Studentship for the M.Phil. study at HKUST 2018-2020
- HKUST awardee for the 8th Global Young Scientists Summit, National Research Foundation, Prime Minister's Office, Singapore 2020
- University Grants Committee Research Travel Grant, HKUST 2019
- Division of Environment and Sustainability Research Travel Grant by HKUST 2019
- Hong Kong Government Innovation and Technology Fund Internship Award 2018
- M.Sc. Excellent Student Scholarship, School of Engineering, HKUST 2017
- Champion Award, BESTo camp, HKUST Entrepreneurship Center 2017
- Entrance Scholarship, School of Engineering, HKUST 2016
- Ministry of Human Resources Development Scholarship, IIT Delhi 2011-2015

Invited Talks

- **Anand, A.**, Presto, A., et al. Long-term measurement of atmospheric black carbon at multiple African cities using low-cost image processing-based method: A potential method for NASA's MAIA mission. *NASA's Jet Propulsion Laboratory*, Pasadena, CA. 2024
- **Anand, A.**, Presto, A., et al. Low-cost methods for measurement of $PM_{2.5}$ composition at African cities by exploiting existing Beta Attenuation Monitors. *Air Sensors International Conference*, Riverside, CA. 2024

Conference Presentations

- **Anand, A.**, Presto, A., et al. Estimation of Total and Biomass-Based BC at African Cities by Applying Image-Reflectance Method on BAM Tapes. *American Association for Aerosol Research*, Albuquerque, NM. 2024.
- **Anand, A.**, Presto, A., Farimani, A. B. Development of an improved deep learning-based $PM_{2.5}$ model for predicting high pollution episodes in Pittsburgh by leveraging GEOS-CF atmospheric composition data. *American Geophysical Union*, San Francisco, CA. 2023.
- **Anand, A.**, Presto, A., Farimani, A. B. Developing a machine learning-based daily $PM_{2.5}$ forecast model with GEOS-CF and land use parameters. *American Association for Aerosol Research*, Portland, OR. 2023.
- **Anand, A.**, Kompalli, S. P., et al. Black carbon measurements in multiple cities of sub-Saharan Africa with low-cost image reflectance method. *American Association for Aerosol Research*, Portland, OR. 2023.
- **Anand, A.**, Presto, A., Kompalli, S. P., et al. Hourly black carbon measurements in Africa using cell phone camera images. *American Geophysical Union*, Chicago, IL. 2022.
- **Anand, A.**, Presto, A., Kompalli, S. P., et al. Low-Cost black carbon detection from Beta Attenuation Monitors using image reflectance-based method. *American Association for Aerosol Research*, Raleigh, NC. 2022.
- Kim, S., **Anand, A.**, Rajan, P. E., Presto, A. Comparison of organic aerosol composition and source distributions across different urban environments. *American Association for Aerosol Research*, Raleigh, NC. 2022.
- **Anand, A.**, Presto, A., Kompalli, S. P., et al. Estimation of hourly BC from BAM tapes using image reflectance-based method. Air Sensors International Conference, Pasadena, CA. 2022.
- **Anand, A.**, Gali, N. K., Yang, F., et al. Laboratory calibration, validation and protocol development to use UAV borne sensor system for fuel sulfur content-based field screening of OGVs. *Global Young Scientists Summit*, Singapore. 2020.
- **Anand, A.**, Gali, N. K., Westerdahl, et al. Technology development and evaluation of an ultra-compact ship fuel Sulfur sniffing sensor system. *Freight and Environment: Ports of Entry*, Newark, NJ. 2019.
- Ning, Z., **Anand, A.**, Gali, N. K., et al. Protocol Development of using Sniffing Method to Identify High Sulfur Fueled Ships. *Freight and Environment: Ports of Entry*, Newark, NJ. 2019.

Teaching and Advising Experience

Future Faculty Career Fellow, Carnegie Mellon University 2020-2024
Designed to help early career researchers develop their teaching skills for a faculty career.

Teaching Assistant, Carnegie Mellon University
Renewable Energy Engineering – 24-792 (Professor Albert Presto) Spring 2023
Fluid Mechanics – 24-231 (Dr. Grigorios Panagakos) Spring 2022

Peer Tutor for Undergraduate Students, Carnegie Mellon University 2022-2023
Physics I for Science Students (33121), Physics II for Biological Sciences and Chemistry Students (33122), Physics I for Engineering Students (33141), Physics II for Engineering and Physics Students (33142), Calculus (21111-122), Differential Equations (21260)

Teaching Assistant, Hong Kong University of Science and Technology
- GIS for Environmental Professionals – EVSM5240 (Prof. Jimmy Chang) — Fall 2019
- Carbon Emission Trading – ENVR6090A (Prof. Michael Edesess) — Spring 2019

Undergraduate Research Mentor, Carnegie Mellon University
- Ria Sharma - Undergraduate student, Mechanical Engineering — Summer 2023
- Jordan Petzold - Undergraduate student, Mechanical Engineering — Summer 2023
- Jocelyn Kiefel - Undergraduate student, Mechanical Engineering — Summer 2023
- Shaborn Leggette - Undergraduate student, Mechanical Engineering — Summer 2023
- Max Labovitz - Undergraduate student, Mechanical Engineering — Summer 2022

Graduate Research Mentor, Carnegie Mellon University
- Aziz Bhetasiwala - Master's student, Mechanical Engineering — Fall 2023 - August 2024
- Ria Sharma - Master's student, Mechanical Engineering — Fall 2023

Academic Service

President, AAAR Student Chapter, Carnegie Mellon University — 2023-2024
Led the student chapter of the American Association for Aerosol Research (AAAR), coordinating events, guest lectures, workshops, and community outreach to promote aerosol science at Carnegie Mellon University.

Coordinator, CAPS Seminar, Carnegie Mellon University — 2022-2023
Organized weekly seminars at the Centre for Atmospheric Particle Studies (CAPS) for lab members and guest speakers to present their research and foster collaborative discussions.

Core Committee member, CAPS Lab, Carnegie Mellon University — 2021-2022
As a part of CAPS laboratory committee, I organized safety trainings, managed instrument use schedules and lab inventories for disposables.

Reviewer Activities

Reviewer, Environmental Science and Pollution Research — 2023-Present
Associate Editor and Reviewer, Journal of Emerging Investigators — 2023-Present

Relevant Coursework

Probability, Machine Learning and Statistics, Carnegie Mellon University — 2020-2024
Introduction to Deep Learning for Engineers, Intermediate Deep Learning, Machine Learning and Artificial Intelligence for Engineers, Probability and Estimation Methods for Engineering Systems, Statistical Learning and Modeling.

Air Quality and Atmospheric Sciences
Air Quality Engineering at CMU; Atmospheric Dynamics at HKUST, Numerical Simulation of Atmospheric Phenomena at IIT Delhi

References

Prof. Albert Presto
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Prof. Peter Adams
Department Head and Professor
Engineering and Public Policy
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Dr. Hamish Gordon
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Chemical Engineering
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