

Matthew Stewart, PhD

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PROFESSIONAL EXPERIENCE

- Postdoctoral Fellow:** Harvard University, Cambridge, MA, United States JAN 2023 – PRESENT
- Managed and mentored undergraduate and graduate student projects in areas related to reinforcement learning, autonomous agents, language models for code optimization, on-device machine learning, and benchmarking of machine learning systems
 - Pioneered the machine learning sensor architecture to achieve more secure and privacy-focused intelligent sensor systems
 - Published and peer-reviewed articles in tier-one machine learning venues including FAccT, CACM, and NeurIPS

EDUCATION

- Harvard University:** Cambridge, MA, United States AUG 2017 – NOV 2022
- Ph.D. in Engineering Sciences with a secondary in Data Science NOV 2022
 - M.S. in Engineering Sciences; GPA: 3.83/4.0 MAY 2020
- Imperial College London:** London, United Kingdom SEP 2013 – JUN 2017
- Integrated BEng/MEng in Mechanical Engineering with a Year Abroad; GPA: 4.0/4.0 JUN 2017
 - Year Abroad: Completed at the National University of Singapore (NUS), Singapore

AWARDS AND RECOGNITION

- Kennedy Research Scholarship (Kennedy Memorial Trust, United Kingdom) SEP 2021
- The Derek Bok Center Distinction in Teaching Award (Harvard University, United States) SPRING 2018,19,21
Award given for achieving above a 4.5/5.0 in course evaluations
- Student Conference Poster Award (American Association for Aerosol Research) OCT 2019
- Stonington Endowment Graduate Fellowship (Harvard University, United States) 2018-2019
- Dean's List (Imperial College London, United Kingdom) 2013-2017

JOURNAL ARTICLES

- Prakash, S., **Stewart, M.**, Banbury, C., Mazumder, M., Warden, P., and Janapa Reddi, V., 2023. Is TinyML Sustainable? Assessing the Environmental Impacts of Machine Learning on Microcontrollers. *Communications of the ACM*. [\[link\]](#)
- **Stewart, M.**, and S. Martin, 2023. Machine Learning for Ionization Potential and Photoionization Cross-Section of Volatile Organic Compounds. *ACS Earth and Space Chemistry*. [\[link\]](#)
- **Stewart, M.**, McKinney, K. and Martin, S.T., 2023. Prediction of the Response of a Photoionization Detector to a Complex Gaseous Mixture of Volatile Organic Compounds Produced by α -Pinene Oxidation. *ACS Earth and Space Chemistry*. [\[link\]](#)
- Warden, P., **Stewart, M.**, Plancher, B., Sachin, K., and Janapa Reddi, V., 2022. Machine Learning Sensors: A Design Paradigm for the Future of Intelligent Sensors. *Communications of the ACM*. [\[link\]](#)
- Aruffo, E., Wang, J., Ye, J., Ohno, P., Qin, Y., **Stewart, M.**, McKinney, K., Di Carlo, P. and Martin, S.T., 2022. Partitioning of Organonitrates in the Production of Secondary Organic Aerosols from α -Pinene Photo-Oxidation. *Environmental Science & Technology*. [\[link\]](#)
- Levy, B. and **Stewart, M.**, 2021. The Evolving Ecosystem of COVID-19 Contact Tracing Applications. *Harvard Data Science Review*. [\[link\]](#)
- Janapa Reddi, V., Plancher, B., Kennedy, S., Moroney, L., Warden, P., Agarwal, A., Banbury, C., Banzi, M., Bennett, M., Brown, B., Chitlangia, S., Ghosal, R., Grafman, S., Jaeger, R., Krishnan, S., Lam, M., Leiker, D., Mann, C., Mazumder, M., Pajak, D., Ramaprasad, D., Smith, J. E., **Stewart, M.**, Tingley, D., 2021. Widening Access to Applied Machine Learning with TinyML. *Harvard Data Science Review*. [\[link\]](#)
- Krittanawong, C., Virk, H.U.H., Kumar, A., Aydar, M., Wang, Z., **Stewart, M.** and Halperin, J.L., 2021. Machine learning and deep learning to predict mortality in patients with spontaneous coronary artery dissection. *Scientific Reports*. [\[link\]](#)
- Zhao, T., Ye, J., Ribeiro, I., Ma, Y., Hung, H., Batista, C., **Stewart, M.**, Guimarães, P., Vilà-Guerau de Arellano, J., de Souza, R., Guenther, A. and Martin, S., 2021. River winds and pollutant recirculation near the Manaus city in the central Amazon. *Communications Earth & Environment*. [\[link\]](#)
- Ye, J., Batista, C.E., Zhao, T., Campos, J., Ma, Y., Guimarães, P., Ribeiro, I.O., Medeiros, A.S., **Stewart, M.**, Vilà-Guerau de Arellano, J. and Guenther, A.B., 2022. River Winds and Transport of Forest Volatiles in the Amazonian Riparian Ecoregion. *Environmental Science & Technology*. [\[link\]](#)
- Jason Yik et al., 2023. NeuroBench: A Framework for Benchmarking Neuromorphic Computing Algorithms and Systems. *Nature Communications*. Submitted. [\[arXiv\]](#)

CONFERENCE PAPERS

- Mayoral-Vilches, V., Jabbour, J., Hsiao, Y., Wan, Z., Martinez-Farina, A., Crespo-Alvarez, M., **Stewart, M.**, Reina-Munoz, J. M., Nagras, P., Vikhe, G., Neuman, S., Plancher, B., Reddi, V.J., Pinzger, M., and Rass, S., 2023. RobotPerf Benchmarks: An Open, Vendor-Agnostic Benchmarking Suite to Evaluate Robotics Computing Performance. International Conference on Robotics and Automation (ICRA) 2023. *Submitted*. [[arXiv](#)]

PREPRINTS AND TECHNICAL REPORTS

- Warden, P., **Stewart, M.**, Plancher, B., Banbury, C., Prakash, S., Chen, E., Asgar, Z., Katti, S. and Reddi, V.J., 2022. Machine Learning Sensors. arXiv preprint arXiv:2206.03266. [[arXiv](#)]
- **Stewart, M.**, Warden, P., Omri, Y., Prakash, S., Santos, J., Hymel, S., Brown, B., MacArthur, J., Jeffries, N., Plancher, B. and Reddi, V.J., 2023. Datasheets for Machine Learning Sensors. arXiv preprint arXiv: 2306.08848. [[arXiv](#)]

BOOK CHAPTERS

- **Stewart, M.**, and Martin, S., 2020. "Unmanned Aerial Vehicles: Fundamentals, Components, Mechanics, and Regulations." In Unmanned Aerial Vehicles. Hauppauge, New York: Nova Science Publishers. [[link](#)]
- **Stewart, M.**, and Martin, S., 2020. "Atmospheric Chemical Sensing by Unmanned Aerial Vehicles." In Unmanned Aerial Vehicles. Hauppauge, New York: Nova Science Publishers. [[link](#)]

POSTERS, WORKSHOPS, ABSTRACTS, AND OTHER

- Aruffo, E., Wang, J., Ye, J., Ohno, P., Qin, Y., **Stewart, M.**, McKinney, K., Di Carlo, P. and Martin, S.T., 2022. Impact of NOx in SOA and organonitrates production (No. EGU22-12952). Copernicus Meetings.
- Zhao, T., Ye, J., Ribeiro, I., Ma, Y., Hung, H.M., Batista, C., **Stewart, M.**, Silva, J., Godoi, R., Vilà-Guerau de Arellano, J. and de Souza, R., 2021, April. River Breezes in the Central Amazon: Cluster Analysis of Meteorological and Chemical Data Sets Collected by an Unmanned Aerial Vehicle. In EGU General Assembly Conference Abstracts (pp. EGU21-961).
- Sevostianov, V., **Stewart, M.**, Ye, J. and Martin, S.T., 2019. Sniffing Trees: a Photoionization Detector for Biogenic Volatile Organic Compound Emission Measurements. In AGU Fall Meeting Abstracts (Vol. 2019, pp. A13T-2996).
- **Stewart, M.**, Ye, J., McKinney, K., and Martin, S., 2019. Real-time Sampling of Total Biogenic Volatile Organic Compounds Using a Compact, Portable Photoionization Detection System. In AAAR Conference Abstracts (pp. 178).

DISSERTATIONS AND THESES

- **M. Stewart**, *Photoionization Detection of Volatile Organic Compounds*, Harvard University, Ph.D. Thesis, November 2022.
- **M. Stewart**, *Development of a computational software program for multi-phase pipe flow simulations*, National University of Singapore, MEng Thesis, May 2017.
- **M. Stewart**, *Development of a single-cylinder engine testing platform*, Imperial College London, BEng Thesis, June 2016.

INVITED TALKS AND SEMINARS

- *Intelligent Gas Sensing with Embedded ML*, ICTP-21: International Centre for Theoretical Physics, Remote, Oct 2021.
- *Machine Learning Sensors*, ICTP-23: International Centre for Theoretical Physics, Remote, April 2023.
- *Datasheets for Machine Learning Sensors*, tinyML Talks: tinyML Foundation, Remote, July 2023.
- *Balancing Privacy and Connectivity in the Digital Age*, South American Business Forum, Argentina, July 2023.

ADVISING

UNDERGRADUATE THESES

- Vladislav Sevostianov: Highest Honors MAY 2019
Sniffing Trees: a Photoionization Detector for Biogenic Volatile Organic Compound Emission Measurements

TEACHING EXPERIENCE

- Harvard University:** Cambridge, MA – *Head Teaching Fellow* SEP 2023 – PRESENT
 - For CS249r: Tiny Machine Learning (2023) [[link](#)], a graduate seminar class on TinyML
 - Designed lectures, homeworks, and mentored student research projects focused on the theory and application of TinyML
 - Co-developed the first open-source collaborative book on machine learning systems for tinyML [[link](#)]
- edX Inc:** Cambridge, MA – *Content Writer* JUN 2020 – JUN 2022
 - For the HarvardX Professional Certificate in Tiny Machine Learning (TinyML) MOOC [[Course 1-3 Link](#) [Course 4 Link](#)]
 - Co-designed a free, hands-on, project-based professional certificate taught through three 6-week courses (and an optional fourth course) on the EdX platform covering the emerging field of Tiny Machine Learning (deploying machine learning onto microcontrollers) with the aim of democratizing access to this developing field

- Enrolled 100,000 students from over 175 countries as of April 2023; the course development process was published in a peer-reviewed research article [\[link\]](#)
- Composed and co-designed course materials including readings, code walkthroughs, and auxiliary blog posts
- Released all course materials open-source to enable global adaptation for further access to TinyML education [\[link\]](#)

PROFESSIONAL SERVICE

Organizing Committee

- Harvard Radcliffe Institute Seminar on “Safeguarding User Privacy in the Era of Sensor Intelligence.” July 2023. [\[link\]](#)
- Sixth Conference of Machine Learning and Systems (MLSys), 3rd On-Device Intelligence Workshop. June 2023. [\[link\]](#)
- Machine Learning and Systems Rising Stars Workshop. August 2023. [\[link\]](#)
- 4th Global Summit on Electronics and Electrical Engineering (GSEEE2024). [\[link\]](#)

Reviewer

- Thirty-Seventh Conference on Neural Information Processing Systems (2023): Datasets and Benchmarks Track, August 2023.
- Institute of Electrical and Electronics Engineers (IEEE) Micro Special Issue on “tinyML”, August 2023.
- Sixth Conference on Machine Learning and Systems (MLSys), June 2023.

Member

- IMechE Special Interest Group’s on Energy, Environment and Sustainability (IMechE-EESG).
- British Computer Society Specialist Group’s on Green IT (BCS-GIT) and Artificial Intelligence (BCS-SGAI).
- IEEE Technical Communities on Sustainable Computing (T-SUSC) and Computer Architecture (TCCA).
- The Society for the Study of Artificial Intelligence and Simulation of Behaviour (AISB).
- ACM Special Interest Group’s on Artificial Intelligence (SIGAI) and Embedded Systems (SIGBED).

Interviews

- What is TinyML? An Interview with Matthew Stewart. Elektor Magazine, 45(12), pp. 62-65. March 2021. [\[link\]](#)
- Data privacy and machine learning in environmental science. Towards Data Science Podcast. June 2020. [\[link\]](#)
- Tiny ML and the future of on-device AI. Towards Data Science Podcast. November 2021. [\[link\]](#)
- The emerging world of ML sensors. Towards Data Science Podcast. September 2022. [\[link\]](#)

Panel Moderator

- Advanced NLP Use Cases: Data Ops, Models, and Strategies. Ai4 2023. Las Vegas, USA. August 2023.
- Computer Vision: Data Labeling, Training and Platforms for Machines That See. Ai4 2023. Las Vegas, USA. August 2023.

ADDITIONAL PROFESSIONAL EXPERIENCE

- MLCommons:** Boston, MA – *Research Director* MAY 2023 – PRESENT
- Lead the development and integration of industry-standard benchmarks: A2Perf, Neurobench, and RobotPerf
 - Organized and coordinated professional events at the intersection of industry and academia, including MLSys Rising Stars
- Medium:** Boston, MA – *Data Science Blogger* SEP 2018 – PRESENT
- Published over 40 articles related to data science, artificial intelligence, and machine learning [\[link\]](#)
 - Accumulated over 6,700 followers on the Medium blogging platform, with over 2 million total reads and 100 citations
 - Acknowledged as one of the top authors in data science according to the publication editor and viewing metrics
 - Invited to speak on TDS Podcast; blog published in ML Conference Global 2019; invited to lecture at QuantUniversity
- Critical Future:** London, United Kingdom – *Machine Learning Consultant* DEC 2019 – DEC 2022
- Developed state-of-the-art machine learning solutions for real estate, fintech, e-commerce, and engineering organizations
 - Pioneered composition learning for machine learning-based business intelligence, with funding from Innovate UK [\[link\]](#)
- Tomorrow.io (formerly Climacell):** Boston, MA – *Data Scientist Intern* JUN 2019 – SEP 2019
- Created a continental-scale pollen emission inventory utilizing MODIS satellite imagery
 - Developed pollen forecasting model by coupling climate, emission, and dispersion models; now in production

REFERENCES

Vijay Janapa Reddi

Associate Professor of Electrical Engineering, John A. Paulson School of Engineering, Harvard University
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Pete Warden

Technical Lead for Mobile and Embedded TensorFlow, Google
pete@petewarden.com

Adam Riccoboni

Chief Executive Officer, Critical Future
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