



EMERGING SCIENCE FOR ENVIRONMENTAL HEALTH DECISIONS

AGENDA

● Leveraging Artificial Intelligence and Machine Learning to Advance Environmental Health Research and Decisions

JUNE 6-7, 2019

THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE

ROOM 100, 500 5TH ST NW, WASHINGTON, DC 20001

THIS WORKSHOP WILL BE WEBCAST

ARTIFICIAL INTELLIGENCE IS BEING CALLED THE NEW

ELECTRICITY—a technological invention that promises to transform our lives and the world. The resurgence of investment and enthusiasm for artificial intelligence, or the ability of machines to carry out “smart” tasks, is driven largely by advancements in the subfield of machine learning. Machine learning algorithms can analyze large volumes of complex data to find patterns and make predictions, often exceeding the accuracy and efficiency of people who are attempting the same task. Driven by tremendous growth in data collection and availability as well as computing power and accessibility, artificial intelligence and machine learning applications are rapidly growing in society, including retail (e.g., predicting consumer purchases), the automotive industry (e.g., self-driving cars), and health care (e.g., automated medical diagnoses). Scientists are also beginning to apply these advanced,

emerging technologies to environmental health research in a variety of ways such as characterizing sources of pollution, predicting chemical toxicity, estimating human exposures to contaminants, and identifying health outcomes. Although these applications show promise, questions remain about the use of artificial intelligence and machine learning in environmental health research and public policy decisions. Fundamental issues of data availability, quality, bias, and uncertainty in the data used to develop machine learning algorithms are compounded by lack of transparency and interpretability of artificial intelligence systems. These issues can impact the replicability of results, deliver misleading or inaccurate results, and potentially diminish trust in artificial intelligence systems. This workshop will explore the promise and challenges faced in applying artificial intelligence to environmental health research and decision making.

THURSDAY, JUNE 6, 8:30 AM–5:00 PM

8:00 Registration

8:30 Welcome and Opening Remarks

- **Keegan Sawyer**, National Academies of Sciences, Engineering, and Medicine
- **Elizabeth Boyle**, National Academies of Sciences, Engineering, and Medicine
- **Melissa Perry**[§], Co-chair of the Standing Committee on the Use of Emerging Science for Environmental Health Decisions

[§] Member of the workshop Organizing Committee for Leveraging Artificial Intelligence and Machine Learning to Advance Environmental Health Research and Decisions.

[†] Member of the Standing Committee on the Use of Emerging Science for Environmental Health Decisions.

SESSION 1 OPPORTUNITIES FOR ARTIFICIAL INTELLIGENCE IN ENVIRONMENTAL HEALTH

Moderator: **Gary Miller**^{§†}, Columbia University

- 8:45 Accessible artificial intelligence for environmental health—**Jason Moore**, University of Pennsylvania
- 9:15 Integrating AI Across the Spectrum of Environmental Health Sciences—**Richard Woychik**, National Institute for Environmental Health Sciences

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THURSDAY, JUNE 6 (CONTINUED)

- 9:45 Battle of Two Cultures: Statistics Versus(?) Data Science in Environmental Health—**Bhramar Mukherjee**[§], University of Michigan
- 10:15 Panel Discussion with Session 1 Speakers
- 10:45 *Break*

SESSION 2 PREDICTING POISONS: APPLICATION OF ARTIFICIAL INTELLIGENCE TO CHEMICAL HAZARDS CHARACTERIZATION

Moderator: **Reza Rasoulpour**^{§†}, Corteva Agriscience

- 10:50 A Large Multitask Neural Network for Chemical Hazards-model deployment and evaluation.—**Thomas Luechtefeld**, Insilica and ToxTrack
- 11:10 Computationally Leveraging the Collective: Mining Published Data and Crowdsourcing Consensus Models—**Nicole C. Kleinstreuer**[§], National Toxicology Program
- 11:30 *Break for Lunch*
- 12:30 Machine learning and artificial intelligence for biomarker discovery—**Katrina Waters**, Pacific Northwest National Laboratory
- 12:50 Machine Learning for Chemical Mixtures in Epidemiology—**Marianthi-Anna Kioumourtzoglou**, Columbia University
- 1:10 Panel Discussion with Session 2 speakers

SESSION 3 ESTIMATING EXPOSURES: APPLICATION OF ARTIFICIAL INTELLIGENCE TO EPIDEMIOLOGY AND EXPOSURE SCIENCE

Moderator: **Melissa Perry**^{§†}, George Washington University

- 1:50 Prioritizing nongenetic associations in massive data sets—**Arjun (Raj) Manrai**, Harvard University
- 2:10 A Picture Tells a Thousand...Exposures—**Scott Weichenthal**, McGill University

- 2:30 Predicting Chemical Exposure Pathways—**John Wambaugh**, Environmental Protection Agency
- 2:50 Panel Discussion with Session 3 speakers
- 3:10 *Break*

SESSION 4 HANDS-ON DEMONSTRATION OF MACHINE LEARNING

This session includes an active learning component. Please bring a laptop to fully participate.

Moderator: **Roger D. Peng**[§], Johns Hopkins University

- 3:30 Key steps and considerations to run artificial intelligence and machine learning algorithms—**David Dunson, Kelly Moran & Evan Poworoznek**, Duke University
- 5:00 Day 1 Closing Remarks—**Roger D. Peng**[§], Johns Hopkins University
- 5:10 *Adjourn*

FRIDAY, JUNE 7, 8:30 AM–12:00 PM

- 8:30 Welcome—**Patrick McMullen**^{§†}, ScitoVation

SESSION 5 SOCIAL AND ETHICAL CONSIDERATIONS OF USING ARTIFICIAL INTELLIGENCE

- 8:35 Ethical decision making in computational systems: Mechanisms for ensuring social trust—**Alex John London**, Carnegie Mellon University
- 9:15 “I’m sorry, Dave. I can’t do that.” Social and ethical issues in training and education—**Lance Waller**, Emory University
- 9:35 Issues with reproducibility and replicability—**Alexander Tropsha**, University of North Carolina
- 9:55 Interpretable machine learning for scientific understanding—**Sorelle Friedler**, Haverford College
- 10:15 *Break*
- 10:30 Panel Discussion with Session 5 Speakers

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SESSION 6 PERSPECTIVES ON THE USE OF ARTIFICIAL INTELLIGENCE RESEARCH FOR ENVIRONMENTAL HEALTH DECISIONS

Moderator: **Nicole C. Kleinstreuer**^{§†}, National Toxicology Program

11:00 Panel Discussion

- **Nadira De Abrew**, Proctor & Gamble
- **Anna Lowit**, Environmental Protection Agency
- **Kristi Pullen Fedinick**[†], National Resource Defense Council
- **Charles Schmitt**, National Institute of Environmental Health Sciences
- **Reza Rasoulpour**^{§†}, Corteva Agriscience

11:50 Closing Remarks—**Gary Miller**^{§†}, Columbia University

12:00 *Adjourn Workshop**

* The Use of Emerging Science for Environmental Health Decisions Committee Business Meeting is from 1:15–4:00pm. This meeting is open to committee members, government liaisons, and workshop participants.

§ Member of the workshop Organizing Committee for Leveraging Artificial Intelligence and Machine Learning to Advance Environmental Health Research and Decisions.

† Member of the Standing Committee on the Use of Emerging Science for Environmental Health Decisions.

Workshop Organizing Committee

This workshop was organized by the following experts:

Kevin Elliott[†], Michigan State University; **Nicole C. Kleinstreuer**, National Toxicology Program; **Patrick McMullen**[†], ScitoVation; **Gary Miller**[†], Columbia University; **Bhramar Mukherjee**, University of Michigan; **Roger D. Peng**, Johns Hopkins University; **Melissa Perry**[†], George Washington University; **Reza Rasoulpour**[†], Corteva Agriscience

For more information and to subscribe for updates, please visit
<http://dels.nas.edu/envirohealth>

Emerging Science workshops are free and open to the public.

About the Use of Emerging Science for Environmental Health Decisions

The National Academies' Standing Committee on the Use of Emerging Science for Environmental Health Decisions (ESEHD) examines and discusses issues on the use of new science, tools, and research methodologies for environmental health decisions. The ESEHD committee is organized under the auspices of Board on Life Sciences and the Board on Environmental Studies and Toxicology of the National Academies of Sciences, Engineering, and Medicine, and sponsored by the National Institute of Environmental Health Sciences.

