+1-(857) 600-9490
Cambridge, MA
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David Rémy Bellamy

PhD Candidate in Medical Machine Learning

Personal website
LinkedIn: drbellamy
Twitter: DavidRBellamy

I am a machine learning scientist with deep expertise in causal inference and molecular biology. My academic work has been featured in top venues such as NeurIPS, the European Journal of Epidemiology, and Nature Medicine. I am an experienced Python developer and can produce high-quality machine learning code, models and experimental workflows in rapid iteration cycles. I am also a PhD candidate of Epidemiology and Biostatistics at the Harvard School of Public Health graduating in May 2023. In my PhD, I have developed deep learning methods for risk prediction in the intensive care unit as well as for causal inference in the presence of unmeasured confounding. In the past, I was a doctoral student at Harvard Medical School in molecular biology and spent 6 years conducting research in epigenetics, mass spectrometry, and virology. You can read more about me on my personal website!

Education

Doctor of Philosophy in Epidemiology, Harvard University — Sep 2018 — Present
Masters of Science in Biostatistics, Harvard University, *summa cum laude* — Sep 2018 — May 2022
Doctor of Philosophy in Biomedical Science, Harvard University — Sep 2016 — Jan 2018 (left)
Honours Bachelor of Science in Biochemistry, University of Ottawa, *summa cum laude* — Sep 2011 — May 2016

Publications

Published Articles

Minimum Norm Solutions and the Complexity of U-Statistics with Applications to Proximal Inference **2023**
Submitted to ICML 2023 Main Conference, preprint available soon!

- Tom Kolokotrones, David Bellamy, Rajarshi Mukherjee, Andrew Beam, James Robins.

Assessment of ChatGPT Anaesthesiology-Specialty Medical Knowledge on Anaesthesiology Board Examination Practice Questions **2023**
Submitted to British Journal of Anaesthesia

- Denys Shay, Bhawesh Kumar, David Bellamy, Anil Palepu, Mark Dershwitz, J Matthias Walz, Maximilian S. Schaefer, Andrew L. Beam.

Deep Learning Methods for Proximal Inference via Maximum Moment Restriction **2022**
NeurIPS 2022 Main Conference, Paper here

- Ben Kompa*, David Bellamy*, Tom Kolokotrones, James Robins, Andrew L. Beam.
- * Denotes equal contribution.

A structural characterization of shortcut features for prediction **2022**
European Journal of Epidemiology, Paper here

- David Bellamy, Miguel Hernan, Andrew L. Beam.

Evaluating Progress on Machine Learning for Longitudinal Electronic Healthcare Data **2020**
Preprint here: arXiv

- David Bellamy, Leo Celi, Andrew L. Beam.
- Under preparation for submission to a conference.

Charity Care: Do Nonprofit Hospitals Give More than For-Profit Hospitals? **2020**
Journal of General Internal Medicine, Paper here

- Joseph D. Bruch, David Bellamy.

Reciprocal cellular cross-talk within the tumor microenvironment promotes oncolytic virus activity **2015**
Nature Medicine, Paper here

- Carolina S Ilkow, Monique Marguerie, Cory Batenchuk, Justin Mayer, Daniela Ben Neriah, Sophie Cousineau, Theresa Falls, Victoria A Jennings, Meaghan Boileau, David Bellamy, et al.

Manuscripts under Preparation

Labrador: Exploring the limits of masked language modeling for laboratory data **2023**

- David Bellamy, Bhawesh Kumar, Cindy Wang, Andrew L. Beam.
- Est. publication date: May 1, 2023.

Adversarial methods for proximal inference **2023**

- David Bellamy*, Tom Kolokotrones*, James Robins, Andrew L. Beam.
- Est. publication date: May 16, 2023 (to NeurIPS 2023).

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Honors & Awards

2nd place in the Harvard LISH datathon **Feb 2022**
- My colleague and I placed second out of 60 teams from top US institutions on the task of predicting functionality of water well pumps in Tanzania. Our simple solution used an ensemble of random forest and XGBoost models.

McMahon Fund recipient **Jan 2022**
- I was awarded this to attend a week-long technical causal inference workshop at The Simons Institute, Theory of Computing in Berkeley, CA.

$60,000 UCB Pharma Fellowship **2021 — Present**
- I was selected as the sole recipient by the Department of Epidemiology to support the remainder of my PhD.

First place prize at Connecting Young Minds **2015**
- I finished first place at the University of Ottawa's research presentation competition by jury vote.

Canada's $8000 NSERC-USRA **2013 & 2015**
- The Canadian Natural Sciences and Engineering Council offers undergraduate student research awards to top applicants.
- I was awarded the USRA twice and conducted two summers of research with this funding.

OHRI's Best Student Researcher **2014**
- The Ottawa Hospital Research Institute awarded $500 to me for being the most promising student researcher at the institute.

J. Armand Bombardier $4000 Scholarship for Research Abroad **2014**
- I was selected for this prize, which enabled me to move to Boston in the fall of 2014 and conduct epigenetics research at Harvard Medical School.

First place at Healthcare Symposium **2014**
- The University of Ottawa held a research presentation competition for healthcare and I won first place.

Merit scholarship for exceptional standing **2012 — 2016**
- The University of Ottawa awarded this to undergraduates in the top percentile of the grade distribution.

Work Experience

Causal Machine Learning Consultant **July 2022 — Present**
Artera.ai *Cambridge, MA*
- I am providing guidance on developing a precision oncology application that predicts the individualized treatment effect (ITE) for each patient using multi-modal data.
- I grounded the Artera AI Department's existing predictive modeling approach in a causal inference framework that provided actionable advice for handling competing risks, selection biases, and confounding in their data.

PhD Candidate with Drs. Andrew Beam and Miguel Hernan **July 2020 — Present**
Harvard School of Public Health *Cambridge, MA*
- I am completing my PhD dissertation research in the Harvard CAUSALab.
- I have developed novel deep learning architectures better-suited for medical data, including a Transformer architecture to handle continuous data.
- I also developed a new deep learning estimator for causal inference in the presence of unmeasured confounding in collaboration with Dr. James Robins. This method uses a hybrid of kernel methods and neural networks.
- I have also developed an extension to this estimator that removes its dependence on kernel functions and instead is based on adversarial methods.

PhD student with Dr. Elise Robinson **Sep 2018 — July 2020**
Stanley Center for Psychiatric Research at Broad Institute *Boston, MA*
- I worked on the world's largest factor analysis to-date with the UK BioBank's questionnaire data.
- I modelled factor scores for each patient as a function of genetic markers.
- This permitted the discovery of novel SNPs associated with latent constructs like depression and anxiety.

PhD student with Dr. Eric Greer / Heritable epigenetics **Sep 2016 — Dec 2016**
Harvard Medical School *Boston, MA*
- I studied regulators of DNA methylation and how they influence transgenerational gene expression.
- In the lab, I developed a screening assay using biochemical fractionation and an HPLC-MS methylation assay to discover new regulators.
- I also performed a knock-out screen in *C. elegans* to assess transgenerational phenotypes.

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Researcher with Dr. Kathryn Wright / Virology **Sep 2015 — May 2016**
University of Ottawa *Ottawa, Canada*

- For my undergraduate thesis, I studied curcumin's inhibition of the HPIV3 virus' replication.
- I discovered which HPIV3 protein interacts with curcumin.

Researcher with Dr. Daniel Figeys / Mass spectrometry **May 2015 — Aug 2015**
Ottawa Institute of Systems Biology *Ottawa, Canada*

- I developed a mass spec.-based technique for identifying novel low molecular weight peptides in the hypothalamus and hippocampus of Mus musculus for applications to human disease profiling.

Researcher with Dr. Yang Shi / Epigenetics **Sep 2014 — Dec 2014**
Boston Children's Hospital *Boston, MA*

- I studied the epigenetic factors in the myeloid differentiation block in acute myeloid leukemia.
- I conducted high-throughput RNAi and chemical inhibitor screens of chromatin-regulating enzymes.
- I followed up this screen with CRISPR knockouts of promising candidates.

Researcher with Dr. John Bell / Viral cancer therapy **Jan 2014 — Aug 2014**
Ottawa Hospital Research Institute *Ottawa, Canada*

- I conducted a high-throughput RNAi screen of a virus library in search of enhancer miRNAs.
- I cloned candidate miRNAs into clinically approved oncolytic viruses (VSV & MG-1).
- I also performed *in vitro* and *in vivo* testing of cloned viruses.

Researcher with Dr. Darrin Richeson / Inorganic chemistry **May 2013 — Sep 2013**
Chemistry department, University of Ottawa *Ottawa, Canada*

- I designed the synthesis of a high molecular weight ligand, capable of binding Rhenium ions.
- The Rhenium-ligand complex was tested for its capacity to reduce CO_2 to formic acid when stimulated by UV.

Mentorship Experience

Cindy Wang / Harvard College Pre-Med **June 2021 — Present**

- We held weekly meetings from her freshman year to sophomore year.
- I onboarded her onto her first deep learning research project.
- I taught her how to write code with more flexibility and maintainability, as well as how to structure large machine learning projects.

Bhawesh Kumar / Harvard MSc student in Health Data Science **Sep 2021 — Present**

- We held weekly meetings throughout his Masters.
- I helped him select a curriculum and prepare for the job market.
- We are currently collaborating on a deep learning project.

Michael Smith / Harvard MSc student in Epidemiology **Sep 2021 — May 2022**

- We held monthly meetings throughout the first year of his Masters.
- I helped formalize his research interests in causality and machine learning and select a curriculum for his Masters.

Denys Shay / Harvard PhD student in Epidemiology **Sep 2021 — Present**

- I am his mentor in the Epidemiology Department.
- I have helped him pick a curriculum for the first 2 years of his PhD in Epidemiology.

Zhaoxun Hou / Harvard MSc student in Epidemiology **Sep 2021 — Dec 2022**

- I was his epidemiology mentor.
- I helped him to pick his curriculum and prepare applications to Biostatistics PhD programs.

Sarthak Agarwal / PhD student in Nutritional Epidemiology **Oct 2021 — March 2022**

- I extensively edited his application to the HSPH PhD program and he was accepted.

Brandon Spiegel / Data Scientist at Qventus

- Brandon is a data scientist in the private sector who I have educated on causality, ML and pursuing graduate education.

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Teaching Experience

Deep Learning Teaching Fellow **March 2022 — May 2022**
Harvard EPI290 / BMI707

- I worked as a teaching fellow with Drs. Andrew Beam and Kun-Hsing Yu in the main course on deep learning at the Harvard Medical campus.
- This course used Tensorflow/Keras.
- I provided extensive office hours to students requiring help with the problem sets, and also helped correct mistakes in the problem sets.

Epidemiology Department Tutor **Feb 2022 — May 2022**
Harvard School of Public Health

- I tutored Masters students in Epidemiology for statistics, learning R, and the core epidemiologic methods courses (EPI201/202/289/203/204).

Epidemiology & Biostatistics Teaching Fellow **June 2021 — Aug 2021**
Harvard ID207 & ID208

- I assisted Drs. Brian Healy and Pamela Rist in the full-time summer foundations course for the Masters of Public Health in Epidemiology.
- I led programming tutorials for students to learn how to analyze data with STATA.

Biochemistry Teaching Fellow (French) **Jan 2016 — April 2016**
University of Ottawa BCH2333

- I gave sections for the core second year class in Biochemistry in French (150 students).

Select Skills

Communication	English, French (bilingual)
Natural Sciences	Molecular biology, (epi)genetics, virology
Quantitative Sciences	Deep learning, causal inference, statistics
Tools and Languages	Python (TensorFlow/Keras, PyTorch, Pandas, Numpy, etc.), R (tidyverse), Cloud (Azure) Git, Makefile, Slurm, Bash/Linux, LaTeX, MarkDown, SQL, unit testing, OOP

Activities

Journal reviewer

- Nature Communications, Nature Scientific Data, uOttawa Journal of Medicine.

Harvard student mental health representative

- I assisted Dr. Paul Barreira in tailoring a mental health survey to the Population Health Sciences PhD students.
- The insights from this survey are being used to alter the PhD program structure and mental health resources at Harvard University to help the students that are in need.

Biochemistry curriculum representative

- I provided perspectives on biochemistry learning objectives and course content.
- I participated in redesigning the undergraduate biochemistry curriculum at the University of Ottawa.
- My efforts helped create a more research-focused biochemistry degree.

Personal

- I am a very passionate person and that translates into my hobbies as well! I love to develop skills outside of work that push my limits in new ways. I am a concert-level pianist, a 99th percentile chess player, a large mountain climber and outdoor enthusiast, a soccer freestyling artist and in the past, I've even been a Twitch streamer! I'm currently falling in love with strength training and would love to take cooking classes once I graduate this spring.