Grey Kuling, Ph.D.

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Teaching Profile

Teaching-stream educator specializing in human-centred data science and AI pedagogy. At Harvard Medical School I design and teach graduate-level data/AI curriculum, build inclusive, evidence-based assessments, and develop educational technology (Canvas LTI, PostgreSQL-backed analytics) to improve learning at scale. I teach Python/R, applied statistics, ML, and LLM literacy and pursue Science of Teaching & Learning (SoTL) on automated feedback and knowledge tracing.

Teaching Areas & Philosophy

- Machine Learning and AI in Health and Education
- Applied Statistics and Data Analysis
- Medical Imaging and Computational Biomedicine
- Generative AI, Natural Language Processing, and Large Language Model Literacy
- Curriculum Design and Educational Technology

Education

- Ph.D. in Medical Biophysics, University of Toronto, 2017-2023
  Thesis: AI-Quantified Tissue Factors in Breast MRI and the Risk of Breast Cancer
- M.A. in Applied Mathematics and Statistics, York University, 2016-2017
  Thesis: Automatic Segmentation of Multiple Sclerosis Lesions Using Dictionary Learning
- B.Sc. in Physics (Minor: Mathematics and Statistics), University of New Brunswick, 2013-2016

Selected Teaching Experience & Educational Leadership *(Cont. on page 2)*

- **Curriculum Fellow,** Harvard Medical School: Developed and taught graduate courses (*AI in Medicine II*, *Foundations of Clinical Data*, *Deep Learning for* Biomedical *Imaging Data*)
- **Teaching Assistant,** University of Toronto, York University, UNB: Supported undergraduate teaching in statistics, calculus, and scientific inquiry across three institutions.

Selected Publications & Presentations *(Cont. on page 4)*

- **Igniting Innovation Through AI at HMS** Invited Co-Presenter. Boston MA, USA – October 2025
- **Society for Teaching and Learning in Higher Education (STLHE) 2025** Presentation. Saskatoon, SK, Canada – June 2025
- **Kuling, G.**, Zitnik, M. (2025). Ken Utilization Layer: Hebbian Replay Within a Student's Ken for Adaptive Knowledge Tracing. *In preparation for Computers & Education*
- **Kuling, G.,** Besche H.et al. (2025). Can ChatGPT Assess Medical Students on Short Answer Questions? – Automated Learning Assessment System (ALAS). *Accepted in press at New England Journal of Medicine AI*.
- ***Frontiers in NeuroAI - Kempner Institute Symposium*** *Poster. Boston, MA, USA – June 2025*
- **Medical Education Day -Harvard Medical School 2024** Poster. Boston, MA, USA – October 2024

Teaching & Curriculum Development

Curriculum Fellow – AI and Machine Learning in Medicine
Department of Biomedical Informatics, Harvard Medical School, Boston, MA
May 2024 – Present

- Co-lead BMI702: AI in Medicine 2 (AIM2) curriculum and delivery: designed and led tutorials and assessments; authored grading rubrics; ran norming; coordinated midterm/final presentations and post-course evaluation.
- Co-lead BMIF204 Foundations of Clinical Data & its Applications curriculum & delivery: developed syllabus and course project design; streamlined TF workflows; managed guest-lecture logistics.
- New course development: initiated proposal and early design for "Deep Learning for Biomedical Imaging Data" (planning/scoping for future offering).
- Teaching & mentorship: delivered AIM2 lectures, led focused tutorials, held weekly AI/ML office hours, facilitated Responsible Conduct of Science courses for graduate students. and supported student learning across programs and departments.
- Educational technology & infrastructure: partnered with HUIT on Canvas LTI 1.3 integration; deployed PostgreSQL-backed assessment/feedback portals; improved reporting UX and instructor workflows.
- Program strategy, admissions & quality assurance: contributed to AIM curriculum mapping; served as PhD admissions reviewer; built/piloted course and project rubrics and led norming sessions.
- Professional development & SoTL: completed HMS Teaching 100; organized and delivered an AI Literature Review workshop; active participant in pedagogy/SoTL communities.

Teaching Assistant
University of Toronto, Toronto, ON, Canada
Jan 2021 – Apr 2022

- Course: *STA288 – Statistics and Scientific Inquiry in the Medical Sciences*
- Adapted instructional support to online learning during COVID-19, guiding students through statistical concepts via virtual office hours, project mentorship, and feedback.

Teaching Assistant
York University, Toronto, ON, Canada
Sept 2016 – Aug 2017

- Course: *MATH10124: Applied Calculus II - Integral Calculus*
- Led weekly recitation tutorials and scaffolded problem sets to reinforce core calculus concepts; supported course logistics and grading using Blackboard for a class of 300 students.

Teaching Assistant
University of New Brunswick, Fredericton, NB, Canada
Sept 2015 – Apr 2016

- Course: *Introduction to Statistics*
- Graded assignments and exams and provided support during office hours, guiding students in foundational statistical methods.

Calculus/Statistics Tutor
University of New Brunswick, Fredericton, NB, Canada
Sept 2010 – Apr 2014

- Provided private and drop-in tutoring in calculus and statistics, supporting undergraduate students in foundational math skills.

Mentorship, Academic Service & Outreach

Master's Thesis Co-Supervisor
Eindhoven University of Technology · 2019–2020
Co-supervised master's thesis on domain transfer for whole-breast segmentation in MRI. Guided the development

of intensity augmentation techniques to improve model generalizability across imaging protocols.
Student: Linde Hesse

Undergraduate Honors Project Advisor
Fanshawe College · 2017
Supervised a project applying convolutional neural networks to automate bacterial colony counting. Supported student development in deep learning and image analysis.
Student: Clarence MacDonald

Graduate Student Mentor
University of Toronto, Department of Medical Biophysics · 2018–2019
Provided one-on-one mentoring to graduate students on research design, academic progression, and career planning. Also served as a supervisor for GLSE graduate rotations.

Admissions Interview Chaperone
University of Toronto, Department of Medical Biophysics · 2018
Supported logistics and candidate experience during graduate program admissions.

AI & NLP Consultant – Medventions Atlantic
2023
Advised on the integration of AI and natural language processing into biomedical innovation projects led by clinician-entrepreneurs.

Outreach Activities

- Volunteer, **Math Kangaroo Competition Test Facilitator**, 2017
- Participant, **STEM Expo**, Fredericton, NB, 2016

Research Experience

Postdoctoral Research Fellow – AI in Medical Education
Harvard Medical School, Dept. of Biomedical Informatics, Boston, MA, USA (Supervisor: Dr. Marinka Žitnik)
May 2024 – Present

- Developed LLM-based systems for automated grading and generative feedback in medical education.
- Designed a Hebbian-inspired knowledge tracing algorithm for adaptive assessment.
- Built reproducible infrastructure for AI-enhanced learning analytics and curriculum evaluation.
- Engineered interpretable agents for syllabus analysis and video-based tutoring with Learning tool integration in Canvas

Research Associate
University Hospital Network, Toronto, ON, Canada
Jan 2023 – Apr 2024

- Developed a Natural Language Processing (NLP) framework for analyzing radiology reports.

Research Assistant
University of Toronto, Sunnybrook Hospital, Toronto, ON, Canada (Supervisor: Dr. Anne L. Martel)
Sept 2017 – Apr 2024

- Led research projects within a multidisciplinary medical AI team.
- Organized weekly group meetings, coordinating staff presentations and guest speakers.

Publications

Works in Progress / Under Review

- **Kuling, G.**, Fischer, K., Finander, B., Kobayashi, A., & Tan, T. (2025). From Framework to Feedback: Operationalizing Learning-Centered Syllabi for Large Language Model Evaluation. *In preparation for New England Journal of Medicine AI, expected submission: Nov 2025.*

- **Kuling, G.**, & Zitnik, M. (2025). Ken Utilization Layer: Hebbian Replay Within a Student's Ken for Adaptive Knowledge Tracing. *arXiv preprint arXiv:2507.00032. In preparation for Computers & Education, expected submission: Dec 2025*.
- **Kuling, G.,** Pullman, S., Vasilev, J., Palmer N., Schwartzstein, R., King, R., Cockrill, B., & Besche, H. (2025). Can ChatGPT Assess Medical Students on Short Answer Questions? – Automated Learning Assessment System (ALAS). *Accepted in press at New England Journal of Medicine AI*.

Peer-Reviewed Journal Articles

- **Kuling, G.,** Brooks, J. D., Curpen, B., Warner, E., & Martel, A. L. (2025). Impact of menopause and age on breast density and background parenchymal enhancement in dynamic contrast-enhanced magnetic resonance imaging. *Journal of Medical Imaging*, *12*(S2), S22002-S22002.
- **Kuling, G.**, Curpen, B., & Martel, A. L. (2024, May). Accurate estimation of density and background parenchymal enhancement in breast MRI using deep regression and transformers. In *17th International Workshop on Breast Imaging (IWBI 2024)* (Vol. 13174, pp. 124-131). SPIE.
- Squires, S., **Kuling, G.,** Evans, D. G., Martel, A. L., & Astley, S. M. (2024). Model uncertainty estimates for deep learning mammographic density prediction using ordinal and classification approaches. *medRxiv*, 2024-08.
- Barszczyk, M., Singh, N., Alikhassi, A., Van Oirschot, M., **Kuling, G.,** Kiss, A., ... & Curpen, B. (2024). 3D CT Radiomic Analysis Improves Detection of Axillary Lymph Node Metastases Compared to Conventional Features in Patients With Locally Advanced Breast Cancer. *Journal of Breast Imaging*, wbae022.
- Guo, F., Ng, M., **Kuling, G.,** & Wright, G. (2022). Cardiac MRI segmentation with sparse annotations: ensembling deep learning uncertainty and shape priors. *Medical Image Analysis*, *81*, 102532.
- **Kuling, G.,** Curpen, B., & Martel, A. L. (2022). BI-RADS BERT and using section segmentation to understand radiology reports. *Journal of Imaging*, *8*(5), 131.
- Bilocq-Lacoste, J., Ferre, R., **Kuling, G.,** Martel, A. L., Tyrrell, P. N., Li, S., ... & Curpen, B. (2022). Missed Breast Cancers on MRI in High-Risk Patients: A Retrospective Case–Control Study. *Tomography*, *8*(1), 329-340.
- Hesse, L. S., **Kuling, G.,** Veta, M., & Martel, A. L. (2020). Intensity augmentation to improve generalizability of breast segmentation across different MRI scan protocols. *IEEE Transactions on Biomedical Engineering*, *68*(3), 759-770.
- **Kuling, G.,** Curpen, B., & Martel, A. L. (2020, May). Domain adapted breast tissue segmentation in magnetic resonance imaging. In *15th International Workshop on Breast Imaging (IWBI2020)* (Vol. 11513, pp. 344-351). SPIE.
- Fashandi, H., **Kuling, G.,** Lu, Y., Wu, H., & Martel, A. L. (2019). An investigation of the effect of fat suppression and dimensionality on the accuracy of breast MRI segmentation using U-nets. *Medical physics*, *46*(3), 1230-1244.

Conference Proceedings

- **Kuling, G.,** Curpen, B., & Martel, A. L. (2024). *Accurate estimation of density and background parenchymal enhancement in breast MRI using deep regression and transformers*. In 17th International Workshop on Breast Imaging (IWBI 2024). Chicago, IL.
- **Kuling, G.,** Curpen, B., & Martel, A. L. (2020). *Domain adapted breast tissue segmentation in magnetic resonance imaging*. In 15th International Workshop on Breast Imaging (IWBI 2020). Leuven, Belgium.

Selected Presentations

- **Igniting Innovation Through AI – Harvard Medical School Postdoctoral Office**
  Boston, MA, USA – October 2025
  Invited Co-Presentation (with Dr. Joseph Loparo): Demonstration of an AI Chatbot for Flipped-Classroom Learning in Biomedical Education
- **Society for Teaching and Learning in Higher Education (STLHE) 2025**
  Saskatoon, SK, Canada – June 2025
  Title: Leveraging AI for Automated Short-Answer Grading: An Educational Theory-Guided Approach in Medical Education

- **Frontiers in NeuroAI - Kempner Institute Symposium**
  Boston, MA, USA – June 2025
  Poster: Ken Utilization Layer: Hebbian Replay Within a Student's Ken for Adaptive Knowledge Tracing
- **Medical Education Day -Harvard Medical School 2024**
  Boston, MA, USA – October 2024
  Poster: Development of a Generative Artificial Intelligence Grading and Learning Tool
- **International Workshop of Breast Imaging 2024**
  Chicago, IL, USA – June 2024
  Poster: Accurate Estimation of Density and Background Parenchymal Enhancement in Breast MRI Using Deep Regression and Transformers
- **ISMRM & SMRT Virtual Conference & Exhibition**
  Virtual hosted by Sydney, Australia – Aug 2020
  Presentation: Data Augmentation with Conditional Generative Adversarial Networks for Improved Medical Image Segmentation

Technical Skills and Tools

- **Programming & Development:** Python, R, MATLAB, C++, Flask web application development
- **Frameworks & Libraries:** PyTorch, TensorFlow, LangChain, scikit-learn, PostgreSQL integration
- **Machine Learning & Specializations:** Large Language Models (LLMs), Generative AI, Medical Imaging Analysis, Knowledge Tracing, Deep Learning, Distributed training (PyTorch DDP); NVIDIA ecosystem
- **Research & Data Tools:** Git, GitHub, RStudio, Jupyter, Docker
- **Educational Infrastructure:** Canvas API, Learning Tools Interoperability (LTI), custom grading pipelines

Fellowships, Awards, and Grants

- **Curriculum Fellow in Biomedical Informatics**
  Harvard Medical School, 2024–present
  Postdoctoral fellowship awarded by the Department of Biomedical Informatics to support curriculum development, educational research, and teaching in AI and medicine.
- **Dean's Innovation Awards – Internal Project Support**
  Harvard Medical School, 2024–2025
  Supported infrastructure for LLM-based grading systems, PostgreSQL backend integration, and educational data workflows as part of AI-driven curriculum tools.
  Amount: $10,000 (in-kind infrastructure, developer time, and administrative support)
- **Canvas Integration and DIA+Ed Infrastructure Support**
  Department of Biomedical Informatics & Educational Technology Group, HMS, 2024–2025
  Awarded access to beta Canvas APIs, LTI consultation, and database resources to support generative AI-based teaching tools.
  Amount: ~$5,000–8,000 (non-cash support)
- **Schmidt Science Fellowship Nominee**
  University of Toronto, 2023-2024
  Nominated for this prestigious fellowship recognizing innovative research in Science.
- **Queen Elizabeth II Graduate Scholarship in Science and Technology**
  University of Toronto, 2018-2023
  Annual scholarship supporting graduate research in Science and Technology.
  Amount: $75,000 over 5 years.
- **Medical Education Day Abstract Award -Harvard Medical School 2024**
  Boston, MA, USA – October 2024
  Abstract Title: Development of a Generative Artificial Intelligence Grading and Learning Tool
- **First Place Winner, Fields Thesis Competition**
  Fields Institute, 2017
  Awarded for outstanding thesis in applied mathematics, focused on segmentation techniques in medical imaging.