Charles Lu

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Education

Massachusetts Institute of Technology.   **2022–2024**
SM in Media Arts and Sciences

University of Georgia.   **2014–2018**
BS in Computer Science

Experience

Research experience

Research assistant, MIT Media Lab, Camera Culture Group.   **2022–2024**
Research on data valuation and computational imaging for digital health applications under the supervision of Professor Ramesh Raskar.

Data scientist, Harvard Medical School, Martinos Center for Biomedical Imaging.   **2020–2022**
Research on fairness, uncertainty, and federated learning in medical imaging applications under the supervision of Professor Jayashree Kalpathy-Cramer.

Research intern, Oak Ridge National Laboratory, Computational Sciences and Engineering.   **2018**
Prototype exascale machine learning algorithms for molecular dynamics simulations on Summit supercomputer under the supervision of Dr. Arvind Ramanathan.

Research intern, NASA, Earth Science Division.   **2018**
Analyzed damage from Hurricane Irma using NASA satellite imagery to inform sustainable environmental infrastructure policy for the City of Miami Beach.

Research collaborator, Children's Hospital of Pittsburgh, University of Pittsburgh Medical   **2017**
Center.
Collaborated with clinicians to study ciliopathy, a rare genetic disorder, in microscopy by detecting abnormal motion using optical flow and semantic segmentation.

Industry experience

Data scientist, Center for Clinical Data Science,   **2019–2022**
Massachusetts General Hospital & Brigham and Women's Hospital.
Led several deep learning for commercial industry partners for the following medical imaging applications:
- *aortic aneurysms* – detect and measure aneurysms in routine computed tomography (CT) exams.
- *ischemic stroke* – detect and locate stroke in CT angiography (designated FDA breakthrough medical device)
- *cervical fractures* – 3D object detection of cervical fractures in CT.
- *lumbar stenosis* – 3D lumbar stenosis severity grading in Magnetic Resonance Imaging (MRI) exams.
- *kidney stone* – 3D segmentation, measurement, and classification of renal stones in CT.

Software engineer, Amazon Web Services.   **2019**
Developed distributed control and data plane functionality for Amazon Connect customer contact routing

Publications

Conferences.

- **A Framework for Model-Free Data Valuation**. **C. Lu**, M. Amiri, R. Raskar. Submitted to *Neural Information Processing Systems (NeurIPS 2023)*.
- **Co-Dream: Collaborative data synthesis with decentralized models** A. Singh, G. Gupta, **C. Lu**, Y. Koirala, S. Shankar, M. Ehab, R. Raskar. Submitted to *Neural Information Processing Systems (NeurIPS 2023)*.
- **Federated Conformal Predictors for Distributed Uncertainty Quantification**. **C. Lu***, Y. Yu*, S. P. Karimireddy, M. I. Jordan, R. Raskar. *International Conference of Machine Learning (ICML 2023)*.
- **Improving Trustworthiness in Automatic Disease Severity Rating with Ordinal Conformal Prediction Sets**. **C. Lu***, A. Angelopoulos*, S. Pomerantz. *Medical Image Computing and Computer Assisted Interventions (MICCAI 2022)*
- **Fair conformal predictors for applications in medical imaging**. **C. Lu**, A. Lemay, K. Chang K. Hoebel, J. Kalpathy-Cramer. *Association for the Advancement of Artificial Intelligence (AAAI 2022)*
- **Classification of ciliary motion with 3D convolutional neural networks**. **C. Lu**, M. Marx, M. Zahid, C. Lo, C. Chennubhotla, S. Quinn. *ACM SouthEast Conference 2017*

Journals.

- **Collaborative, Privacy-Preserving Approaches For Distributed Deep Learning Using Multi-Institutional Data**. S. Gupta*, S. Kumar*, K. Chang, **C. Lu**, P. Singh, J. Kalpathy-Cramer. *Radiographics*
- **Federated Learning for Multi-Center Collaboration in Ophthalmology: Improving Classification Performance in Retinopathy of Prematurity**. **C. Lu***, A. Hanif*, P. Singh, K. Chang, A. Coyner, J. Brown, S. Ostmo, P. Chan, D. Rubin, M. Chiang, P. Campbell, J. Kalpathy-Cramer. *Ophthalmology Retina*
- **Federated Learning for Multi-Center Collaboration in Ophthalmology: Implications for Clinical Diagnosis and Disease Epidemiology**. A. Hanif*, **C. Lu***, K. Chang, P. Singh, A. Coyner, J. Brown, S. Ostmo, P. Chan, D. Rubin, M. Chiang, J. Kalpathy-Cramer, P. Campbell. *Ophthalmology Retina*
- **Quantification of the thoracic aorta and detection of aneurysm in computed tomography: validation of a fully automatic methodology**. F. Macruz*, **C. Lu***, J. Strout, A. Takigami, R. Brooks, S. Doyle, V. Buch, S. Hedgire, B. Ghoshajra. *Radiology: Artificial Intelligence*

Workshops.

- **Conformal Prediction with Large Language Models for Multi-Choice Question Answering**. **C. Lu**, B. Kumar, G. Gupta, A. Palepu, D. Bellamy, R. Raskar, A. Beam. *Trustworthy, Enhanced, Adaptable, Capable and Human-centric (TEACH) Workshop at ICML 2023*
- **Federated Conformal Predictors for Distributed Uncertainty Quantification**. **C. Lu***, Y. Yu*, S. P. Karimireddy, M. I. Jordan, R. Raskar. *Federated Learning and Analytics in Practice: Algorithms, Systems, Applications, and Opportunities Workshop at ICML 2023*
- **Co-Dream: Collaborative data synthesis with decentralized models**. A. Singh, G. Gupta, **C. Lu**, Y. Koirala, S. Shankar, M. Ehab, R. Raskar. *Localized Learning Workshop at ICML 2023*
- **Estimating Test Performance for AI Medical Devices under Distribution Shift with Conformal Prediction**. **C. Lu**, S. Rakin Ahmed, P. Singh, and J. Kalpathy-Cramer. *Principles of Distribution Shift (PODS) Workshop at ICML 2022*
- **Three Applications of Conformal Prediction for Rating Breast Density in Mammography**. **C. Lu**, K. Chang, P. Singh, J. Kalpathy-Cramer. *Workshop on Distribution-Free Uncertainty Quantification (DFUQ) at ICML 2022*
- **Distribution-free federated learning with conformal prediction sets**. **C. Lu** and J. Kalpathy-Cramer. *International Workshop on Trustable, Verifiable and Auditable Federated Learning in Conjunction with AAAI 2022*
- **Deploying Clinical Machine Learning? Consider the Following...**. **C. Lu**, K. Chang, P. Singh, S. Pomerantz, S. Doyle, S. Kakarmath, C. Bridge, J. Kalpathy-Cramer. *Workshop on Trustworthy AI for Healthcare at AAAI 2022*
- **Evaluating Subgroup Disparity using Epistemic Uncertainty in Mammography**. **C. Lu**, A. Lemay, K. Hoebel, J. Kalpathy-Cramer. *Interpretable Machine Learning in Healthcare workshop at ICML 2021*
- **An Overview and Case Study of the Clinical AI Model Development Life Cycle for Healthcare Systems**. **C. Lu**, J. Strout, R. Gauriau, B. Wright, F. Marcruz, V. Buch, K. Andriole. *AI for Affordable Healthcare workshop at ICLR 2020*
- **"Name that Manufacturer!": A Simple Experiment to Show Image Acquisition Bias when Training Deep Learning Models**. G. Biondetti, R. Gauriau, C. Bridge, **C. Lu**, K. Andriole. *Society for Imaging Informatics in Medicine (SIIM 2020)*

Patents & Book chapters.

- **CTA Large Vessel Occlusion Model**. **Charles Lu**, Christopher Bridge, Markus Hermann, John Kalafut, Bernardo Bizzo, Michael Lev. United States Patent Trademark Office Patent 17/083,761
- **Radiology and Artificial Intelligence: Medical and Societal Impacts**. Chapter on Societal view of AI Applications in Development. **Charles Lu**, Ken Chang, Jay Patel, Praveer Singh, Jayashree Kalpathy-Cramer

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*Equal contribution