Charles Godfrey

godfrey-cw.github.io | godfrey.cw@gmail.com | www.linkedin.com/in/godfrey-cw

Skills

Machine Learning: large language models, retrieval augmented generation (RAG), agentic patterns, model interpretability, computer vision, reinforcement learning, A/B testing and experimentation design

MLOps & System Design: distributed training, model serving architectures, LLM-automated evaluation and analytics

Tools & Technologies:

- **ML Frameworks**: PyTorch, HuggingFace, DeepSpeed, lightgbm, scikit-learn
- **Data Science**: NumPy, SciPy, Pandas, Matplotlib, Seaborn, Jupyter
- **Cloud & Infrastructure**: AWS (EC2, S3, SageMaker), Docker, Git, Linux
- **Databases & Search**: OpenSearch, Postgres, Redis, vector similarity search
- **Monitoring**: MLFlow, Tensorboard, DataDog

Experience

Senior Machine Learning Researcher, AKASA   September 2025 - Present

- Applied research on LLM-driven machine learning systems for healthcare revenue cycle management

Senior Applied Machine Learning Scientist, Thomson Reuters Labs   December 2024 - August 2025

Driving accuracy and quality improvements of agentic AI assistants for tax and accounting professionals

- Lead benchmarking data curation efforts, collaborating with domain experts to identify representative user needs, corresponding agent tasks and design rigorous annotation processes
- Specify and track comprehensive evaluation framework combining human expert assessment and automated LLM-based metrics
- Conduct systematic error analysis and literature review of state-of-the-art methods to identify improvement opportunities, implement and evaluate experimental system variants

Applied Machine Learning Scientist, Thomson Reuters Labs   October 2023 - December 2024

- Conducted experiments to measure and improve quality of a retrieval augmented generation (RAG) based AI assistant for tax professionals, resulting in over $12M in new sales within the first 6 months after launch. Only individual contributor scientist on the project at the outset.
  - Technical lead for human evaluations to assess quality of AI assistant responses; error-analysis report on first evaluation helped define research and development agenda leading up to beta release
  - Iteratively improved language model prompts for chat interaction, significantly reducing rate of harmful AI assistant outputs to meet product MVP requirements on a tight timeline (4 months between start of project and beta release)
  - Designed and evaluated system updates significantly improving citation quality (near unanimous win in human expert AB testing) and expanding the retrieval content sets to cover a wider range of tax topics
- Upgraded a ranking algorithm for passages of editorial content to be displayed in search results
  - Designed and implemented a hybrid search algorithm fusing keyword and vector (text embedding) relevance scores
  - Worked closely with product team to tune a relevance threshold parameter, and with engineering team to ensure continued compatibility of model API with surrounding application

– Improved rate at which best available passage (based on human annotated data) is ranked first by over 3%

Research Associate, Machine Learning, Pacific Northwest National Laboratory   October 2021 - October 2023
National Security Directorate, Mathematics of Data Science Team

- Improved MosaicBERT language model training efficiency by 50% through cluster environment optimization, enabling higher accuracy models within fixed compute budgets
- Enhanced multispectral satellite image segmentation performance (+5% IoU) by implementing multi-GPU distributed training
- Reduced neural image compressor training time from 3 minutes to 6 seconds per epoch through modernized data pipeline, enabling rapid hyperparameter optimization
- Researched ML system safety and security, developing datasets to evaluate out-of-distribution performance of computer vision models
- Effectively communicated research findings to senior leadership and project sponsors through technical reports and presentations

Program Associate, Mathematical Sciences Research Institute   March-May 2019

- Participated in the Birational Geometry and Moduli Spaces semester program
- Presented research on logarithmic Chow-to-Hodge cycle maps at the institute's graduate student seminar

Education

PhD in Mathematics, The University of Washington-Seattle   June 2021

- Thesis: *Higher Direct Images of Ideal Sheaves, Correspondences in Log Hodge Cohomology and Globally F-Full Varieties*
- Completed the eScience Institute's Advanced Graduate Data Science Option (PhD-level courses in machine learning, data visualization and statistical inference, implemented machine learning methods like LASSO, kernel regression and k-means clustering in raw NumPy and SciPy)
- Department of Mathematics Graduate Fellowship (2018-2019)

Student, MSRI Mathematics of Machine Learning Summer Graduate School   July 29-August 9 2019

- Attended mini-courses and problem sessions on statistical learning, convex optimization, deep learning and reinforcement learning
- Presented an expository account of recent work on linear stochastic bandits

Master's of Science in Mathematics, The University of Washington-Seattle   June 2018
Bachelor's of Science in Mathematics and Physics, The University of Wisconsin-Madison   May 2014

Mentoring

Intern Mentor, Thomson Reuters Labs   May 2024 - September 2024

- Mentored a master's student running experiments on LLM contextual non-compliance (knowing when to not attempt to answer a question)
- Helped the intern get up to speed on the project, connected them with a variety of scientists, engineers and leaders for a series of one-on-one meetings, met regularly to discuss technical work as well as career development

Industry Mentor, Math-to-Industry Boot Camp   July 2023-August 2023

- Mentored a team of math PhD students evaluating the usefulness of GPT-type large language models for scientific knowledge retrieval and the robustness of Segment Anything for person (e.g. pedestrian) detection

- To facilitate this capstone project, implemented a Segment Anything inference endpoint using TorchServe and provided a notebook demonstrating inference using the HuggingFace API

Graduate Mentor, Washington Experimental Math Laboratory   January 2019-December 2020

- Mentored undergraduate research projects on foundations of quantum mechanics and mathematical epidemiology

Publications

Main Track

1. Davis Brown, **Charles Godfrey**, Nicholas Konz, Jonathan Tu and Henry Kvinge. Understanding the Inner Workings of Language Models Through Representation Dissimilarity. In *EMNLP 2023*.

2. Kelsey Lieberman, James Diffenderfer, **Charles Godfrey** and Bhavya Kailkhura. Neural Image Compression: Generalization, Robustness, and Spectral Biases. In *NeurIPS 2023* (was also selected for an oral presentation at the *ICML 2023 Workshop Neural Compression: From Information Theory to Applications*).

3. **Charles Godfrey**, Davis Brown (equal contribution), Tegan Emerson and Henry Kvinge. On the Symmetries of Deep Learning Models and their Internal Representations. In *NeurIPS 2022*. **Code available at** github.com/pnnl/modelsym.

Workshop

1. Nicholas Konz, **Charles Godfrey**, Madelyn Shapiro, Jonathan Tu, Henry Kvinge and Davis Brown. Attributing Learned Concepts in Neural Networks to Training Data. In *The 1st Workshop on Attributing Model Behavior at Scale at NeurIPS 2023*, **selected for oral presentation**.

2. **Charles Godfrey**, Henry Kvinge, Elise Bishoff, Myles Mckay, Davis Brown, Tim Doster and Eleanor Byler. How many dimensions are required to find an adversarial example?. In *The 3rd Workshop of Adversarial Machine Learning on Computer Vision at CVPR 2023*, **selected for oral presentation**.

3. **Charles Godfrey**, Michael Rawson, Henry Kvinge and Davis Brown. Fast computation of permutation equivariant layers with the partition algebra. In *ICLR 2023 Workshop on Physics for Machine Learning*.

4. Davis Brown, **Charles Godfrey** (equal contribution), Cody Nizinski, Jonathan Tu, Henry Kvinge. Robustness of edited neural networks. In *ICLR 2023 Workshop on Mathematical and Empirical Understanding of Foundation Models*.

5. Henry Kvinge, Davis Brown and **Charles Godfrey**. Exploring the Representation Manifolds of Stable Diffusion Through the Lens of Intrinsic Dimension. In *ICLR 2023 Workshop on Mathematical and Empirical Understanding of Foundation Models*, **featured in The Gradient**.

6. **Charles Godfrey**, Elise Bishoff, Myles McKay and Eleanor Byler. Impact of architecture on robustness and interpretability of multispectral deep neural networks. In *SPIE Defense + Commercial Sensing 2023*.

7. Elizabeth Coda, Nico Courts, Colby Wight, Loc Truong, WoongJo Choi, **Charles Godfrey**, Tegan Emerson, Keerti Kappagantula and Henry Kvinge. Fiber bundle morphisms as a framework for modeling many-to-many maps. In *ICLR 2022 Workshop on Geometrical and Topological Representation Learning*.

Preprints

1. **Charles Godfrey**, Ping Nie, Natalia Ostapuk, David Ken, Shang Gao and Souheil Inati. Likert or Not: LLM Absolute Relevance Judgments on Fine-Grained Ordinal Scales (2025).

2. Correspondences in log Hodge cohomology (2023).

3. Henry Kvinge, Grayson Jorgenson, Davis Brown, **Charles Godfrey** and Tegan Emerson. Neural frames: A Tool for Studying the Tangent Bundles Underlying Image Datasets and How Deep Learning Models Process Them (2022).

4. **Charles Godfrey**, Elise Bishoff, Myles Mckay, Davis Brown, Grayson Jorgenson, Henry Kvinge and Eleanor Byler. Testing predictions of representation cost theory with CNNs (2022). Code available at https://github.com/pnnl/frequency_sensitivity.

5. Takumi Murayama and **Charles Godfrey**. Pure subrings of Du Bois singularities are Du Bois singularities (2022).

6. Higher direct images of ideal sheaves (2022).

Invited Talks

1. June 2023 ICERM Mathematical and Scientific Machine Learning Workshop.

2. February 2023 Boston College Math and Machine Learning Seminar.

3. January 2023 Joint Mathematics Meetings (Boston, MA).

4. November 2022 Purdue Algebraic Geometry Seminar.

5. October 2020 AMS Fall Eastern Sectional Special Session on Algebraic Singularities in Arbitrary Characteristic.