

# GREGORY CANAL

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## EDUCATION

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**Ph.D. in Electrical and Computer Engineering** August 2015 – August 2021

Georgia Institute of Technology

**Dissertation:** Feedback Coding for Efficient Interactive Machine Learning

**Advisor:** Dr. Christopher Rozell

**B.S.E. in Electrical and Computer Engineering, Minor in Music** August 2011 – May 2015

Duke University (*Summa Cum Laude*)

**Senior Thesis:** Visual Search Using Event-Related Potentials in a Brain-Computer Interface

**Advisor:** Dr. Leslie Collins

## SELECTED WORK EXPERIENCE

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**Postdoctoral Research Associate** 2021 – 2023

*Wisconsin Institute for Discovery, University of Wisconsin-Madison*

*Madison, WI*

Postdoc Advisor: Dr. Robert Nowak

- Developed and analyzed convex algorithms for simultaneous metric and preference learning in a multi-user comparison-based recommender system, in collaboration with another postdoctoral researcher
- Theoretically proved the significant increase in query efficiency gained by modeling shared structure across users, and empirically validated the proposed algorithms on a color preferences task
- Frequent prototyping, algorithm development, and experiment execution in Python 3 using libraries including PyTorch, Scikit-learn, SciPy, NumPy, CVXPY, Pandas, Matplotlib, Seaborn

**Graduate Research Assistant** 2016 – 2021

*Georgia Institute of Technology*

*Atlanta, GA*

- Formulated active learning as a feedback coding problem to develop a novel example selection algorithm and empirically demonstrated (in Python) the algorithm's reduced label cost and order of magnitude computational speed-up when compared to existing selection methods on real-world datasets
- Developed and analyzed new algorithms for rapidly estimating a user's preferences in a recommender system by adaptively querying paired comparisons between items, and demonstrated significant accuracy and compute cost improvements over state-of-the-art methods in Python simulations
- Developed a brain-computer interface that utilizes an optimal feedback coding scheme to efficiently control a robotic swarm through the extraction and classification of EEG features with filtering and machine learning techniques (in MATLAB), achieving an accuracy of 75% correct swarm configurations over 70 trials of a single subject and verifying system usability via Amazon Mechanical Turk
- Collaborated with other Ph.D. students to develop novel deep generative models for a causality-based explainable artificial intelligence system and a variational inference method based on manifold learning

**Intern** Summer 2017

*LGS Innovations (now CACI)*

*Florham Park, NJ*

- Developed and analyzed signal models and source separation solutions for multiple-input multiple-output digital communications systems, including a novel problem-specific extension of independent component analysis which was subsequently integrated into a deployed customer system

**Undergraduate Researcher - Pratt Fellows Research Program** 2014 – 2015

*Duke University*

*Durham, NC*

- Designed and analyzed experiments investigating the use of a brain-computer interface for rapid visual searching of images by a human operator, as an alternative to point-and-click image searching
- Learned C++ to develop real-time experimental applications that measure scalp electrode data for subsequent signal processing and classification in MATLAB

## SELECTED TEACHING AND MENTORING EXPERIENCE

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**Project Mentor - Interactive Image Segmentation** 2016 – 2018  
*Georgia Institute of Technology* Atlanta, GA

- Managed and mentored two undergraduate students on an image processing project applying optimal feedback coding to interactively specifying image segments using only one-bit inputs, applicable to hands-free human-computer interaction and assistive devices
- Demonstrated significant query savings (thereby reducing human interaction burden) compared to the state-of-the-art interaction algorithm, resulting in a conference publication

**Laboratory Teaching Assistant - Signals and Systems** Fall 2013, Fall 2014, Spring 2015  
*Duke University, Department of Electrical and Computer Engineering* Durham, NC

- Led weekly laboratory sessions that implemented signal processing concepts with MATLAB, Simulink, and data acquisition boards, and served as head laboratory teaching assistant in spring 2015, with additional responsibilities consisting of coordinating with laboratory managers and faculty to plan exercises, and leading weekly meetings to prepare teaching assistants for each lab

## SELECTED PROFESSIONAL ACTIVITIES AND SERVICE

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- **Organizer and Session Chair**, “Robustness in Deep Learning” mini-symposium at the 2022 SIAM Conference on Mathematics of Data Science (MDS22), San Diego, CA
- **Board Member**, Georgia Tech ECE Graduate Student Organization 2016 – 2019
- **Student Technician**, Duke Engage / Engineering World Health, Tanzania Summer 2013
  - Volunteered as a hospital technician, with duties including troubleshooting and repairing over 70 biomedical devices, and creating and maintaining an inventory of over 200 devices and parts

## SELECTED HONORS AND AWARDS

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- IDEaS-TRIAD Research Scholarship 2020
- LGS Innovations STAR Scholar Award 2017
- Georgia Tech President’s Fellowship 2015
- Tau Beta Pi Fellowship 2015
- Outstanding Undergraduate Teaching Award 2015

## SELECTED PUBLICATIONS

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1. **G. Canal**, B. Mason, R. K. Vinayak, and R. Nowak. One for all: simultaneous metric and preference learning over multiple users. In *The 36th Conference on Neural Information Processing Systems (NeurIPS)*, New Orleans, LA, December 2022. (Acceptance rate 26%).
2. **G. Canal**, M. Bloch, and C. Rozell. Feedback coding for active learning. In *The 24th International Conference on Artificial Intelligence and Statistics (AISTATS)*, April 2021. (Acceptance rate 30%).
3. M. Connor, **G. Canal**, and C. Rozell. Variational autoencoder with learned latent structure. In *The 24th International Conference on Artificial Intelligence and Statistics (AISTATS)*, April 2021.
4. M. O’Shaughnessy, **G. Canal**, M. Connor, M. Davenport, and C. Rozell. Generative causal explanations of black-box classifiers. In *The 34th Conference on Neural Information Processing Systems (NeurIPS)*, December 2020. (Acceptance rate 20%).
5. **G. Canal**\*, S. Fenu\*, (equal contribution) and C. Rozell. Active ordinal querying for tuplewise similarity learning. In *AAAI Conference on Artificial Intelligence (AAAI)*, New York, NY, February 2020. **Selected for oral presentation**. (Acceptance rate 20%).
6. **G. Canal**, A. Massimino, M. A. Davenport, and C. J. Rozell. Active embedding search via noisy paired comparisons. In *The 36th International Conference on Machine Learning (ICML)*, Long Beach, CA, June 2019. **Selected for long oral presentation**. (Acceptance rate 23%).