

# Ian Connick Covert

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## EDUCATION

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### University of Washington

*Ph.D. in Computer Science (Machine Learning)*

Seattle, WA

*Expected March 2023*

### Columbia University

*BA in Computer Science, BA in Math/Statistics; GPA: 4.00; Summa Cum Laude; Phi Beta Kappa*

New York, NY

*May 2017*

### French American International High School

*International Baccalaureate (IB), Bilingual in French*

San Francisco, CA

*June 2013*

## EXPERIENCE

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### University of Washington

*Graduate Student Researcher (advised by Su-In Lee)*

Seattle, WA

*January 2019-Present*

- Developed tools and information-theoretic results for explaining black-box ML model predictions. Introduced a unified framework for 26 published methods, including LIME, SHAP, permutation tests, etc.
- For Shapley value-based approaches, introduced an accelerated sampling method and a deep learning-based approximation applicable to large deep learning models (CNNs, ViTs, etc).
- Developed a deep-learning based feature selection approach to select genes for spatial transcriptomics studies.

### Citadel Securities

*Quantitative Research Intern*

Chicago, IL

*June 2022-August 2022*

- Options alpha research.

### Google Brain

*Student Researcher (supervised by Jiening Zhan, Ming Jack Po)*

Mountain View, CA

*June 2018-March 2019*

- Created deep learning models for automatic seizure detection from EEG data. Trained large convolutional and recurrent models, and a new topologically-aware architecture based on graph neural networks (GNNs).
- Led our team's efforts in creating model interpretability solutions. Adapted several algorithms to work with EEG data, proposed novel visualizations, and presented results both internally and at our partner institution.

### University of Washington

*Graduate Student Researcher (advised by Emily Fox)*

Seattle, WA

*September 2017-December 2018*

- Developed algorithms for nonlinear Granger causality discovery with deep learning models.
- Proposed a regime-switching time series model based on deep learning with hidden Markov switching dynamics.

### Goldman Sachs

*IB Strategist Summer Analyst (supervised by Ketan Vyas, Joey Allcock)*

New York, NY

*June 2016-August 2016*

- Researched corporate counterparty credit risk pricing via credit default swaps and the corporate bond market.
- Developed a prototype application for data-driven share allocation in equity issuance processes.

### Columbia University

*Undergraduate Student Researcher (supervised by Liam Paninski)*

New York, NY

*February 2016-May 2017*

- Designed a ML pipeline to extract neuron structure and activation from 3D calcium imaging videos.

### Société Générale

*Global Markets Summer Analyst (supervised by Bruno Braizinha, Barry Cohen)*

New York, NY

*June 2015-August 2015*

- Contributed to interest rate derivative pricing models and a tool to quantify historical richness in the swaption market.

**SAGE** ([github.com/iancovert/sage](https://github.com/iancovert/sage))

- A game-theoretic global explanation method for ML models.

**Easy-Ensemble** ([github.com/iancovert/easy-ensemble](https://github.com/iancovert/easy-ensemble))

- A tool for learning optimal model ensembles via sequential quadratic programming (SQP).

**Neural-GC** ([github.com/iancovert/Neural-GC](https://github.com/iancovert/Neural-GC))

- Granger causality discovery using neural networks (MLPs, RNNs, LSTMs).

**Shapley Regression** ([github.com/iancovert/shapley-regression](https://github.com/iancovert/shapley-regression))

- Shapley value estimation via linear regression, with convergence detection and uncertainty estimation.

**FastSHAP** ([github.com/iancovert/fastshap](https://github.com/iancovert/fastshap))

- An amortized approach to Shapley value estimation for large deep learning models.

## PUBLICATIONS

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- Ian Covert**, Wei Qiu, Mingyu Lu, Nayoon Kim, Nathan White, Su-In Lee. “Greedy Information Maximization for Online Feature Selection.” *Preprint (2022)* [link]
- Ian Covert\***, Chanwoo Kim\*, Su-In Lee. “Learning to Estimate Shapley Values with Vision Transformers.” *Preprint (2022)* [link]
- Hugh Chen\*, **Ian Covert\***, Scott Lundberg, Su-In Lee. “Algorithms to Estimate Shapley Value Feature Attributions.” *Preprint (2022)* [link]
- Ian Covert**, Rohan Gala, Tim Wang, Karel Svoboda, Uygur Sümbül, Su-In Lee. “PROPOSE: Predictive and Robust Probe Selection for Spatial Transcriptomics.” *Preprint (2022)* [link]
- Neil Jethani\*, Mukund Sudarshan\*, **Ian Covert\***, Su-In Lee, Rajesh Ranganath. “FastSHAP: Real-Time Shapley Value Estimation.” *International Conference on Learning Representations (ICLR) 2022*. [link]
- Ian Covert**, Scott Lundberg, Su-In Lee. “Explaining by Removing: A Unified Framework for Model Explanation.” *Journal of Machine Learning Research (JMLR) 2021*. [link]
- Alex Tank\*, **Ian Covert\***, Nicholas Foti, Ali Shojaie, Emily Fox. “Neural Granger Causality.” *Transactions on Pattern Analysis and Machine Intelligence (TPAMI) 2021*. [link]
- Ian Covert**, Su-In Lee. “Improving KernelSHAP: Practical Shapley Value Estimation via Linear Regression.” *Artificial Intelligence and Statistics (AISTATS) 2020*. [link]
- Ian Covert**, Scott Lundberg, Su-In Lee. “Feature Removal Is A Unifying Principle For Model Explanation Methods.” *NeurIPS Machine Learning Retrospectives, Surveys & Meta-Analyses (ML-RSA) Workshop 2020*. [link]
- Ian Covert**, Scott Lundberg, Su-In Lee. “Understanding Global Feature Contributions With Additive Importance Measures.” *Neural Information Processing Systems (NeurIPS) 2020*. [link]
- Ian Covert**, Uygur Sümbül, Su-In Lee. “Deep Unsupervised Feature Selection.” *Preprint (2018)*. [link]
- Ian Covert**, Scott Lundberg, Su-In Lee. “Shapley Feature Utility.” *Machine Learning in Computational Biology (MLCB) Workshop 2019*. [link]
- Ian Covert**, Uygur Sümbül, Su-In Lee. “Principal Genes Selection.” *Machine Learning in Computational Biology (MLCB) Workshop 2019*. [link]
- Ian Covert**, Balu Krishnan, Imad Njam, Jiening Zhan et al. “Temporal Graph Convolutional Networks for Automatic Seizure Detection.” *Machine Learning for Healthcare (MLHC) 2019*. [link]
- Jiening Zhan, Hector Yee, **Ian Covert** et al. “EEG Seizure Detection via Deep Neural Networks: Application and Interpretation.” *NeurIPS Machine Learning for Health (ML4H) Workshop 2018*.
- Alex Tank, **Ian Covert**, Nicholas Foti, Ali Shojaie, Emily Fox. “An Interpretable and Sparse Neural Network Model for Nonlinear Granger Causality Discovery.” *NeurIPS Time Series Workshop 2017*. [link]

## AWARDS AND HONORS

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- Outstanding Reviewer (ICLR 2022, NeurIPS 2021, ICLR 2021, ICML 2020)
- PhD Fellowship Recipient (Princeton, UIUC, UMass Amherst)
- Computer Science Award for Academic Excellence, Columbia University (2017)
- Summa Cum Laude, Columbia University (2017)
- Phi Beta Kappa, Columbia University (2017)
- Presidential Scholar Nominee (2013)
- President's Award for Academic Excellence (2013)