Ian Connick Covert

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Education

University of Washington — Seattle, WA
Ph.D. in Computer Science (Machine Learning) — *Expected March 2023*

Columbia University — New York, NY
BA in Computer Science, BA in Math/Statistics; GPA: 4.00; Summa Cum Laude; Phi Beta Kappa — *May 2017*

French American International High School — San Francisco, CA
International Baccalaureate (IB), Bilingual in French — *June 2013*

Experience

University of Washington — Seattle, WA
Graduate Student Researcher (advised by Su-In Lee) — *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 — Chicago, IL
Quantitative Research Intern — *June 2022-August 2022*

- Options alpha research.

Google Brain — Mountain View, CA
Student Researcher (supervised by Jiening Zhan, Ming Jack Po) — *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 — Seattle, WA
Graduate Student Researcher (advised by Emily Fox) — *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 — New York, NY
IB Strategist Summer Analyst (supervised by Ketan Vyas, Joey Allcock) — *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 — New York, NY
Undergraduate Student Researcher (supervised by Liam Paninski) — *February 2016-May 2017*

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

Société Générale — New York, NY
Global Markets Summer Analyst (supervised by Bruno Braizinha, Barry Cohen) — *June 2015-August 2015*

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

Open-Source Software

SAGE (github.com/iancovert/sage)

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

Easy-Ensemble (github.com/iancovert/easy-ensemble)

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

Neural-GC (github.com/iancovert/Neural-GC)

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

Shapley Regression (github.com/iancovert/shapley-regression)

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

FastSHAP (github.com/iancovert/fastshap)

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

Publications

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, Uygar 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, Uygar 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, Uygar 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

- 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)