Charles Topliff
ctopliff0@gatech.edu | ctopliff.github.io

Education

Georgia Institute of Technology | Atlanta, GA *August 2018 - Present*
National Defense Science & Engineering Graduate Fellowship (3 Years Full Funding)
PhD. Machine Learning

University of Kansas | Lawrence, KS *August 2014 – May 2018*
BS in Electrical Engineering, Magna Cum Laude

Research Experience

Graduate Research Fellow | Atlanta, GA *May 2019 – Present*
Advised by Dr. Morris Cohen & Dr. Mark Davenport
• Trained convolutional autoencoders and other generative models for dimensionality reduction of coronal images to enable downstream time series forecasting tasks.
• Applied long short-term memory networks to time series forecasting problems in predicting geomagnetic substorms, improving the state of the art for substorm forecasting.
• Frequently applied high performance computing resources to enable massively parallel training of neural networks for large scale hyperparameter searches, leading to more comprehensive training process.

Graduate Research Assistant | Atlanta, GA *August 2018 – May 2019*
Advised by Dr. Douglas Williams & Dr. William Melvin
• Implemented value iteration algorithms utilizing efficient linear program solvers to solve for the optimal decision-making policy in high-dimensional scenarios.
• Investigated the use of Partially Observable Markov Decision Processes in adaptive control for radar decision making in adversarial scenarios.

Industry Experience

Research Intern *Summers 2017 & 2018*
Systems & Technology Research *Boston, MA*
• Applied Euler Lagrange equations to waveform design to dynamically mitigate interference in adversarial scenarios.
• Modeling and simulation for clutter modeling of Space-Time Adaptive Processing (STAP) scenarios.
• Work in second summer led to two conference publications (listed below).

Projects

Semantic Classification of Financial Documents for Forecasting *Spring 2021*
• Applied ML techniques to the problem of predicting fixed income rate movements as a result of Federal Open Market Committee (FOMC) announcements.
• Pretrained BERT model used to predict positive, neutral, or negative semantics of FOMC documents to build overall semantic score; regressions to predict the movement of 1-Year to 10-Year instrument movements.

IMDB Semantic Classification *Spring 2019*
• Applied long short-term memory networks to the problem of classifying semantics of IMDB movie reviews using n-gram embedding models, found an improvement over baseline methods.
• Compared model to different classical classification models such as logistic classification and kernelized support vector machines as a baseline.

Coursework / Skills

Relevant Coursework: Statistical Machine Learning, Digital Signal Processing, Convex Optimization, Deep Learning, Theoretical Statistics, Stochastic Processes in Finance, Natural Language Processing, Numerical Methods in Finance.
Programming / Software / Platforms: Python, R, MATLAB, Git, Vim, VSCode, Slack, Linux (Ubuntu, Red Hat), High Performance Computing (PBS, Ray Hyperparameter Tuning library).

Awards / Service

National Defense Science & Engineering Graduate Fellowship *2020-2023*
Selective national fellowship providing three years of full support (total value > $200,000)
Reviewer, IEEE Transactions on Signal Processing *2021*
TA for Georgia Tech Undergraduate Professional Communication Center 2019
Best senior design project 2018
Monetary award for best overall senior design project in graduating class.
Undergraduate Research Experience for Undergraduates (REU) *2015*
NSF-Sponsored undergraduate research experience for Time Difference of Arrival (TDOA) localization for robot swarms.
University of Kansas Dean's List *2014-2018*

Publications / Conference Presentations

• **C. Topliff**, M. Cohen, W. Bristow "Simultaneously forecasting global geomagnetic activity using Recurrent Networks." arXiv preprint arXiv:2010.06487 (2020). (NeurIPS Workshop ML4PS). [arXiv]
• **C. Topliff**, W.M. Melvin, D. Williams "Application of POMDPs to Cognitive Radar" 2019 53rd Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, USA, 2019, Accepted. [Ungated]
• J. Kota, **C. Topliff**, R. Prasanth, G. Ushomirsky and S. Kogon, "Radar Waveform Design Using Lagrangian Dynamics for Co-Channel Interference Mitigation," 2019 IEEE Radar Conference (RadarConf), Boston, MA, USA, 2019, pp. 1-5.
• J. Kota, **C. Topliff**, R. Prasanth, G. Ushomirsky and S. Kogon, "RF Convergent Waveform Design Using Time-Modulated Phase Functions,"2018 52nd Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, USA, 2018, pp. 409-413.
• C. Mohr, P. McCormick, **C. Topliff**, S. Blunt, J. Baden (2020). "Gradient-based optimization of PCFM radar waveforms" IEEE Transactions on Aerospace and Electronic Systems, 57(2), 935-956.

• "Improving the Lead Time of Geomagnetic Index Forecasts using Solar Wind Forecasts and Deep Learning" Presented at American Geophysical Union Fall 2020 conference (virtual).
• "Recurrent Neural Networks for forecasting geomagnetic indices using Solar Wind, IMF, and SuperDARN Data" Presented at American Geophysical Union Fall 2019 conference in San Francisco, CA.