Charles Topliff

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Education

Georgia Institute of Technology | Atlanta, GA

National Defense Science & Engineering Graduate Fellowship (3 Years Full Funding)

PhD. Machine Learning

University of Kansas | Lawrence, KS

BS in Electrical Engineering, Magna Cum Laude

Research Experience

Graduate Research Fellow | Atlanta, GA

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

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

Systems & Technology Research

• 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

• 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

• 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.

August 2018 – May 2019

Summers 2017 & 2018

Boston, MA

August 2014 – May 2018

August 2018 - Present

May 2019 – Present

Spring 2019

Spring 2021

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 robo	ot swarms.
University of Kansas Dean's List	2014-2018

Publications / Conference Presentations

• **C. Toplif**f, 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.