GEORGE **HALAL**

Personal Site: https://georgehalal.github.io | GitHub: https://github.com/georgehalal | georgech@stanford.edu | 650.422.9033

EDUCATION

Stanford University | Ph.D. Physics | GPA: 4.00/4.00 | 2019–2024
Lehigh University | B.S. Physics & Minor in Applied Mathematics | GPA: 3.97/4.00 | 2015–2019
Thesis: "Machine Learning Applications for Relativistic Heavy-Ion Collisions"

SKILLS

Proficient | Python • SQL • MATLAB • LaTeX | **Familiar** | C++ • HTML • Tableau
Python Packages | scikit-learn • pandas • SciPy • statsmodels • NumPy • PyTorch (incl Lightning) TensorFlow/Keras • seaborn • xgboost • shap • Hugging Face transformers • matplotlib • pytest
Tools | Git • High Performance Computing (Slurm) • Vim • VS Code
Machine Learning Topics | Computer Vision • Generative Modeling • Natural Language Processing • Reinforcement Learning
Other Topics | Causal Inference • Bayesian Inference • Hypothesis Testing • Time Series/Signal Processing

RELEVANT INDUSTRY EXPERIENCE

Data Science Intern | Alife Health, Inc., San Francisco, CA | 2023
- Used causal inference and machine learning techniques to study dose adjustment patterns and their effects on IVF outcomes.
- Developed statistical tests to alert clinics when one of their doctors performs better or worse than average on different metrics.

RELEVANT RESEARCH PROJECTS

Deep Learning-Based Super-Resolution for Dust Polarization Images | Stanford University |2023
- Leveraged high-resolution spatial data from HI and PAH and low-resolution polarization images from dust to predict high-resolution polarization images for dust using PyTorch in sky regions where only low-resolution data is available.

Causal Inference for Quantifying the Effects of the Local Bubble and Dust on Magnetic Field Tracers | Stanford University |2023

Spherical Harmonic Convolutional Hough Transform | Stanford University | GitHub Link | 2021–2023
- Developed a computer vision algorithm in Python to model the morphology of interstellar gas.
- Achieved 3000x runtime speedup and 5x decrease in memory consumption over the previous algorithm.

Quantification of Foreground Signal Obscuring Residual Radiation from Early Universe | Stanford University | 2020–2022
- Developed statistical tests in Python and MATLAB for quantifying the dust contribution of different components and measuring the dust's properties through correlations of different datasets.

Bayesian Inference on Vansyngel Dust Model | Stanford University | GitHub Link | 2020
- Implemented the model in Python and performed Markov Chain Monte Carlo methods to fit its parameters to data.

Deep Learning for Stochastic Generation of Observed Galaxy Properties | Stanford University | GitHub Link | 2020
- Developed a conditional Wasserstein generative adversarial neural network with gradient penalty (cWGAN- GP) in PyTorch to generate observed galaxy properties in wide-field surveys. Processed data in Python.

Deep Learning for Modeling the Transfer Function of Galaxy Detection | Stanford University | GitHub Link | 2020

Deep Learning for Searching for 2-ν Double-β Decay of ^{136}Xe | Stanford University | 2019
- Developed a Long Short-Term Memory-based network in TensorFlow/Keras to search for this decay to the excited state of ^{136}Ba in EXO-200 data. Processed data in Python.

Deep Learning for Heavy-Flavor Jet Classification at RHIC | Yale University & Lehigh University | 2018–2019
- Developed a model made of a concatenation of Long Short-Term Memory and fully connected layers in TensorFlow/Keras to classify charm, bottom, and light jets in heavy-ion collisions. Processed data in C++.

Deep Learning for Collision Geometry Determination | The Ohio State University & Lehigh University | 2017–2018
- Developed a model in TensorFlow/Keras to identify the collision geometry of nuclei, based on which of the STAR EPD detector tiles are hit during a given collision. Processed data in C++.

PUBLICATIONS

First/Corresponding-Author Publications
- BICEP/*Keck* Collaboration, et al. BICEP/*Keck* XVI: Characterizing Dust Polarization Through Correlations with Neutral Hydrogen. *The Astrophysical Journal*, 2023. https://arxiv.org/abs/2210.05684
- G. Halal, S. E. Clark, et al. Filamentary Dust Polarization and the Morphology of Neutral Hydrogen Structures. *The Astrophysical Journal*, accepted. https://arxiv.org/abs/2306.10107
- G. Halal, S. E. Clark, M. Tahani. Imprints of the Local Bubble and Dust Complexity on Magnetic Field Tracers. In prep.

Full Publications List | https://ui.adsabs.harvard.edu/search/q=%20author%3A%22Halal%2C%20G