GEORGE **HALAL**

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EDUCATION

Stanford University | Ph.D. Physics | GPA: 4.0/4.0 | 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 • PyTorch (incl. Geometric, Lightning) • TensorFlow/Keras • LaTeX • scikit-learn • pandas • SciPy • NumPy
Familiar | C/C++ • HTML • Hugging Face transformers
Tools | Git • Cloud Computing • Vim • Bash/Zsh

RESEARCH EXPERIENCE

Spherical Harmonic Convolutional Hough Transform | Stanford University | 2021–Present

- 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.
- GitHub: https://github.com/georgehalal/sphericalrht

Dust Polarization Characterization | Stanford University | 2020–2022

- Developed statistical tests in **Python** and **MATLAB** for quantifying the dust contribution of different components in a certain sky area and measuring the dust's properties through correlations of different datasets.

Bayesian Inference on Vansyngel Model | Stanford University | 2020

- Implemented the model in **Python** and performed Markov Chain Monte Carlo methods to fit its parameters.
- GitHub: https://github.com/georgehalal/BayesInfer_DustModel

Machine Learning for Stochastic Generation of Observed Galaxy Properties | Stanford University | 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**.
- GitHub: https://github.com/georgehalal/cWGAN-GP

Machine Learning for Modeling the Transfer Function of Galaxy Detection | Stanford University | 2020

- GitHub: https://github.com/georgehalal/DetectNet

Machine Learning for Searching for 2-ν Double-β Decay of ^{136}Xe | Stanford University | 2019

- Developed a Long Short-Term Memory neural network in **TensorFlow/Keras** to search for this decay to the Excited State of ^{136}Ba in EXO-200 data. Processed data in **Python**.

Machine 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++**.

Machine 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++**.

RELEVANT COURSEWORK

Taken | Deep Learning • Machine Learning • Statistical Methods in Astrophysics
Audited | Machine Learning with Graphs • Deep Learning for Computer Vision • NLP with Deep Learning • Foundations of Reinforcement Learning • Computer Vision: Foundations & Applications • Design & Analysis of Algorithms • Signal Processing & Linear Systems • Computer Organization & Systems
Coursera | SQL for Data Science • Data Wrangling, Analysis, and AB Testing with SQL

PUBLICATIONS

First/Corresponding-Author Publications in Progress

- BICEP/*Keck* Collaboration, et al. BICEP/*Keck* XVI: Characterizing Dust Polarization Through Correlations with Neutral Hydrogen. *The Astrophysical Journal*, submitted. https://arxiv.org/abs/2210.05684
- G. Halal, S. E. Clark, A. Cukierman, D. Beck, and C. L. Kuo. Dust Filament Morphologies with the Spherical Rolling Hough Transform. *The Astrophysical Journal*, in prep.

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