Devin D. **Whitten**

Data Science · Machine Learning · Astrophysics

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- **Intersectional Data Science Solutions:** I develop algorithms and pipelines utilize a broad range of mathematical and computational approaches from applied mathematics and physics.
- **Machine Learning:** I work extensively with multi-layered networks, convolution, clustering algorithms, classification, and regression-based tasks in high-dimensionality space. I develop generative network models and training procedures.
- **Software Developer:** I actively develop and maintain software packages through PyPi and Github, incorporating *machine learning*, *Bayesian modeling*, *automation*, *robust statistical methods*, applied to *big data*.
- **Expert in Python 2.7 & 3.0:** iPython, Jupyter, Pandas, Sklearn, HDF5
- **Robust Statistics and Exploratory Methods:** My work frequently handles non-homogeneous data distributions. I am highly experienced with feature extraction from low-resolution data
- **Collaborative team-member:** works with international collaborations
- **Excellent written and verbal communication skills in English**
- **Project-oriented:** I have taken numerous projects from conception to peer-reviewed publication, and I am highly familiar with each phase of project development: data exploration, model development, implementation and software development, to distribution.

Skills

Computational	Machine Learning	Algorithms
Object-oriented Programming	Artificial Neural Networks	Parallelization
Python (2.7, 3.0 | iPython | Jupyter)	Support Vector Classification	Optimization
Bash (ssh, ftp, scp, wget, screen)	K-means/K-medoids	Markov Chain Monte Carlo
R (Rstudio, RScript)	Random Decision Forests	Numerical Integration
SQL ADQL, SDSS CasJobs	Maximum Likelihood Estimation	nD Interpolation
C++	Convolution	Kernel Density Estimation
LaTeX		Cross-validation

Projects

CEMP Automated Stellar Parameter Estimation Routine (CASPER)

Main developer | https://github.com/DevinWhitten/CASPER

Developed novel automated technique to measure chemical abundances and effective temperatures in stellar atmospheres.

- Bayesian synthetic spectral matching algorithm based on chi-distribution likelihood maximization
- Utilizes N-dimensional interpolation, Markov Chain Monte Carlo (MCMC) procedure
- Poisson noise estimation via beta prior implementation with Bayesian likelihood signal-to-noise maximization.

Stellar Photometric Index Network Explorer (SPHINX)

Main developer | https://github.com/DevinWhitten/SPHINX

Developed the first mixed-bandwidth photometric technique to accurately estimate the abundance of Carbon in stellar atmospheres, based on deep learning and massive ($N > 10^8$) astronomical catalogs.

- A generative deep learning network procedure for determination of chemical abundances in stellar atmospheres
- Developed hybrid training procedure, incorporating synthetic inputs with Gaussian noise injection procedures
- Function distribution sampling via Kernel Density Estimation procedure
- Deep learning network implementation

Gaussian Inflection Spline Interpolation Continuum (GISIC)

Sole developer | https://pypi.org/project/GISIC/

- Automated spectral normalization procedure
- Implements Gaussian Kernel Convolution on spectral energy distributionss
- Gradient-based pseudo-continuum identification via numerical differentiation
- n-order spline interpolation

Photometric Support Vector Classification

Research Assistant

- Developed Support Vector Classifier for photometric selection of low-surface gravity stars.
- Implemented 3D Principal Component Analysis, ND regression, 3D convex hull, and grid-based parallelized hyperparameter optimization

Education

University of Notre Dame – Department of Physics (Notre Dame, IN) *8/2015 - Current*

DOCTOR OF PHILOSOPHY – PHYSICS

University of Notre Dame – Department of Physics (Notre Dame, IN) *8/2015 - 1/2019*

MASTER OF SCIENCE – PHYSICS | *Constraints on Milky Way Formation from Machine-Driven Analyses of Chemical, Age, and Stellar Density Profiles*

Purdue University Northwest – Department of Physics and Chemistry (Hammond, IN) *1/2011 - 5/2015*

BACHELOR OF SCIENCE – COMPUTATIONAL PHYSICS | MINORS: COMPUTER SCIENCE & APPLIED MATHEMATICS

Job Experience

Graduate Research Assistant *Nov 2017 - Present*

DEPARTMENT OF PHYSICS, UNIVERSITY OF NOTRE DAME *Notre Dame, IN*

- Conducted research and produced publications in Galactic Archaeology and Near-field Cosmology
- Specialized in large (N^{10-12}) astronomical stellar catalogs
- Developed machine learning software for classification and regression
- Population modeling with Bayesian Maximum Likelihood Estimation

Teaching Assistant and Residential Mentor *6/2015 - 8/2015 | 6/2018 - 8/2018*

SUMMER SCIENCE PROGRAM *New Mexico Tech, NM*

- Supervised observations of Near-Earth Asteroids at Etscorn Observatory
- Tutored and lectured students in physics, astronomy, and computer programming
- Developed new statistical component of the curriculum
- Mentored high-school students on the transition to university

Teaching Assistant *12/2017 - Present*

DEPARTMENT OF PHYSICS, UNIVERSITY OF NOTRE DAME *Notre Dame, IN*

- Laboratory teaching assistant for Classical Mechanics and Electrodynamics

Supplemental Instructor *6/2015 - 8/2015*

DEPARTMENT OF PHYSICS & CHEMISTRY, PURDUE UNIVERSITY NORTHWEST *Hammond, IN*

- Conducted semi-weekly supplemental lectures on Physics I & II course material.

Publications

See full Publication List

Notable Refereed

[**] **Whitten, D. D.**, Beers, T. C., Placco, V. M., et al. **2019b**, *Constraints on the Galactic Inner Halo Assembly History from the Age Gradient of Blue Horizontal-Branch Stars*
The Astrophysical Journal, 884, 67, doi: 10.3847/1538-4357/ab4269 (ADS link)

[**] **Whitten, D. D.**, Placco, V. M., Beers, T. C., et al. **2019a**, *J-PLUS: Identification of low-metallicity stars with artificial neural networks using SPHINX*
Astronomy & Astrophysics, 622, 18, doi: 10.1051/0004-6361/201833368 (ADS link)

[**] Yoon, J., **Whitten, D. D.**, Beers, T. C., et al. **2020**, *The First Identification of the Group III CEMP star in Satellite Dwarf Galaxy Canes Venatici I*
The Astrophysical Journal (ADS link)

Service

Executive Board Member - Astrophysics Representative *2018*

GRADUATE PHYSICS SOCIETY – UNIVERSITY OF NOTRE DAME

Young Member Subcommittee Member *2016 – Present*

SUMMER SCIENCE PROGRAM

Frontiers in Nuclear Astrophysics Organizing Committee *2018*

JINA-CEE – UNIVERSITY OF NOTRE DAME