

Andres Alejandro Navarro Alsina

AUFENTHALTSERLAUBNIS: 18D ABS.1 FORSCHER (bis 30-09-2024)

I am a Data Scientist with a Ph.D. in astrophysics, having processed 200+ TB of data from simulations and observations. I excel at Advanced Analytics (e.g., image processing, Bayesian statistics) with ML methods.

EXPERIENCE

Argelander-Institut für Astronomie - University of Bonn

Research Assistant ([Euclid Satellite](#))

06/2020 - present

- Created realistic sky image simulations (+100 Tb), including galaxies, stars, Gaussian and Poisson noise.
- Extracted features relevant to training (from images to catalogs). Using techniques such as:
 1. Image filtering (detections of sources, outliers rejection, star-galaxy separation, deblending of sources)
 2. Fitting sources (2D profiles, surface brightness moments, joint fitting multiple sources)
 3. Sampling in Fourier space
- Developed and tested various shallow neural network (NN) architectures, which involved custom loss functions, custom connected NNs, Bayesian NNs, and probabilistic NNs.
- Demonstrated analytically the superiority of this ML method in terms of accuracy, precision, and processing time when compared to conventional (non AI) methods.

Gleb Wataghin Institute of Physics - University of Campinas

Research Scholar ([Dark Energy Survey Collaboration](#))

06/2017 - 12/2019

- Processed large observational catalogs (+10 Tb) and conducted null testing for systematics.
- Implemented a Bayesian statistical methodology based on Markov Chain Monte Carlo to construct the contaminant correlation function associated with systematic errors and to assess its impact on parameter inference.
- Forecasted cosmological parameters by utilizing the cross-covariance of thousands of mock data and estimated the alterations in confidence intervals crucial for chi-square optimization.
- Found that PSF modeling met scientific requirements and that PSF systematic errors will have a negligible effect on cosmological parameter inference.

COMMUNICATION AND LEADERSHIP

- +30 [Publications](#), 3 in first tier of authorship
- Participated in +20 events, during which I gave 7 talks (4 science and 3 outreach talks) and presented 3 posters, reaching audiences of +100 people.
- 6 years as a tutor of Master's and Bachelor students, 9 courses (7 as part of paid scholarship and 2 within my PhD duties).
- [IMPRS](#) (Max Planck) student representative: organized monthly discussion meetings, social events, provided support to new students, and engaged in discussions with coordinators.
- Presenting progress reports at weekly working group meetings, which included local working groups and international collaboration networks.
- Responding to weekly progress reports by coworkers.



TECHNICAL SKILLS Repository Packages

- Programming languages: Python (8 yrs), C++ (5 yrs), Java (1 yr), and Bash (8 yrs)
- Other tools: L^AT_EX, Emacs, git, ssh, Numpy, Matplotlib, Scipy, Pandas, Jupyter, TensorFlow, Keras, Scikit-learn, emcee, Docker, Root-CERN, Geant4, +10 astro software.
- Operating systems: Arch-linux (10 yrs, [AUR packages](#)), and Windows (6 yrs)

MACHINE LEARNING

- Feature engineering, Linear/logistic regression, classification.
- Methods: Random Forests, k-mean, PCA
- Custom connected NN with customized loss function (1 paper to be published)
- Bayesian NNs, Probabilistic NNs, and probabilistic predictions.

EDUCATION

06/2020 - present Bonn, Germany	Rheinische Friedrich-Wilhelms-Universität Bonn Ph.D candidate in Astrophysics
06/2017 - 12/2019 Campinas, Brasil	Universidade Estadual de Campinas (acceptance rate 4.3%) M.Sc. in Physics Thesis: <i>Effects of PSF modeling in cosmological estimates using weak gravitational lensing</i> Link Grade: 1.0 (german equivalent)
06/2011 - 06/2017 Bogotá, Colombia	Universidad Nacional de Colombia (acceptance rate of 13 %) B.Sc. in Physics Grade: 1.3 (german equivalent) Final work: <i>Casos de estudio de imagenología por retrodispersión gamma con potenciales aplicaciones industriales</i> Link
01/1996 - 12/2010 Aguachica, Colombia	Colegio Teresiano Reina del Carmelo Andres Bello distinction, for getting top results in high school final exam (Abitur)

Languages

✓Spanish ✓Portuguese ✓English ✓German: B1 (2.5 yrs in Germany)

Hobbies

In the past, I practiced judo and played the saxophone in my hometown's city band. Nowadays, I enjoy dancing salsa and forró.

