

# 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

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### 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 different shallow neural network (NN) architectures including custom loss functions, custom connected NNs, Bayesian and probabilistic NNs.
- Deployed shallow machine learning based framework, that uses realistic sky simulations to accurately predict gravitational shear.
- Demonstrated analytically the superiority of this ML method in terms of accuracy, precision and processing time in comparison with 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 of systematics.
- Implemented a Bayesian statistical methodology based on Markov Chain Monte Carlo to construct the contaminant correlation function associated with systematic errors and its consequences on parameter inference.
- Forecasted cosmological parameters, using the cross-covariance of thousands of mock data and estimated the alteration in confidence intervals crucial for chi-square optimization.
- Found that PSF modeling met scientific requirements and that PSF systematic errors will have negligible effect in cosmological parameter inference.

## COMMUNICATION AND LEADERSHIP

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- (+30) [Publications](#), 3 in first tier of authorship
- Participated in (+20) events, where I gave 6 talks (4 science, 2 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 teaching scholarship with extra payments, 2 within PhD duties).
- [IMPRS](#) (Max Planck) student representative: organize monthly discussion meetings, social events, support new students, and discuss with coordinators.
- Presenting progress reports at weekly working group meetings, e.g., local working groups and international collaboration networks.
- Responding to weekly progress reports by coworkers

## TECHNICAL SKILLS Repository Packages

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- Programing languages: Python (8 yrs), C++ (5 yrs), Java (1 yr), and Bash (8 yrs)
- Other tools: L<sup>A</sup>T<sub>E</sub>X, 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

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- 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

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06/2020 - present Bonn, Germany	<b>Rheinische Friedrich-Wilhelms-Universität Bonn</b> Ph.D candidate in Astrophysics
06/2017 - 12/2019 Campinas, Brasil	<b>Universidade Estadual de Campinas</b> (acceptance rate 4.3%) M.Sc. in Physics Thesis: <i>Effects of PSF modeling in cosmological estimates using weak gravitational lensing</i> <a href="#">Link</a> Grade: 1.0 (german equivalent)
06/2011 - 06/2017 Bogotá, Colombia	<b>Universidad Nacional de Colombia</b> (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> <a href="#">Link</a>
01/1996 - 12/2010 Aguachica, Colombia	<b>Colegio Teresiano Reina del Carmelo</b> Andres Bello distinction, for getting top results in high school final exam (Abitur)

## Languages

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