Fernando Becerra

Astrophysicist · Data Scientist

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Education

Harvard University — *Cambridge, MA*

Ph.D. in Astronomy & Astrophysics — *May 2018*

Thesis: Formation of Supermassive Black Hole Seeds, Advisor: Lars E. Hernquist.

Harvard University — *Cambridge, MA*

A.M. in Astronomy & Astrophysics — *May 2014*

Universidad de Chile — *Santiago, Chile*

M.Sc. in Astronomy, with Highest Honors — *Aug 2012*

Thesis: A Study of Galactic Star Formation and Massive Black Hole Growth Through Simulations, Advisor: Andrés Escala.

Universidad de Chile — *Santiago, Chile*

B.Sc. in Astronomy, with Highest Honors — *Dec 2009*

Relevant experience

Fathom Information Design — *Boston, MA, USA*

Data Visualization Developer — *Jun 2018 - Jun 2019*

- Coded back end and designed front end prototype for *Laniakea* app (http://laniakea.fathom.info)
- Used Python packages such as spaCy and nltk to perform Natural Language Processing techniques on large document sets.
- Implemented topic modeling to group and classify more than 100,000 documents using LDA, NMF, and t-SNE.
- Optimized routines for fast processing with NumPy, SciPy, and multiprocessing, achieving a 100x speed increase.
- Coded back end and designed front end prototype for *Myriscope* app (http://myriscope.com).
- Used Machine Learning libraries to extract and consolidate abstract, sections, and figures from academic papers.
- Created prototype for front end employing Javascript, jQuery, CSS and HTML.
- Coded back end and front end for *The Joy of Parsing* (https://fathom.info/bobross/).
- Scrapped all 403 transcripts from the show *The Joy of Painting* using the YouTube API and packages such as beautifulsoup.
- Analyzed, grouped, and classified the transcripts using NLP techniques and Python packages like spaCy and nltk.
- Created interactive tool to explore paintings of the show using d3.js.

Harvard University, Department of Astronomy — *Cambridge, MA, USA*

Graduate Research Assistant — *Aug 2012 - May 2018*

- Explored the formation of stars and black holes in the early Universe.
- Lead, guided, directed, and managed group of collaborators to design and execute a research plan.
- Implemented new modules for primordial chemistry and sink particles in C for the *arepo* code to model behavior of black holes.
- Developed tools to generate plots, images, and videos of simulation outputs: the Python analysis tool *pacha* using packages like NumPy, SciPy, and matplotlib; and the parallel C analysis tool *sator* using MPI.
- Reported findings in astronomy journals like *Monthly Notices of the Royal Astronomical Society* and *The Astrophysical Journal*.
- Presented results in astronomy conferences across many continents.
- Mentored and supervised undergrad and graduate students.

EdX *Cambridge, MA, USA*

Web Developer *Jul 2017 - May 2018*

- Built and developed a webpage using HTML, CSS and JavaScript to host an interactive module to explain randomness and normal distribution.
- Coded a tabletop simulation in three.js as the central element of the module.
- Created a matrix plot with d3.js to visualize the results of many realizations of such simulation.
- Linked both elements and added interactivity between them to control parameters and analyze how they influence the results.

Astrollytelling.io *Cambridge, MA, USA*

Creator, webmaster and lead developer *Jun 2017 - May 2018*

- Crafted, designed, and sketched idea project to teach astronomy concepts through visual stories.
- Built, designed, and developed webpages using HTML, CSS, JavaScript, and Bootstrap. (http://astrollytelling.io)
- Contacted and coordinated people in different areas of astronomy to collaborate in creating and designing storytelling for interactive modules.
- Coded interactive visualizations with d3.js.

Harvard University, School of Engineering and Applied Sciences *Cambridge, MA, USA*

Predicting Seizures and Epilepsy Project, Data Scientist *Oct - Dec 2016*

- Developed model to enhance predictions of seizures and epilepsy based factors such as the individual's identity, medical history, and social behavior.
- Collected and manipulated data with the Python package pandas.
- Built models based on Decision Trees, Random Forests, Linear SVM, Logistic Regression, LDA and QDA using NumPy, SciPy, and scikit-learn in Python.
- Visualized results with matplotlib in Python and plot.ly for web interactive plots.
- Created project website to publish results. (http://fernandobecerra.com/seizuresandepilepsy/)

Harvard University, School of Engineering and Applied Sciences *Cambridge, MA, USA*

The Final Element Project, Web Developer *Mar - May 2016*

- Designed interactive visualization to show geographic location, magnitude, and number of natural disasters around the world from 1900 to 2016 using d3.js. (http://fernandobecerra.com/natural_disasters/)
- Utilized d3.js to create an interactive force layout to show human and economic costs of natural disasters.

Harvard University, School of Engineering and Applied Sciences *Cambridge, MA, USA*

Pavoreal Project, Code Developer *Oct - Dec 2013*

- Developed a robust volume rendering tool to visualize (astrophysical) simulations using Python and GPUs.
- Created routines to read 3D data, bin it into a Cartesian grid, cast it to a texture on the GPU that uses a cubic spline to interpolate the data, and then perform a raycasting based on a transfer function.
- Implemented routines using Python packages like NumPy, SciPy, matplotlib, mpi4py, and pyCUDA.
- Created website to publish results and make code publicly available. (http://fernandobecerra.com/pavoreal/)

Universidad de Chile, Department of Astronomy *Santiago, Chile*

Graduate Research Assistant *Mar 2010 - Aug 2012*

- Conducted independent research on the relation between star formation and properties of the host galaxy.
- Modified old modules and added new ones in C and fortran to the code *Enzo*.
- Developed the Python analysis package *pigs* based on the *yt* code to analyze simulation outputs.
- Coded analysis routines in IDL to examine simulation outputs from the code *Gadget*.
- Presented results in paper published in *The Astrophysical Journal*.

Universidad de Chile, Department of Astronomy *Santiago, Chile*

Undergraduate Research Assistant *Mar 2009 - Dec 2009*

- Conducted research on distribution of energy in local galaxies under the supervision of Astronomy Department Faculty.
- Performed simulations using the *Enzo* code written in C and Fortran.
- Modified the IDL visualization package *Jacques* and wrote routines in MATLAB to analyze the results.

Las Campanas Observatory, Carnegie Institution of Washington *La Serena, Chile*

Research Assistant *Jan 2009*

- Conducted research on supernovae with our team at the Carnegie Supernova Project.
- Performed observations of supernova at the *DuPont* and *Swope* telescopes.
- Analyzed observational data with the IRAF package and the plotting program *supermongo*.

Skills

Programming	Python, C, fortran, IDL, MATLAB, Javascript, Java, LaTeX
Web	HTML5, CSS, jQuery, D3.js, Three.js, Processing
Software	Adobe Photoshop, Adobe Illustrator, Microsoft Office Suite
Languages	English, Spanish
Other	Landscape and Nature Photography