Bryant E. Avila

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Computational and hands on physics PhD, data scientist and team manager. Developed new measuring techniques to extract information from data to resolve long standing impasse for multiple projects. Wrote production quality code in various languages. Led laboratory team to deliver high quality support for scientists and facility users. Authored in 6 peer reviewed articles and presented findings at many conferences. Taught courses on multiple subjects and for different audiences. Always looking for a challenge.

AWARD:

Secured a prestigious SBIR Phase I grant from the National Science Foundation along with my PhD Principal Investigator for pioneering an artificial intelligence system to enhance transparency and predict trends in democratic elections.

PROFESSIONAL EXPERIENCE

Research Assistant - Physics PhD

CUNY Graduate Center — August 2019 – May 2024

Scientific advisor: Dr. Hernan Makse

Project: Bridging the gap between physics, network theory and neuro-science.

- Collaborated with a multidisciplinary and international team to guide their sourcing of neural activity signals by analyzing their data resulting in a pipeline leading to a prime dataset providing the basis for high quality research.
- Applied advanced concepts of graph theory to study the complex network of a worm's brain, leading to the identification of key structures responsible for synchronization and writing one of the first papers on how a particular type of network symmetry may lurk in the brain's structure. Calculations done via NetworkX and Pandas.
- Developed an open-source GUI Matlab software toolkit for analyzing and visualizing time series neural dynamics through which the previous hypotheses were further supported.

Project: A/B testing of optimal network repairing algorithms with statistical support.

- Applied dozens of statistical measuring techniques on the dataset collected above to capture relational information, transformed each into a unique developed data structure, implemented various community detection algorithms on each, producing a plethora of options to be tested.
- Developed integer linear programming GUROBI scripts to optimally repair a network informed by aforementioned results and hyperparameters. Rigorously tested code for bugs, improved efficiency and running time 10-fold, and reduced memory consumption. Tracked versions via Git producing 3 final production level versions for research challenges that lay ahead.
- Filtered over 200k results from the above to find the optimal solution for multiple categories, determined significance of each result via statistical p-value permutation tests. Ensured reproducibility of results several times to test robustness of the pipeline.

Project: Simulations to improve industrial processes.

- Employed discrete element methods for simulations to analyze and optimize the dry impregnation process in porous particles, leading to significant improvements in catalyst preparation, and how to best scale-up the processes involved tested against rigorous experimenting by our collaborative engineering team.
- Applied mathematical modeling for efficient and reproducible solutions in industrial catalyst preparation.

Mentorship & Teaching:

- Mentored 1 underrepresented high school student over one year, providing guidance in multiple STEM fields, leading to their acceptance into MIT. Taught physics classes to medical, engineering and fashion students.

Data Analyst

Kcore Analytics — Nov 2023 – April 2024

- Built new calls not offered in the US census bureau python library via their API to retrieve demographic data on multiple resolution levels, stored data into custom SQL tables prior to GeoPandas calculations. Created a Selenium based web crawler tailored towards specific websites for data extraction.
- Implemented pre-trained transformers to do sentiment analysis on retrieved tweets, incorporating results with aforementioned population data to infer election outcomes via the training of multiple convolutional graph neural network models via PyTorch.

Principal Lab Technician

Fashion Institute of Technology — Feb 2018 – Feb 2024

Budget, Funding and Team Leadership:

- Administered a yearly budget of over $100K, ensuring efficient allocation towards upgrades, chemical and equipment purchasing, and training initiatives. Successfully captured internal funds to spearhead the integration of 3D printing technology in the classroom, enhancing the practical learning experience for students.

- Led and managed a team of staff members, ensuring well-planned and efficient laboratory setups for diverse classroom experiments

Innovation, Characterization & Design:

- Collaborated with faculty in pioneering the development of sustainable materials, including bacterial leather, alginate & mushroom fabrics, and mycelium wood. Conducted detailed characterization of biological samples using Scanning Electron Microscope (SEM), and diligently reported findings relevant for further advancement.
- Utilized advanced generative design software plus AutoCAD to innovate and prototype new furniture designs, contributing to the institute's portfolio of cutting-edge creations.

Data Analyst and Electron Microscopy Specialist

Dr. Reza Kahayt's lab CCNY — April 2016 – Oct 2017

- Diligently analyzed vast datasets composed of millions of images through Relion and R, extracting pixel patches using advanced statistical software/packages, leading to the generation of atom-resolution 3D electron density models of molecules. Utilized generated insights to guide the future preparation of samples, achieving desired outcomes.
- Authored compact C shell & Python scripts, streamlining the process of running multiple calculations in parallel and manipulating thousands of files and folders being careful with the limited amount of storage available.
- Pioneered a multi-processing technique to ascertain the confidence of a 3D molecular model fit to the data.

RESEARCH PRESENTATIONS:

- **9th Annual Brain Initiative**, Bethesda, Maryland - Research presentation. Avila B, et al. "*Fibration symmetries reveal neuronal synchronizations in the C.elegans connectome*" 2023
- **8th Annual Brain Initiative**, Online - Research presentation. Avila B, et al. "*From symmetric building blocks to neural synchronization in the connectome*" 2022
- **FIT Convocation,** New York, NY - *Faculty Convocation Presentation*. Avila B, Sanchez C. 2019. "*Generative design for furniture design"* FIT Emerging Technology funded. January 2019.
- **ABRCMS,** Seattle, WA - *Poster Presentation.* Avila B, Kohley Z. 2015. "*Simulations on Rare Isotope Beams Nuclear Reaction 38S+208Pb using Time Dependent Hartree Fock theory."* NIH funded. November 2015.

ADDITIONAL WORKS

Sentimental analysis analysis for stock market predictions - Used tweeter feeds and support vector machines for stock prediction
Step by step calculus 1: Learn from scratch - Creator of online calculus course for beginners (4.4/5 star rating)
Unique Tensorflow architecture - Created a unique neural network architecture and tested its performance against other architectures
NYC rat infestation predictor - Inferred rat infestation of buildings using NYC public data on sanitation, housing, ArcGIS and more

PUBLICATIONS

- Khayat R, Avila B, et al. "Porcine circovirus 2 uses a multitude of weak binding sites to interact with heparan sulfate, and the interactions do not follow the symmetry of the capsin." Journal of Virology. 2019.
- Khayat R, Avila B, et al. "Cryo-electron microscopy structure of the 70S ribosome from Enterococcus faecalis." Nature. 2020.
- Avila B, et al. "Fibration symmetries and cluster synchronization in the Caenorhabditis elegans connectome." PLOS One 2024.
- Tommasone M, Avila B, et al. "Scale-up of Dry Impregnation Processes for Porous Spherical Catalyst Particles in a Rotating Drum: Experiments and Simulations." preprint arXiv:2307:1444, Granular Matter (submitted August 2023).
- Avila B, et al. "Exploring Fiber Symmetries of the Caenorhabditis elegans locomotion gait through Calcium Imaging and Graph Repair: An Integration of Functional and Structural Networks." (Submission planned for March 2024).

EDUCATION

PhD candidate in Physics	CUNY Graduate Center	Present
Masters of Philosophy in Physics.	CUNY Graduate Center	February 2023
Bachelors of Science in Physics (Cum Laude and Research honors)	City College of New York	February 2016

TECHNICAL SKILLS:

Programing Languages & Softwares:

NumPy, SciPy, Pandas, SKlearn, Matplotlib, TensorFlow, PyTorch, Geopandas, NetworkX, Selenium, GUROBI, hugging face, R, C shell, Fortran, Matlab, SQL, LateX, Labview, Relion, Fusion 360, Solidworks, GitHub, ArcGIS, AutoCAD, and Salesforce.