Brandon N. Benton, PhD

Data Scientist, Climate Scientist

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Postdoctoral Research Fellow at Cornell University. Consistent record of achievement in the areas of data science, machine learning, and scientific computing. Multiple publications and presentations relating to climate modeling, condensed matter, and fluid dynamics. Additional experience instructing physics and mathematics classes for undergraduates, overseeing graduate student research programs, and creating algorithms and prototypes.

Work History

2020-01 - Current

Post-Doctoral Fellow - *CORNELL UNIVERSITY, Ithaca, NY*

Climate AI: *Image classification – Computer vision – python – TensorFlow – Keras*.

- Developing tools for detecting hurricane conditions in satellite images. Will help to identify hurricane conditions before hurricane formation.
- Using satellite composites for all storms after year 2000 for training.

Climate Modelling: *Cloud-based development – python – modelling*.

- Developing AWS interface to allow general public to perform climate simulations.
- Successfully ported CESM to AWS architecture for backend modeling.
- Developed novel tools to streamline CESM paleoclimate modeling.
- $250,000 Grant provided by Carl Sagan Institute.

Weather Forecasting: *Big Data – python – modelling – cloud-based development – applied math – education*.

- Developing and planning hyperlocal weather forecasting system designed to improve winter-storm emergency response and enhance natural disaster coordination for New York state's rural communities.
- Developed python code to setup WRF on AWS and post-processing environment on Amazon Workspace.
- Led team of four undergraduate students using this code to perform on-demand weather forecasting for Tompkins County.

Idealized Planet Simulations: *Cloud-based development – cluster deployment – python – fortran – modelling*.

- Led research on effect of heat anomalies injected into aquaplanet SSTs and drycore surface fields on polar vortex.
- Ran aquaplanet and drycore simulations on 5.34-petflop Cheyenne Supercomputer using CESM.

COVID Modeling: *Big Data – cloud-based development – python – modelling – applied math*.

- Built custom compartmental infectious disease model including asymptomatic, symptomatic, hospitalization, and death projections for entire United States.
- Social distancing included along with gradient descent-based parameter estimation.
- Correctly predicted deaths and hospitalizations in New York one month ahead.
- Model hosted on AWS and constantly updated using CovidTracking API.

Skills

High Performance Computing ●●●●● Excellent

Machine Learning ●●●●● Excellent

Data Visualization ●●●●● Excellent

Numerical Modeling ●●●●● Excellent

Statistical Analysis ●●●●● Excellent

Scientific Computing ●●●●● Excellent

Development

Python ●●●●● Excellent

Bash ●●●●● Excellent

TensorFlow ●●●●● Excellent

Keras ●●●●● Excellent

Mathematica ●●●●● Excellent

Pandas ●●●●● Excellent

Scikit-Learn ●●●●● Excellent

Git

Low Frequency Climate Variability in Tree Rings: *Big data – python – MATLAB – modelling – statistical analysis*.

- Updated and improved complex database of tree ring information from variety of disparate, obscure, and hard-to-access data sources.

2012-01 - 2021-01

Independent Researcher - *BRANDON BENTON, Ithaca, NY*

Quadcopter Build:

- Designed and built working quadcopter with GPS-enabled navigation, remote control capability, and computer control interfaces.

Twitch Bot: *NLP – python – NLTK – scikit-learn.*

- Developed Twitch bot to filter offensive content in channels.
- Bot trained on chat data classified based on messages being timed out or not.
- Bot achieved 98% success rate and is currently in use on Twitch channel.

2013-01 - 2019-01

PhD Researcher - *CORNELL UNIVERSITY, Ithaca, NY*

Low Frequency Climate Variability in Tree Rings: *Big data – python – MATLAB – modelling – statistical analysis*

- Performed multi-taper Fourier and singular value decomposition analysis on chronologies to detect and reconstruct climate signals.
- Developed successful code to construct and de-trend tree ring chronologies from various data sources.
- Built first comprehensive tree ring chronology database, to facilitate detection and reconstruction of climate response signals.

Effect of Volcanic Eruptions on Hurricanes: *Big data – python – CESM – WRF – modelling – statistical analysis*.

- Analyzed effect of volcanic eruptions on hurricane intensity, life span, and frequency.
- Led largest (temporally and spatially) downscaling of global circulation model data, spanning 1,000 years of climate data and encompassing Atlantic Ocean and continental US.
- Produced and analyzed 20TB of raw data from high-resolution coupled atmosphere-ocean regional climate simulations with focus on hurricane statistics.
- Created code to parallelize annual downscaling of global circulation model data.
- Improved efficiency by automating storage, cleaning, and compression of dataset.
- Accepted for publication in Journal of Climate Dynamics, demonstrating minor effects of volcanic eruptions and hurricane statistics.

Virtual Reality Quadcopter Interface: *Python – C++*.

- Designed comprehensive plan for constructing virtual reality interface for unmanned aerial vehicles.
- Utilized 3D spatial reconstruction from sparse sensor data to resolve bandwidth and latency issues.

First-Person Aerodynamic Sound: *Python – C++ – OpenFOAM*.

- Developed algorithmic approach for producing first-person aerodynamic sound in real time, for use on Facebook's Oculus Rift VR System.
- Modeled air flow around human head using computational fluid dynamics software.
- Investigated feasibility of particle-based fluid modeling operating on GPUs coded in CUDA to generate aerodynamic sound.
- Used MATLAB to generate sound using autoregressive stochastic models.

Aerodynamics of Maple Seeds: *Python – C++ – MATLAB*.

- Analyzed the aerodynamics of falling maple seeds, using analytical and

Excellent

NumPy

Excellent

SciPy

Excellent

experimental procedures to create a physical model, with the goal of applying insights to miniature drone flight performance.
- Developed empirical models using computer vision techniques in laboratory.

2009-01 - 2013-01 **Undergraduate Researcher -** *GEORGIA SOUTHERN UNIVERSITY, Statesboro, GA*
- Conducted research and experimentation in physics.
- Performed numerical modeling.
- Studied Bose-Einstein condensate systems undergoing various dynamics.
- Modeled expansion, pulsed laser response, and confinement behavior of condensate systems.
- Published 3 papers in professional journals and presented on results at NIST and DAMOP conferences.

Education

2016-01 - 2019-01 **PhD: Physics,** Cornell University - *Ithaca, NY*
Thesis: Analysis of Low-Frequency Climate Variability Through Computational Modeling and Tree-Ring Data Synthesis

2013-01 - 2016-01 **MS: Physics,** Cornell University - *Ithaca, NY*
Thesis: VR Quadcopter Telepresence Proposal

2008-01 - 2012-01 **BS: Physics,** Georgia Southern University - *Statesboro, GA*
Thesis: Prototyping method for Bragg-type atom interferometers
Graduated magna cum laude, University Honors Program

Certifications

- IBM Data Science Specialization
- Stanford Online Algorithms Specialization
- IBM Advanced Data Science Specialization
- IBM Applied Data Science Specialization

Publications

- Evans, C, Ault, T, **Benton, B**, Carillo, C, Coats, S, and Herrera, D; "Intrinsic century-scale variability in tropical Pacific SSTs and their influence on western US hydroclimate," Geophysical Review Letters, submitted, July 2021.
- **Benton, B,** Herrera, D, Li, X, Allesi, M, and Ault, T; "Minor impacts of major volcanic eruptions in dynamically-downscaled last millennium ensemble data," Climate Dynamics, accepted, October 2021.
- Edwards, M, Krygier, M, Seddiqi, H, **Benton, B,** and Clark, C; "Approximate mean-field equations of motion for quasi-2D Bose-Einstein condensate systems," Physical Review E, 86(5), November 2012.
- **Benton, B,** Krygier, M, Heward, J, Edwards, M, and Clark, C; "Prototyping method for Bragg-type atom interferometers," Physical Review A, 84(4), October 2011.
- Edwards, M, **Benton, B,** Heward, J, and Clark, C; "Momentum-space engineering of gaseous Bose-Einstein condensates," Physical Review A, 84(4), December 2010.