

## Wilka Torrico De Carvalho, *Aspiring Brain Scientist*

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### CONTACT INFORMATION

Website: [wcarvalho.github.io](http://wcarvalho.github.io)  
E-mail: [wcarvalh@umich.edu](mailto:wcarvalh@umich.edu)

Github: [github.com/wcarvalho](https://github.com/wcarvalho)  
Google Scholar

### RESEARCH INTERESTS

I like to hypothesize about what “basic” models and algorithms the brain may employ to solve the computational problems it faces. I suspect that brains use simple models and algorithms to solve complex problems by solving and combining solutions to simpler sub-problems. For inspiration, I look towards machine learning. For example, generative models offer solutions for how brains may learn patterns that describe data production, and reinforcement learning offers solutions for how an agent can choose actions that maximize its satisfaction in the world. I am also interested in social equity and justice, so I have more high-level interests in exploring why social stereotyping seems to *naturally emerge* as brains learn to create and generalize category representations for objects.

### TOPICS

**Machine Learning:** Implicit Inference, Bayesian Nonparametric Methods, Generative Models  
**Reinforcement Learning:** Value Estimation, Credit Assignment, Intrinsic Motivation  
**Computational Cognitive Science:** Stereotyping, Causality, Compositionality  
**Theoretical Neuroscience:** Neural Networks, Sub-symbolic & Distributed Representations

### EDUCATION

**University of Michigan—Ann Arbor**, Ann Arbor, Michigan USA  
*School of Engineering*, Ph.D. in Computer Science & Engineering, May 2022

**University of Southern California**, Los Angeles, California USA  
*Viterbi School of Engineering*, M.S. in Computer Science, May 2017  
Advisor: [Yan Liu](#)

**Stony Brook University**, Stony Brook, New York USA  
*College of Arts and Sciences*, B.S. in Physics, May 2015  
Advisor: [Axel Drees](#)

**Brooklyn Technical High School**, Brooklyn, New York USA  
Diploma in Applied Physics, May 2011

### HONORS & AWARDS

1/200 chosen internationally for Heidelberg Laureate Forum	2018
GEM Fellowship sponsored by IBM, Adobe	2017, 2018
University of Michigan Rackham Merit Fellowship	2017
ICLR Travel Award	2017
NSF Graduate Research Fellowship (Neuroscience)	2015
Provost Award for Academic Excellence (~ 0.5% of graduates chosen)	2015
Researcher of the Month	2014
HHMI Minority Undergraduate Research Fellowship	2014
NSF Louis Stokes Alliance for Minority Participation Scholar	2011
Deans List	2011-2015
USA National Achievement Scholarship Finalist (top 5% nationally)	2011

### PREPRINTS

Bryant Chen\*, [Wilka Carvalho](#)\*, Benjamin Edwards, Taesung Lee, Ian Molloy, Heiko Ludwig, Jaehoon Safavi. “*Detecting Backdoor Attacks on Deep Neural Networks by Activation Clustering.*” 2018

### CONFERENCE PUBLICATIONS

Sanjay Purushotham\*, [Wilka Carvalho](#)\*, Tanachat Nilanon, Yan Liu. “*Variational Recurrent Adversarial Domain Adaptation.*” In 5th International Conference on Learning Representations (ICLR), 2017

Sanjay Purushotham\*, **Wilka Carvalho**\*, Yan Liu. “Variational Adversarial Deep Domain Adaptation for Health Care Time Series Analysis.” In 29th Annual Conference on Neural Information Processing Systems Workshop on Machine Learning for Healthcare (NIPS ML4HC), 2016 (**Spot-light**)

**Wilka Carvalho.** “Modeling a Detection of internally reflected Cherenkov light (DIRC) Particle Detector for High-Multiplicity Collisions.” In State University of New York Undergraduate Research Conference (SURC), 2015

#### INVITED TALKS

Machine Learning Lunch Seminar. University of Southern California. (April, 2017)

#### SYMPOSIUM PRESENTATIONS

“Variational Adversarial Deep Domain Adaptation for Healthcare Time Series.” *Southern California Machine Learning Symposium. California Institute of Technology*, Pasadena, CA, 2016. **Runnerup, Best Poster. Worth \$1000 in Amazon AWS credit.**

“Modeling a DIRC Particle Detector for High-Multiplicity Collisions.” *23rd Annual CSTEP Statewide Student Conference*, Bolton Landing, NY, 2015. **2nd Place, Physics and Math.**

“Modeling the Cognitive Process of Attributing Traits to Others.” *Summer Seminar Day. California Institute of Technology*, Pasadena, CA, 2014.

“Modeling Deep Brain Stimulation of Globus Palidus Internus.” *22nd Annual CSTEP Statewide Student Conference*, Bolton Landing, NY, 2014.

“Modeling a Detection of internally reflected Cherenkov light (DIRC) Particle Detector for High-Multiplicity Collisions.” *URECA Celebration of Undergraduate Research & Creativity. Stony Brook University*, Stony Brook, NY, 2014.

“Modeling Deep Brain Stimulation of Globus Palidus Internus.” *Poster Symposium. University of Minnesota*, Minneapolis, MN, 2013.

#### RESEARCH EXPERIENCE

**Microsoft Research**, Redmond, Washington USA  
**Medical Devices Group**, June 2018 – August 2018  
Advisor: [Sumit Basu](#)

- Developed a machine learning model that can predict clinical measures from physiological signals measured by a wearable device.

**IBM Research**, San Jose, California USA  
**AI Platform Research Group**, September 2017 – December 2017  
Advisor: [Heiko Ludwig](#)

- Contributed to novel research algorithm by suggesting subspace projection technique that increased our performance from 15% to 95% accuracy. Designed and implemented environment for testing algorithm.
- Developed baseline and state-of-the-art neural networks using Tensorflow.
- Built data pipeline for large image dataset.

**Visa Research**, Palo Alto, California USA  
**Data Analytics Group**, June 2017 – August 2017  
Advisor: [Hao Yang](#)

- Formulated a novel neural network for learning a language model.
- Implemented model and baselines for language generation and question answering using Tensorflow and Facebook’s ParlAI NLP software.

- Performed extensive literature reviews on machine reading comprehension and generative models.

**University of Southern California**, Los Angeles, California USA

**Melady Machine Learning Lab**, *November 2015 – May 2017*

Advisor: [Yan Liu](#)

Samsung and NSF funded project: “Variational Adversarial Deep Domain Adaptation for Health Care Time Series Analysis”

- Implemented novel neural network that employed variational inference and adversarial training for transfer learning of multivariate time-series.
- Proposed analyses used in publications to empirically verify that our model (a) performed domain adaptation by creating domain-invariant representations and (b) transferred temporal dependencies across domains. Research led to 2 publications and a patent.
- Communicated research to general public through research feature by the USC Graduate School and to technical audience at ICLR poster presentation.

**Stony Brook University**, Stony Brook, New York USA

**Heavy Ion Research Group**, *January 2013 – August 2015*

Advisor: [Axel Drees](#)

DOE funded project: “Modeling a Detection of internally reflected Cherenkov light Particle Detector for High-Multiplicity Collisions”

- Built and maintained a simulator in C++ for the heavy ion particle detector at the Brookhaven National Laboratory.
- Contributed methods from multivariate calculus and linear algebra to particle detection algorithm. Accuracy improved from 60% to 80%.
- Designed and implemented a statistical analysis pipeline in C++ for measuring efficacy of particle detection algorithm.

**Stony Brook University**, Stony Brook, New York USA

**Computational Neuroscience Group**, *Fall 2014*

Advisor: [Giancarlo La Camera](#)

NSF LSAMP funded project: “Spectral Analysis of Rodent Neural Data”

- Performed spectral analyses on neural data to determine behavioral correlates of neural activity.

**California Institute of Technology**, Pasadena, California USA

**Emotion and Social Cognition Laboratory**, *Summer 2014*

Advisor: [Ralph Adolphs](#)

HHMI funded project: “Modeling the Cognitive Process of Attributing Traits to Others”

- Formulated a trait learning behavioral experiment to study human inference.
- Built online platform to administer psychology experiments using Javascript, PHP, and HTML.

**University of Minnesota**, Minneapolis, Minnesota USA

**Neuromodulation Research and Technology Laboratory**, *Summer 2013*

Advisor: [Matthew Johnson](#)

NIH funded project: “Modeling Deep Brain Stimulation of Globus Pallidus Internus”

- Implemented python script to build a biologically feasible computational model of neural networks
- Created template for using python to simulate deep brain stimulation with “Neuron” software

**National Central University**, Jhongli City, Taiwan

**Turbulent Combustion Laboratory**, *Summer 2012*

Advisor: [Shengyang Shy](#)

“Empirical Analysis of Theories from Fluid Dynamics”

- Explored boundary layer conditions, and laminar and turbulent flow of fluids through pipes of varying cross-sections.

TEACHING  
EXPERIENCE

**Stony Brook University**, Stony Brook, NY

**Calculus Instructor**, *Spring 2015*

Worked with two math professors to develop and teach a supplementary calculus curriculum that promoted minority representation in stem majors.

**Stony Brook University**, Stony Brook, NY

**Educational Opportunity Program Personal Tutor**, *Spring 2013 - Fall 2014*

Tutored marginalized students in introductory physics and math courses

SERVICE

Student Volunteer, ICLR, 2017

OUTREACH

*Research and Fellowships Week NSF Panel*, Los Angeles, CA, 2016

*National Society of Black Engineers Grad Panel*, Los Angeles, CA, 2016

*Graduate School External Fellowship Boot Camp*, Los Angeles, CA, 2016

*Mentored marginalized high school youth through the Pullias Center for Higher Education*, Los Angeles, CA, 2016

*Engineering Graduate Diversity Symposium*, Los Angeles, CA, 2015

*Black Student Association: What it takes to go to Graduate School*, Los Angeles, CA, 2015

*Collegiate Science and Technology Entry Program Undergraduate Research Panel*, Stony Brook, CA, 2014

SKILLS

Machine Learning Software: TensorFlow, Theano, Pytorch, Keras

Neuroscience Software: Neuron

Languages: Python, C++, C, Java

Systems: Unix, Linux, OSX

PRESS

[Exploring the source of social stereotypes](#)

[Black History Month: Why a career in science?](#)

Research Feature by the USC Graduate School

[2015 NSF Graduate Research Fellow Wilka Carvalho](#)

[Biomath Learning Center Launches Modified Supplemental Instruction Program](#)

[URECA Research of the Month: Wilka Carvalho](#)

Student Feature by Stony Brook University

INTERESTS

- traveling • chess • software development • improvisational dance • deadpan humor