

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

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CONTACT INFORMATION	<i>Website:</i> <a href="http://wcarvalho.github.io">wcarvalho.github.io</a> <i>Github:</i> <a href="https://github.com/wcarvalho">github.com/wcarvalho</a> <i>E-mail:</i> <a href="mailto:wcarvalh@umich.edu">wcarvalh@umich.edu</a> <i>Google Scholar</i>
RESEARCH INTERESTS	I am interested in developing cognitive theories of learning that help us understand how humans infer, reason with, and exploit the rich structure present in realistic visual scenes to enable sophisticated behavioral policies. Towards this end, I am currently studying how object-centric representation learning and reinforcement learning can bring us closer to human-level artificial intelligence.
EDUCATION	<div><div><b>University of Michigan—Ann Arbor</b>, Ann Arbor, Michigan USA <i>School of Engineering</i>, Ph.D. in Computer Science Advisors: <a href="#">Honglak Lee</a>, <a href="#">Satinder Singh</a>, <a href="#">Richard Lewis</a></div><div>Sep 2018 - Present</div></div> <div><div><b>University of Southern California</b>, Los Angeles, California USA <i>Viterbi School of Engineering</i>, M.S. in Computer Science Advisor: <a href="#">Yan Liu</a></div><div>Aug 2015 - May 2017</div></div> <div><div><b>Stony Brook University</b>, Stony Brook, New York USA <i>College of Arts and Sciences</i>, B.S. in Physics Advisor: <a href="#">Axel Drees</a></div><div>Aug 2011 - May 2015</div></div> <div><div><b>Brooklyn Technical High School</b>, Brooklyn, New York USA Diploma in Applied Physics</div><div>May 2007 - May 2011</div></div>
HONORS & AWARDS	<div>1/200 chosen internationally for Heidelberg Laureate Forum2018</div> <div>GEM National Fellowship sponsored by IBM, Adobe2017, 2018</div> <div>University of Michigan Rackham Merit Fellowship2017</div> <div>ICLR, Neurips Travel Award2017, 2019</div> <div>NSF Graduate Research Fellowship (Neuroscience)2015</div> <div>Provost Award for Academic Excellence (~ 0.5% of graduates chosen)2015</div> <div>Researcher of the Month (1 monthly at Stony Brook University)2014</div> <div>HHMI Minority Undergraduate Research Fellowship2014</div> <div>ΣΠΣ Physics Honor Society (sponsored by <a href="#">Alfred Goldhaber</a>)2013</div> <div>NSF Louis Stokes Alliance for Minority Participation Scholar2011</div> <div>Deans List2011-2015</div>
IN PREPARATION	<b>Wilka Carvalho</b> , Anthony Liang, Kimin Lee, Sungryull Sohn, Richard L. Lewis, Satinder Singh, Honglak Lee. “ <i>ROMA: A Relational, Object-Model Learning Agent for Sample-Efficient Reinforcement Learning</i> .” ICML Object-Oriented Learning Workshop. 2020
CONFERENCE PUBLICATIONS	<div>Sanjay Purushotham*, <b>Wilka Carvalho</b>*, Tanachat Nilanon, Yan Liu. “<i>Variational Recurrent Adversarial Domain Adaptation</i>.” In International Conference on Learning Representations (ICLR), 2017</div> <div><b>Wilka Carvalho</b>. “<i>Modeling a Detection of internally reflected Cherenkov light (DIRC) Particle Detector for High-Multiplicity Collisions</i>.” In State University of New York Undergraduate Research Conference (SURC), 2015</div>
WORKSHOP PUBLICATIONS	<b>Wilka Carvalho</b> , Kimin Lee, Anthony Liang, Ryan Krueger, Richard L. Lewis, Satinder Singh, Honglak Lee. “ <i>Efficiently Learning to Perform Household Task with Object-oriented Exploration</i> .” In NeurIPS Black In AI Workshop (Neurips BAI), 2019 <b>(Oral)</b>

Bryant Chen\*, **Wilka Carvalho**\*, Benjamin Edwards, Taesung Lee, Ian Molloy, Heiko Ludwig. “*Detecting Backdoor Attacks on Deep Neural Networks by Activation Clustering.*” In Artificial Intelligence Safety Workshop at Association for the Advancement of Artificial Intelligence (AAAI AASW), 2018 (**Best Paper**)

Sanjay Purushotham\*, **Wilka Carvalho**\*, Yan Liu. “*Variational Adversarial Deep Domain Adaptation for Health Care Time Series Analysis.*” In NeurIPS Workshop on Machine Learning for Healthcare (Neurips ML4HC), 2016 (**Spotlight**)

#### PATENTS

Bryant Chen, **Wilka Carvalho**, Heiko Ludig, Ian Molloy, Jialong Zhang, Benjamin Edwards. “*Detecting poisoning attacks on neural networks by activation clustering.*” 2020

**Wilka Carvalho**, Bryant Chen, Benjamin Edwards, Taesung Lee, Ian Molloy, Jialong Zhang. “*Using Gradients to Detect Backdoors in Neural Networks.*” 2018

**Wilka Carvalho**, Yan Liu, Tanachat Nilanon, Sanjay Purushotham. “*Effective Knowledge Transfer Among Patient Populations via Deep Learning.*” 2017

#### INVITED TALKS

Object Representations for Learning and Reasoning Workshop. NeurIPS. (December, 2020)  
Cognitive Science Community. University of Michigan. (November, 2020)  
Stony Brook Society of Physics. Stony Brook, NY. (April, 2020)  
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.

“Testing Theories in Fluid Dynamics.” *Global Lab Poster Symposium. Suny Oswego*, Oswego, NY, 2012.

#### RESEARCH EXPERIENCE

**University of Michigan—Ann Arbor**, Ann Arbor, Michigan USA  
**AI Lab**, August 2018 – Present

Advisors: [Honglak Lee](#), [Satinder Singh](#), [Richard Lewis](#)

Project: Data-Efficient Reinforcement Learning with Object-Oriented Representations

- Developed and implemented novel nonparametric neural network that employs contrastive learning to learn an invariant object recognition function that enables sample-efficient reinforcement learning in complex 3D domains

- Implemented reinforcement learning and computer vision baselines

**Microsoft Research**, Redmond, Washington USA

**Medical Devices Group**, *June 2018 – August 2018*

Advisor: [Sumit Basu](#)

Project: Predicting clinical measures from physiological signals measured by a wearable device

- 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](#)

Project: Detecting Backdoor Attacks on Deep Neural Networks by Activation Clustering

- 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.
- Research was presented in global meeting to IBM executives including CEO and selected for funding.

**Visa Research**, Palo Alto, California USA

**Data Analytics Group**, *June 2017 – August 2017*

Advisor: [Hao Yang](#)

Project: Learning latent language models for improved machine reading comprehension

- 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 Palidus 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: [Shenqyang Shy](#)

## 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

Reviewer, NeurIPS Deep Reinforcement Learning Workshop, 2020

Student Volunteer, ICLR, 2017

## OUTREACH

*Stony Brook Society of Physics*, Stony Brook, NY, 2020

*Michigan Explore Graduate Studies Workshop*, Ann Arbor, MI, 2019

*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: Pytorch, TensorFlow, Theano, Keras  
Neuroscience Software: Neuron  
Languages: Python, C++, C, Java  
Systems: Unix, Linux, OSX

PRESS

[This Week In Machine Learning \(TWIML\) Research Feature](#)  
[University of Michigan Research Feature](#)  
[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