

BRANDON CARTER

MIT CSAIL, 32-G540 (Stata Center), Cambridge MA 02139
bcarter@mit.edu | 516.350.0380 | www.brandoncarter.me

Education

- Massachusetts Institute of Technology**, Cambridge, MA June 2019
M.Eng Computer Science, Machine Learning GPA: 5.0/5.0
Developed methods for ML interpretability and computational antibody design; advised by Prof. David Gifford
Thesis Title: Interpreting Black-box Models Through Sufficient Input Subsets
- Massachusetts Institute of Technology**, Cambridge, MA June 2017
B.S. Computer Science and Engineering, B.S. Mathematics, Minor in Economics GPA: 4.7/5.0
Select Coursework: Bayesian Modeling and Inference, Machine Learning, Advanced Natural Language Processing, Performance Software Engineering, Theory of Computation, Computer and Network Security, Systems Security
Select Projects: Variational LDA Topic Modeling Implementation, Collaborative Filtering with Sentiment, Twitter Follower Count Prediction with NLP, Unsupervised Network Anomaly Detection, Understanding eBay Price Dispersion

Academia

- MIT Computer Science & Artificial Intelligence Laboratory: Gifford Lab** Cambridge, MA
Research Specialist (with Prof. David Gifford) June 2019 - Present
Graduate Research Assistant September 2017 - June 2019
Undergraduate Researcher February 2017 - June 2017
 - Developing interpretability methods for understanding black-box deep neural networks
 - Designing novel methods for therapeutic antibody design using machine learning
- Leiden Institute of Advanced Computer Science** Leiden, The Netherlands
Visiting Researcher (with Profs. Aske Plaat and Siegfried Nijssen) January 2016
 - Investigated decision tree models using time series data of intensive care unit patients to enable physicians to make more informed decisions about blood transfusions
- MIT Computer Science & Artificial Intelligence Laboratory: Haystack Group** Cambridge, MA
Undergraduate Researcher (with Prof. David Karger) August 2015 - August 2016
 - Assisted development of DataHub, a platform for managing and collaborating with data, including designing a general-purpose recommendation system using collaborative filtering
- Whitehead Institute for Biomedical Research at MIT** Cambridge, MA
Student Researcher (with Prof. Hidde Ploegh) June 2012 - August 2013
 - Developed novel single-domain antibodies (nanobodies) for tumor vaccine development
- Mount Sinai School of Medicine: Department of Ophthalmology** New York, NY
Student Researcher (with Dr. Seth Epstein) June 2011 - August 2011
 - Investigated safety and efficacy of ganciclovir gel as an adenovirus treatment in cell culture and animal models

Industry

- Google** Cambridge, MA
Student Researcher and Software Engineering Intern, Google Brain September 2018 - May 2019
 - Developed methods to evaluate concordance between ML model behavior and underlying scientific principles
 - Developed a dataset for benchmarking models that predict protein function from amino acid sequence
- Facebook** Menlo Park, CA
Software Engineering Intern June 2018 - August 2018
 - Developed and launched internationalized classifiers used in misinformation detection, leading to recall improvement up to 4x over existing methods, even when labeled data in foreign languages is unavailable
 - Discovered technique for paraphrasing text using neural machine back-translation to improve model performance and robustness in natural language tasks
- Bloomberg LP** New York, NY
Engineering Machine Learning Intern June 2017 - August 2017
 - Researched techniques for automatically recommending intelligent financial market alerts to Bloomberg users

- Improved methods for implicit matrix factorization with side information, outperforming published approaches
- Engineering Machine Learning Intern May 2015 - August 2015
- Designed and implemented a topic modeling architecture to infer abstract topics from a large corpus of legal documents, including NLP preprocessing, evaluation, web-based topic visualizations, and parallelized computation
 - Enables lawyers to more quickly discover documents through improved information retrieval and recommendation

KAYAK

Cambridge, MA

Software Engineering and Data Analytics Intern May 2016 - September 2016

- Designed algorithms to analyze flight pricing data and generate informative natural language tips on a per-route basis, allowing users to save money when buying airfare; tips were used to build the 2017 KAYAK Travel Hacker

Software Engineering and Data Analytics Intern June 2014 - May 2015

- Designed and implemented an algorithm for re-structuring links across millions of webpages to improve user experience and maximize profits, also built web interface and monitoring dashboard
- Designed and implemented clustering model to compute similarities between hotels and cities

Consulting and Personal Projects

June 2009 - June 2017

- Built save-science.org as co-president of Academics for the Future of Science at MIT, allowing thousands of people to easily contact Congress to support increased funding for scientific research
- Designed a customer relation manager and donation-tracking platform for the Institute of MERIT math enrichment program at SUNY Old Westbury, used to manage hundreds of donors
- Created StudentsThink, a resource for students to collaborate online, including forums and virtual whiteboards
- Designed a social, music-optimizing jukebox in MIT's October 2013 Hackathon
- Created website for lecture notes sharing in MIT's February 2013 Hackathon

Publications

What made you do this? Understanding black-box decisions with sufficient input subsets

Brandon Carter*, Jonas Mueller*, Siddhartha Jain, David Gifford

Artificial Intelligence and Statistics (AISTATS), 2019

[Featured as contributed talk at NeurIPS 2018 Workshop on Interpretability and Robustness]

Antibody Complementarity Determining Region Design Using High-Capacity Machine Learning

Ge Liu, Haoyang Zeng, Jonas Mueller, Brandon Carter, Ziheng Weng, Jonas Schilz, Geraldine Horny, Michael Birnbaum, Stefan Ewert, David Gifford

Accepted in Bioinformatics. bioRxiv: 682880, 2019

Critiquing Protein Family Classification Models Using Sufficient Input Subsets

Brandon Carter, Max Bileschi, Jamie Smith, Theo Sanderson, Drew Bryant, David Belanger, Lucy Colwell

ICML Workshop on Computational Biology, 2019. Accepted in Journal of Computational Biology.

[Featured as spotlight talk at ICML Workshop on Computational Biology]

Machine learning optimization of MHC class II presented peptides

Haoyang Zeng, Brandon Carter, Siddhartha Jain, Brooke Huisman, Michael Birnbaum, David Gifford

Machine Learning in Computational Biology (MLCB), 2019

[Featured as spotlight talk at MLCB]

Using Deep Learning to Classify the Protein Universe

Max Bileschi, David Belanger, Drew Bryant, Theo Sanderson, Brandon Carter, D. Sculley, Mark DePristo, Lucy Colwell

bioRxiv: 626507, 2019

Safety and Efficacy of Ganciclovir Ophthalmic Gel for Treatment of Adenovirus Keratoconjunctivitis Utilizing Cell Culture and Animal Models

Seth Epstein, Karen Fernandez, Brandon Carter, Salma Abdou, Neha Gadaria, Penny Asbell

Investigative Ophthalmology and Visual Science (IOVS), 2012

Interpreting Black-Box Models Through Sufficient Input Subsets

Brandon Carter

M.Eng Thesis, MIT Dept. of Electrical Engineering and Computer Science, 2019

Talks

Sufficient Input Subsets for Black-Box Model Interpretability and Applications in the Biological Domain

Given at Brigham and Women's Hospital (September 2019)

DeepLigand: Accurate prediction of MHC class I ligands using peptide embedding

Given at ISMB 2019 (Basel, Switzerland)

What Made You Do This? Understanding Black-box Decisions with Sufficient Input Subsets

Given at Bloomberg LP (Feb. 2019), Google Brain (Oct. 2018), Facebook (Aug. 2018)

[Also featured as lightning talk at CSAIL-MSR Trustworthy and Robust AI Workshop (Nov. 2019)]

Teaching

Introduction to Machine Learning (MIT 6.036), Graduate Teaching Assistant, Fall 2017

with Profs. Leslie Kaelbling, Tommi Jaakkola, Tomas Lozano-Perez, and Jacob White

- Developed new teaching materials, assignments, and exams for class of 300 students and supervised lab sessions and office hours

Fundamentals of Programming (MIT 6.009), Lab Assistant, Spring 2016

with Prof. Srinivas Devadas

- Worked with students during weekly lab sessions and office hours

Posters

Sufficient Input Subsets for Understanding Black-box Models and Deriving Scientific Insights

New York Academy of Sciences Machine Learning Symposium, 2019

Sufficient Input Subsets for Understanding Black-box Models and Deriving Scientific Insights

MIT EECS Masterworks, 2019

[First Place Audience Choice Award]

Skills

Programming: Python, Java, C, JavaScript, SQL, PHP, HTML/CSS, familiar with R

Technologies: NumPy/SciPy/Scikit-learn (contributor), TensorFlow, Keras, git, React, Apache Beam, Hive, LaTeX

Activities

World Traveling; Sailing; Golf; Aviation (student pilot); Music (concert pianist and double bassist)