

# BRIAN K. PLANCHER

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## ACADEMIC POSITIONS

**BARNARD COLLEGE, COLUMBIA UNIVERSITY:** New York, NY

STARTING JULY 2022

- Assistant Professor of Computer Science

## EDUCATION

**HARVARD UNIVERSITY:** Cambridge, MA

AUG 2016 – MAY 2022

- PhD Engineering Sciences: Electrical Engineering with a focus in Robotics; GPA: 3.9/4.0  
Dissertation: “GPU Acceleration for Real-time, Whole-Body, Nonlinear Model Predictive Control”  
Advisors: Vijay Janapa Reddi and Scott Kuindersma  
MAY 2022
- MEng in Engineering Sciences: Electrical Engineering with a focus in Robotics; GPA: 3.9/4.0  
Thesis: “Parallel and Constrained Differential Dynamic Programming for Model Predictive Control”  
Advisor: Scott Kuindersma  
MAY 2018

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT):** Cambridge, MA

AUG 2015 – JUNE 2016

- Advanced Study Non-Degree Student; GPA: 5.0/5.0

**HARVARD UNIVERSITY:** Cambridge, MA

AUG 2009 – MAY 2013

- B.A. Magna Cum Laude in Computer Science with a Minor in Economics; GPA: 3.9/4.0  
Thesis: “Hacking the White House: Election Fraud in the Digital Age”  
Advisor: Greg Morrisett

## AWARDS AND RECOGNITION

- IEEE Micro Top Picks Honorable Mention  
JANUARY 2022
- Harvard Faculty of Arts and Sciences Certificate in Undergraduate Mentoring  
APRIL 2021  
Certificate given for completing three undergraduate mentorship trainings covering: Developing Research Projects with Undergraduates, Undergraduate Research Fellowships, Supporting Student Science Writing, Writing Recommendation Letters, Handling Challenges and Celebrating Successes, and Supporting Student Diversity and Inclusion
- The Derek Bok Center Distinction in Teaching Award  
FALL 2017, 2018, 2019  
Award given for achieving above a 4.5/5.0 in course evaluations
- The Derek Bok Center Teaching Certificate  
DEC 2019  
Certificate given for recognition of commitment to improving one’s teaching through enrollment in Bok Center teaching courses (Foundations of Teaching in STEM, Problems and P-Sets: Creating and Teaching Questions in STEM, Teaching and the Job Market), filmed teaching pedagogy reviews, and development of teaching materials
- National Science Foundation Graduate Research Fellowship (NSF GRFP)  
APR 2018

## TEACHING EXPERIENCE

**edX Inc:** Cambridge, MA – *Teaching Staff Lead*

SUMMER 2020 – SUMMER 2022

- For the HarvardX Professional Certificate in Tiny Machine Learning (TinyML) MOOC [[Course 1-3 Link](#) [Course 4 Link](#)]
- Co-designed a free, hands-on, project-based professional certificate taught through three 6-week courses (and an optional fourth course) on the EdX platform covering the emerging field of Tiny Machine Learning (deploying machine learning onto microcontrollers for machine learning at the extreme edge) with the aim of democratizing access to this developing field
- Over 66,000 students from over 175 countries enrolled as of April 2022 since the four courses launched in September 2020, December 2020, February 2021, and March 2022 respectively
- Served as the laboratory instructor both co-designing hands-on exercises as well as recording video walkthroughs
- Managed the 10-person course staff to ensure that content was created, reviewed, and produced in a timely manner
- Led and managed external relations for the course team coordinating with edX, Google, and Arduino
- Co-designed course materials including short video lectures, readings, code walkthroughs, assessments, and discussion forums
- Released all course materials open-source to enable global adaptation for further access to TinyML education [[link](#)]

**HARVARD UNIVERSITY:** Cambridge, MA – *Head Teaching Fellow (Head TA)*

FALL 2020

- For CS 249r: Special Topics in Edge Computing: Tiny Machine Learning (TinyML)
- Co-designed a new 40 student course at the intersection of machine learning and embedded systems
- Designed and gave lectures for the introduction to machine learning section of the course
- Co-developed hands-on project-based assignments training TinyML models with Google Colab and deploying on Arduinos
- Mentored student teams pursuing research-based final projects

**HARVARD UNIVERSITY:** Cambridge, MA – *Head Teaching Fellow (Head TA)*

FALL 2019

- For CS 249r: Special Topics in Edge Computing: Autonomous Machines
- Co-designed a new 45 student course at the intersection of robotics and computer architecture / embedded systems
- Served as the robotics instructor: designed and gave lectures for the robotics section of the course
- Co-developed course assignments and course infrastructure/tools (e.g., the online paper discussion forum)
- Mentored student teams pursuing research-based final projects

**HARVARD UNIVERSITY:** Cambridge, MA – *Head Teaching Fellow (Head TA)*

FALL 2017,18

- For CS 182: Introduction to Artificial Intelligence
- Managed a team of 11 teaching fellows supporting the 150 student course to ensure sections and office hours were held, exams and homework assignments were graded, and student questions on the online forum were answered.
- Designed and gave two lectures: “Introduction to Robotics and Path Planning I/II” and the related assignment/exam questions
- Co-Designed and gave a new set of weekly recitations that mapped the weekly course content to cross-cutting course themes
- Co-developed course coding and written (theoretical) assignments, and developed course infrastructure/tools (e.g., autograders)
- Mentored student teams pursuing research-based final projects

**MIT / HARVARD UNIVERSITY:** Cambridge, MA – *Teaching Assistant*

FALL 2017,18,19,21

- For Harvard’s 15 student section of MIT’s MAS.863: How to Make Almost Anything
- Gave recitations: “Introduction to Embedded Programming”, “Introduction to Electronics Fabrication and Design”
- Held office hours, led introductory sessions for course software, aided students in lab work, machine usage, and project design

**MIT LINCOLN LABORATORIES BEAVER WORKS:** Cambridge, MA – *Associate Instructor*

SUMMER 2016,17,18,19

- For the RACECAR Mini Grand Prix Challenge: a hands-on, intensive, residential, project-based, free to attend, 4-week program for high school students interested in studying STEM
- Worked with 9-12 teams of 4-6 students to teach programming concepts and robotic algorithm design through the completion of fast autonomous navigation tasks using 1/10 scale racecars using Python/ROS
- Co-designed weekly challenges to ensure all teams developed the technical skills needed for the final race
- Co-designed and co-built the final race track spanning an entire ice hockey rink

**HARVARD UNIVERSITY:** Cambridge, MA – *Course Assistant*

FALL 2010, SPRING 2011

- For Math 1a (Fall) and 1b (Spring): Introduction to Calculus I and II and Introduction to Differential Equations
- Taught a weekly breakout section, staffed the Math Question Center to aid students in problem sets, and graded problem sets

**JOURNAL PAPERS**

- B. Boroujerdian, H. Genc, S. Krishnan, P. Bardienus, B. Duisterhof, **B. Plancher**, K. Mansoorshahi, M. Almeida, A. Faust, V. Janapa Reddi. “The Role of Compute in Autonomous Aerial Vehicles.” in IEEE Transactions on Computers, 2022.
- V. Janapa Reddi, **B. Plancher**, S. Kennedy, L. Moroney, P. Warden, A. Agarwal, C. Banbury, M. Banzi, M. Bennett, B. Brown, S. Chitlangia, R. Ghosal, S. Grafman, R. Jaeger, S. Krishnan, M. Lam, D. Leiker, C. Mann, M. Mazumder, D. Pajak, D. Ramaprasad, J. E. Smith, M. Stewart, D. Tingley, “Widening Access to Applied Machine Learning with TinyML,” in Harvard Data Science Review, 2022.
- **B. Plancher**, S. M. Neuman, T. Bourgeat, S. Kuindersma, S. Devadas, V. Janapa Reddi, “Accelerating Robot Dynamics Gradients on a CPU, GPU, and FPGA,” in IEEE Robotics and Automation Letters (RA-L), January 2021.
  - Additionally dual-accepted under the RAL+ICRA option for presentation at the IEEE International Conference on Robotics and Automation (ICRA), Xi’an China and Virtual, June 2021.

**CONFERENCE PAPERS**

- [Under Review] V. Mayoral-Vilches, S. M. Neuman, **B. Plancher**, V. Janapa Reddi, “RobotCore: An Open Architecture for Hardware Acceleration in ROS 2,” in the in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Kyoto, Japan, October 2022.
- S. M. Neuman, **B. Plancher**, B. P. Duisterhof, S. Krishnan, C. Banbury, M. Mazumder, S. Prakash, J. Jabbour, A. Faust, C.H.E. de Croon, and V. Janapa Reddi, “Tiny Robot Learning: Challenges and Directions for Machine Learning in Resource-Constrained Robots,” in the IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), Incheon, Korea, June 2022.
- **B. Plancher**, S. M. Neuman, R. Ghosal, S. Kuindersma, V. Janapa Reddi, “GRiD: GPU-Accelerated Rigid Body Dynamics with Analytical Gradients,” IEEE International Conference on Robotics and Automation (ICRA), Philadelphia PA, May 2022.
- B. Boroujerdian, R. Ghosal, J. Cruz, **B. Plancher**, and V. Janapa Reddi, “RoboRun: A Robot Runtime to Exploit Spatial Heterogeneity,” in the Design Automation Conference (DAC), Virtual, December 2021.
- S. M. Neuman, **B. Plancher**, T. Bourgeat, T. Tambe, S. Devadas, V. Janapa Reddi, “Robomorphic Computing: A Design Methodology for Domain-Specific Accelerators Parameterized by Robot Morphology,” in the ACM International Conference on Architecture Support for Programming Languages and Operating Systems (ASPLOS), Virtual, April 2021.
  - IEEE Micro Top Picks 2022 Honorable Mention

- **B. Plancher**, C. Brumaar, I. Brumar, L. Pentecost, S. Rama, D. Brooks, “Application of Approximate Matrix Multiplication to Neural Networks and Distributed SLAM,” in the IEEE High Performance Extreme Computing Conference (HPEC), Waltham, MA, September 2019.
- **B. Plancher** and S. Kuindersma, “A Performance Analysis of Parallel Differential Dynamic Programming on a GPU,” in the Workshop on the Algorithmic Foundations in Robotics (WAFR), Merida, Mexico, December 2018.
- **B. Plancher**, Z. Manchester, and S. Kuindersma, “Constrained Unscented Dynamic Programming,” in the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Vancouver, Canada, September 2017.
- S. Karaman, A. Anders, M. Boulet, J. Connor, K. Gregson, W. Guerra, O. Guldner, M. Mohamoud, **Brian Plancher**, R. Shin, and J. Vivilecchia, “Project-based, collaborative, algorithmic robotics for high school students: Programming self-driving race cars at MIT,” in the IEEE Integrated STEM Education Conference (ISEC), Princeton, NJ, March, 2017.

## DISSERTATIONS AND THESES

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- **B. Plancher**, “GPU Acceleration for Real-time, Whole-Body, Nonlinear Model Predictive Control,” Harvard University, PhD Dissertation, April 2022.
- **B. Plancher**, “Parallel and Constrained Differential Dynamic Programming for Model Predictive Control,” Harvard University, MEng Thesis, May 2018.
- **B. Plancher**, “Hacking the White House: Election Fraud in the Digital Age,” Harvard University, Undergraduate Thesis, March 2013.

## POSTERS, WORKSHOPS, ABSTRACTS, AND OTHER

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- Pete Warden, Matthew Stewart, **Brian Plancher**, Colby Banbury, Shvetank Prakash, Emma Chen, Zain Asgar, Sachin Katti, and Vijay Janapa Reddi, “Machine Learning Sensors,” arXiv preprint. June 2022.
- Marco Zennaro, **Brian Plancher**, and Vijay Janapa Reddi, “TinyML: Applied AI for Development,” at the UN 7th Multi-stakeholder Forum on Science, Technology and Innovation for the Sustainable Development Goals. Remote. May 2022.
- **B. Plancher** and V. Janapa Reddi, “The Tiny Machine Learning Open Education Initiative (TinyMLedu),” ACM Technical Symposium on Computer Science Education (SIGCSE), Providence, Rhode Island, March 2022.
- **B. Plancher** and S. Kuindersma, “Realtime Model Predictive Control using Parallel DDP on a GPU,” in the workshop Toward Online Optimal Control of Dynamic Robots at the International Conference on Robotics and Automation (ICRA), Montreal, Canada, May 2019.

## INVITED TALKS AND SEMINARS

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- “Data Pre-Processing for Hands-on Keyword Spotting,” SciTinyML-22 Africa: African Regional Workshop on Scientific Use of Machine Learning on Low-Power Devices Workshop, Remote, April 2022.
- “Convolutions for Hands-on Computer Vision,” SciTinyML-22 Africa: African Regional Workshop on Scientific Use of Machine Learning on Low-Power Devices Workshop, Remote, April 2022.
- “TinyMLedu: Widening Access to TinyML Education and Resources,” TinyML Toronto Meetup, Remote, January 2022.
- “Hardware Acceleration for Realtime Robotics,” Barnard College, New York, NY, December 2021.
- “Introduction to Robot Motion Planning,” Simmons College, Boston, MA, December 2021.
- “TinyMLedu Outreach: Embedded Machine Learning for the Navajo Nation,” TinyML for Good, Remote, November 2021.
- “Hands-on Embedded ML from Theory to Practice: Vision and Audio,” SciTinyML-21: Scientific Use of Machine Learning on Low-Power Devices Workshop, Remote, October 2021.
- “Robust Realtime Model Predictive Control through Co-Design,” CMU Robotic Exploration Lab, Remote, December 2020.
- “Custom Accelerator Chips (ASICs) for Robotics / Autonomous Systems,” Pillar VC, Boston, MA, April 2020.
- “Accelerating Real Time Model Predictive Control,” Optimus Ride, Boston, MA, October 2019.
- “GPU Acceleration for Robotics,” DUT/MIT Formula Student Driverless, Cambridge, MA, November 2018.

## ADVISING

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### UNDERGRADUATE THESES

- |   |          |
|---|----------|
| • Dhilan Ramaprasad: Highest Honors<br><i>Teaching Embedded Systems Programming</i>                                     | MAY 2022 |
| • Lev Jacob Grossman: Highest Honors<br><i>Reinforcement Learning to Enable Robust Robotic Model Predictive Control</i> | MAY 2020 |
| • John Alex Keszler: Honors<br><i>FPGA Acceleration of Motion Planning Algorithms For Robotics Applications</i>         | MAY 2019 |

### MENTOR

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|---|-------------------------|
| • Harvard College Women in STEM Mentorship Program  | FALL 2021 – SPRING 2022 |
| • Try AI: “A program designed to introduce early undergraduate students, particularly those identifying as women, Black, Latinx, and/or Indigenous, to research in Artificial Intelligence” | FALL 2020               |

## OUTREACH

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### *Co-Chair:*

- The Tiny Machine Learning Open Education Initiative (TinyMLedu): A group of academics and industry professionals from around the globe working to increase global access to low-cost embedded machine learning education and research. [[Link](#)]

### *Co-Organizer:*

- SciTinyML 2021, 2022: Scientific Use of Machine Learning on Low-Power Devices: a 5-day hands-on, virtual workshop for university students and professors exploring real-world applications of TinyML and how they can impact the developing world. The 2021 workshop was run globally with 216 participants from 48 countries, while the 2022 workshops were run regionally for Africa (187 participants from 29 countries), Asia (100 from 8), and Latin America to enable more targeted and locally relevant materials. [[Link-21](#), [Link-22](#)].
- EASI 2022: the Edge AI Summer Institute. A 3-day, hands-on workshop for high school teachers and students exploring real-world applications of artificial intelligence at the edge through hands-on examples of TinyML. This program was a collaboration between Harvard University, Navajo Technical University, and Barnard College, Columbia University. [[Link](#)].
- CRESTLEX 2021: CReating Effective STem Learning Experiences. A 4-day, hands-on workshop for high school teachers and students serving the Navajo Nation exploring real-world applications of artificial intelligence through hands-on examples of TinyML. This program was a collaboration led by Harvard and Navajo Technical University with support from industry sponsors including Google, and Edge Impulse. [[Link](#)]

### *Judge:*

- Harvard Women in STEM ENVISION Proposal-Writing Competition – 2021, 2022
- Harvard i3: The Harvard College Innovation Challenge – 2021

### *Member:*

- Harvard SEAS Committee on Diversity, Inclusion, and Belonging: Post-Bachelorette Outreach Working Group – 2021

## PROFESSIONAL SERVICE

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### *Associate Co-Chair:*

- RAS TC Model-Based Optimization for Robotics – 2022 to Present [[Link](#)]

### *Lead Organizer:*

- Mind the Gap: Opportunities and Challenges in the Transition Between Research and Industry. A Robotics Science and Systems (RSS) 2022 Workshop. [[Link](#)]

### *Program Committee:*

- ACM Innovation and Technology in Computer Science Education (ITiCSE) – 2022

### *Reviewer:*

- IEEE Robotics and Automation Letters (RAL)
- IEEE International Conference on Robotics and Automation (ICRA) – 2021, 2022
- IEEE International Conference on Advanced Motion Control (AMC) – 2022
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) – 2020, 2022
- IEEE Integrated STEM Education Conference (ISEC) – 2018

### *Working Group Member:*

- Stop Reinventing the Wheel! Leveraging Community Software in CS Education – ITiCSE 2022

### *Member:*

- IEEE Robotics and Automation Society (IEEE-RAS)
- IEEE-RAS Technical Committee on Model-Based Optimization for Robotics
- ACM Special Interest Group on Computer Science Education (ACM-SIGCSE)

## ADDITIONAL PROFESSIONAL EXPERIENCE

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### **PILLAR VC:** Boston, MA – *Fellow*

JAN 2020 - MAY 2020

- Assisted in sourcing and evaluating potential investments with a focus in robotics and AI

### **McKINSEY & COMPANY:** Boston, MA – *Business Analyst*

AUG 2013 - JULY 2015

- Offered promotion to senior associate (designation reserved for top ~5% of business analyst class)
- On multiple projects, played “junior engagement manager” role, project managing newer business analysts
- Led product development strategy for a software product, interfacing between multiple engineering teams and management at the business unit and corporate levels for a prime defense contractor
- Analyzed the value chain, market dynamics, and entry strategy for a new product for a high-tech materials manufacturer
- Led business case and market entry strategy development for a novel aircraft for a major aerospace manufacturer
- Designed a network deployment and capital planning strategy for a national wireless carrier
- Facilitated a culture transformation for a Fortune 500 company including a simultaneous worldwide conference
- Designed a comprehensive economic development and revitalization strategy for a rural area of the United States
- Performed the strategic due diligence that led to a successful large (>\$10Bn) deal between Fortune 500 companies

**UNITED STATES DEPARTMENT OF DEFENSE:** Fort Meade, MD – *Cryptologic Access Program* MAY 2012 - AUG 2012

- Led an internal consulting project on the use of Cloud-based solutions by developing a Map-Reduce Analytic backed GUI prototype and researching and presenting findings on possible use cases to division management
- Helped lead weekly meetings to coordinate a 15 person development team and ensure code reuse and efficient production
- Designed and built generic and reusable widgets in EXT-JS and the Ozone Widget Framework in order to aid leadership in analyzing current operational metrics and improve operational efficiency and oversight

**US GREEN DATA:** Cambridge, MA – *Senior Software Engineer*

SEPT 2011 - MAY 2012

- Managed the tech team consisting of 4 Harvard Students and 4 professional web developers to ensure collaboration and production as lead web designer and developer in a Django / jQuery environment
- Evaluated the web development direction, product line and client requirements with the CEO and other company leaders
- Worked with the consulting team to create data models to improve data analysis efficiency and maximize client savings
- Provided system administrator function to maintain and improve the web architecture, security and design

## REFERENCES

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**Vijay Janapa Reddi**

Associate Professor of Electrical Engineering, John A. Paulson School of Engineering, Harvard University  
vj@eecs.harvard.edu

**Scott Kuindersma**

Senior Director of Robotics Research, Boston Dynamics  
skuindersma@bostondynamics.com

Former Assistant Professor, John A. Paulson School of Engineering, Harvard University  
scottk@seas.harvard.edu

**Zachary Manchester**

Assistant Professor at the Robotics Institute, Carnegie Mellon University  
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**Patrick Wensing**

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