

# VINEET JAGADEESAN NAIR

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## EDUCATION

**Massachusetts Institute of Technology** | PhD in Computational Science and Engineering | **GPA: 5.0/5.0** Jan 2021 - May 2025 (*expected*)  
PhD Candidate in the Mechanical Engineering department

**Massachusetts Institute of Technology** | SM in Computational Science and Engineering | **GPA: 5.0/5.0** Sep 2019 - Jan 2021  
*Thesis:* Estimating cumulative prospect theoretic passenger behavioral models for dynamic pricing & transactive control of shared mobility

**University of Cambridge** | MPhil in Energy Technologies | 1<sup>st</sup> Class Honors | Gates Cambridge Scholar Sep 2018 - Sep 2019  
*Thesis:* Optimal design & energy management of islanded, hybrid microgrids for off-grid communities with no external power exchange

**University of California, Berkeley** | **Cumulative GPA: 3.842/4.0** | Dean's Honors List | Phi Beta Kappa Aug 2014 - May 2018  
B.S. Mechanical Engineering Honors, B.A. Economics | Distinction | Cal Alumni Association Leadership Award | Tau Beta Pi  
Minor in Electrical Engineering & Computer Sciences | Certifications in Human-Centered Design and Entrepreneurship & Technology

## SKILLS

**Technical Skills:** Python, Julia, MATLAB/Simulink, Java, JAX, R, Fortran, Git, Bash, Shell, STATA, Data science & visualization, High performance computing, Machine learning frameworks, SolidWorks, AutoCAD, Fusion 360, LaTeX, LabVIEW, Finite element analysis,  
**Languages:** English, Hindi, Malayalam, Sanskrit, German (intermediate), Spanish (basic), French (basic)

## RESEARCH EXPERIENCE

- Graduate Research Assistant** | Active Adaptive Control Lab, MIT Mechanical Engineering Department Sep 2019 - *present*
- Apply distributed optimization, game theory, and control systems tools to model power grids and distributed energy resources (DERs)
  - Design new local market structures and algorithms to better coordinate and compensate DERs and prosumers in distribution networks
  - Model dynamic pricing for shared, mobility-on-demand services using cumulative prospect theory, supervised by Dr. Anuradha Annaswamy
  - Work with external partners including Ford, Siemens, GE, PNNL, NREL, Dept. of Energy and Princeton University
- Computational Scientist PhD Resident** | [Google] X, the moonshot factory, Mountain View, CA May - Dec 2023
- Developed faster solvers and simulators; applying physics-informed machine learning to study power system dynamics at Project Tapestry
  - Applied stochastic & multiperiod optimization methods to study impacts on renewables variability on the value of battery storage
- Graduate Research Intern** | National Renewable Energy Laboratory (NREL), Golden, CO May - Aug 2022
- System modeling and digital real-time simulation for hardware-in-the-loop validation of optimization/control algorithms in power grids
- Research Intern, Artificial Intelligence/Deep Learning for Smart Grids** | Siemens, Princeton, NJ May - Sep 2020
- Developed a bilevel optimization framework and market mechanism for grid integration of DERs along with demand response
- Graduate Student Researcher** | Control Group, Cambridge University Engineering Department Nov 2018 - Aug 2019
- Researched the optimal design, energy management, dispatch, and control of hybrid, islanded microgrids, supervised by Dr. Ioannis Lestas
- Mechanical and Process Engineering Intern** | Applied Materials, Santa Clara, CA May - Aug 2017
- Developed a more accurate, real-time and cost-effective method for monitoring levels of solid chemicals inside process chambers
  - Drafted 3D models, detail drawings, collaborated with suppliers to implement alternative sensors and measurement techniques
- Honors Undergraduate Researcher** | Energy and Resources Group (Prof. Duncan Callaway), UC Berkeley Jan 2017- May 2018
- Designed and prototyped low-cost energy monitors, scaled up to produce 80+ units for field trials in Nicaragua via laser cutting
  - Researched user incentives, programmed sensor networks to optimize electricity use and improve behavioral energy efficiency
- Cal Energy Corps Research Intern** | Academia Sinica, Taipei, Taiwan | Berkeley Energy & Climate Institute Jun - Aug 2016
- Optimized organic, low-cost dye-sensitized solar PV cells to raise efficiency from 8 to 9%, improved stability through co-sensitization
- Undergraduate Research Apprentice** | Indoor Air Lab, Civil and Environmental Engineering, UC Berkeley Jan - Jun 2016
- Investigated and modeled temperature effects on airflow patterns and mixing times of gaseous pollutants, under Prof. William Nazaroff
  - Independently designed and completed pilot experiment studying ultrafine particle emissions from dust and hot surfaces

## PROFESSIONAL EXPERIENCE

### **Artificial Intelligence (AI) Fellow** | MIT-Pillar AI Collective

*Jan 2024 - present*

- Customer discovery to explore commercial applications of my research in timeseries forecasting & physics-informed ML for power systems
- Participating in the National Science Foundation (NSF) Innovation Corps (I-Corps) program at MIT

### **MIT Delegate & UNFCCC Observer** | COP28, Dubai, United Arab Emirates

*Oct - Dec 2023*

- Represented MIT and observed international negotiations at the 2023 United Nations Climate Change Conference of the Parties

### **Technical Curriculum Developer & Lead Instructor** | MIT International Science & Technology Initiatives

*Nov 2023 - Jan 2024*

- Developed curriculum for, and taught course on renewable energy and climate change for high school students in South Africa & Botswana

### **Data Science & Machine Learning Instructor** | MIT International Science & Technology Initiatives, Montevideo, Uruguay

*Jan 2023*

- Organized 3-week machine learning & entrepreneurship course at Universidad Tecnológica del Uruguay as part of MIT Global Startup Labs
- Developed & taught interactive lessons on neural networks, advanced deep learning methods, model validation, and hyperparameter tuning
- Mentored teams of students and professionals working on diverse applied ML startups and research projects

### **Research Consultant for Innovation Challenge** | Avangrid, Orange, CT

*May - Oct 2021*

- Worked with Avangrid's Smart Grids Innovation team to implement a distributed energy resources management system (DERMS) pilot
- Developed a hybrid/federated software architecture and decision-making method for DERMS, to enhance cybersecurity & interoperability

### **Thriving Earth Exchange Community Science Fellow** | American Geophysical Union (AGU)

*Jan 2021 - Nov 2023*

- Part of 2021 cohort, in partnership with American Meteorological Society (AMS) and Association of Science & Technology Centers (ASTC)
- Worked with scientists, community leaders, legislators, gas & power utility representatives, environmental advocates, and local citizens
- GIS data collection, infrastructure planning, and environmental impact assessment to build an energy plan for Otsego County, New York

### **Entrepreneurship Project Director** | Cambridge Development Initiative and Kite Dar es Salaam

*Oct 2018 - Sep 2019*

- Designed and implemented projects to boost youth technology entrepreneurship, improve sanitation and clean energy access in Tanzania

### **Ruhr Fellow** | University Alliance Ruhr and TU Dortmund, Germany

*Jun - Aug 2018*

- One of only 12 undergraduates selected from across the US to participate in a 2-month transatlantic summer exchange program

### **Energy Management Intern at DEW21 (Energy & Water Authority)** | Dortmund, Germany

*Jul - Aug 2018*

- Modeled and optimized hourly/daily price forward curves to predict natural gas prices in European markets, five years into the future

### **Engineering, Math, Physics and Chemistry Tutor** | Center for Access to Engineering Excellence, UC Berkeley

*Aug 2016 - May 2018*

- Tutored students and peers for 14+ hours a week, both individually and in study groups (3-5 students), and hosted review sessions

### **Vice President of Operations** | Bay Area Environmentally Aware Consulting Network (BEACN)

*May 2017 - Jan 2018*

- Spearheaded client acquisition, sponsorships and member recruitment, supervised project management, club logistics and finances

### **Strategic Partnerships Coordinator** | ASUC Helios Solar Program, UC Berkeley

*Oct 2015 - Aug 2017*

- Connected student group housing to low-cost solar PV installations and promoted sustainability through rolling renewable energy fund

### **Undergraduate Liaison and Vice President of Technology** | Berkeley Energy & Resources Collaborative (BERC)

*Dec 2015 - May 2018*

### **R&D Engineer and Controls Sub Team Member** | Berkeley Hyperloop (bLoop)

*Sep 2016 - Aug 2017*

- Designed control systems, improved efficiency of propulsion and self-powering components, predicted the pod's socioeconomic impact
- Competed as a finalist in the SpaceX Hyperloop on-track competition in January 2017

### **Senior Consultant and Project Manager** | Bay Area Environmentally Aware Consulting Network (BEACN)

*Sep 2015 - May 2017*

- Led team of consultants in competitive strategy, market research, studying socioeconomic impact and technical data analysis
- Provided triple bottom line consulting for sustainable firms including a cleantech financier, geothermal startup & agrochemical biotech firm

### **External Consultant** | BERC Innovative Solutions Consulting

*Jan 2016 - Jun 2017*

- **Electric Power Research Institute:** Identified key drivers and use-cases for production, storage, transport, and use of hydrogen energy
- **Amazon Web Services:** Analyzed technical, financial, and policy aspects regarding renewable energy storage in Amazon's data centers

### **Residential Sustainability Program Coordinator** | Office of Student Development, UC Berkeley

*May 2015 - May 2016*

- Implemented sustainable projects, organized events in dorms and dining halls to raise environmental awareness among 7000+ residents

### **Peer Advisor** | Department of Economics, UC Berkeley

*Jan - Jun 2016*

- Advised fellow economics students on areas related to academic planning, research, the honors program, and other opportunities

### **Undergraduate Student Instructor for General Chemistry** | College of Chemistry, UC Berkeley

*Jan - Dec 2015*

- Assisted graduate students in teaching two discussion sections and helped facilitate two laboratory sessions of 30+ students each

## PROJECTS

### Selected Programming Projects | UC Berkeley, University of Cambridge, MIT

Jan 2018 - present

- Used natural language processing and deep neural networks for future stock price predictions based on textual news data
- Extended sparse regression techniques to discover partial differential equations and denoised data via dynamic mode decomposition
- Implemented a numerical model in MATLAB to simulate traffic flows on highways and mitigate congestion
- Wrote a finite-element, computational fluid dynamics program from scratch in Fortran to analyze compressible flow through pipes
- Developed finite state machine model based on hybrid systems theory to optimally schedule and coordinate EV charging along highways
- Implemented various Java data structures to build a basic version of Google Maps, an auto grader, and an interactive, 2D game

### Selected Controls, Modeling, and Design Projects | UC Berkeley, University of Cambridge, MIT

Aug 2014 - May 2018

- Designed and built an automated, voice-controlled coconut processor as part of my senior year capstone mechatronics project
- Designed and built a voice-controlled, miniature car using Python, Arduino, and proportional control schemes in negative feedback
- Designed feedback control systems for magnetic levitation and a self-erecting inverted pendulum, implemented via MATLAB/Simulink
- Designed and 3D printed a mini-windmill to maximize structural strength and stability, built control system for optimal power output

### Tensegrity Lights for Homes and Entertainment | Berkeley Emergent Space Tensegrities Lab and NASA Ames

Jan 2017 - Aug 2017

- Developed applications for flexible, light-weight, autonomous tensegrity robots outside space exploration, based on user feedback
- Designed and prototyped versatile, kinetic lighting structures based on tensegrity with programmable motion and color schemes

### Locus: Improved Vision for Autonomous Vehicles | Sutardja Center for Entrepreneurship & Technology

Jan 2017 - Dec 2017

- Created passive RFID road marking & readers to improve lane detection and safety of autonomous cars in low-visibility & bad weather
- Created a working prototype, raised >\$10000 of seed funding and set up partnerships with city governments to develop our new venture

### Mobile App Challenge Finalist | Center for Information Technology Research in the Interest of Society (CITRIS)

Jan - May 2016

- Designed and built a prototype for an app providing short-term 'micro tasks' and online volunteering opportunities to users

### Predicting Academic Performance | Term Project for the Econometric Analysis class, UC Berkeley

Mar - May 2016

- Developed and evaluated a multiple linear regression model to accurately predict students' Math test scores, using STATA and Excel

### Engineering Design team member & Robotics Mentor | Pioneers in Engineering (PiE), UC Berkeley

Jan 2015 - May 2016

- Helped design, fabricate and code a computer numerical control mill, mentored high school teams, and developed robot kits

## LEADERSHIP, TEAMWORK & ACTIVITIES

### Climate Reality Leadership Corps Member

Apr 2024 - present

### Impact Officer & Project Lead | Global Shapers, World Economic Forum

Sep 2023 - present

### Graduate Student Representative | MIT Corporation Joint Advisory Committee on Institute-Wide Affairs

Aug 2022 - Aug 2023

### Co-President | MIT Energy & Climate Club

Apr 2022 - May 2023

### Content & Operations Team Member | MIT Global Startup Workshop (GSW)

Oct 2021 - Mar 2023

### Technical Research Seminar Organizer | MIT International Science & Technology Initiatives (MISTI)

Sep - Nov 2022

### Elite Summer School in Robotics, Automation & Entrepreneurship | Innovation Centre Denmark

Aug 2022

### Co-Managing Director | 2022 MIT Energy Conference

May 2021 - Apr 2022

### Vice President of Community & Education | MIT Energy & Climate Club

May 2020 - May 2021

### Co-Director of Applicant Experience | 2021 Climate & Energy Prize (CEP) @ MIT

Sep 2020 - April 2021

### Young Professionals Affinity Group Team Lead | Clean Energy for Biden (CE4B)

Jun - Nov 2020

### 2020 MIT Energy Conference Showcase Co-Director | MIT Energy Club

Sep 2019 - Apr 2020

### Graduate Student Leadership Incubator Fellow | MIT 2019-20 Cohort

Sep 2019 - Sep 2020

### Engage for Change Fellow | Cambridge Hub and University of Cambridge Environment & Energy Team

Jan - April 2019

### Undergraduate Student Representative At-Large | The Green Initiative Fund, UC Berkeley

Aug 2017 - May 2018

### Industrial & Public Relations Officer | Tau Beta Pi National Engineering Honor Society, CA-A Chapter

Jan 2016 - May 2018

### Professional Development & Outreach Officer | Pi Tau Sigma Mechanical Engineering Honor Society

Sep 2016 - May 2018

### LeaderShape Institute Graduate | Leadership Development Program, UC Berkeley College of Engineering

Jan 2016

### UCB Solar Spring Break Team Member | GRID Alternatives, Oakland, CA

Oct 2015 - May 2016

### Alternative Spring Break Volunteer | United Way, Biloxi-Gulfport, MS

Mar 2015

## HONORS & AWARDS

### Conference Travel Grant Award | MIT Graduate Student Council

Mar 2024

### MIT-Pillar AI Collective Fellowship | Pillar VC & MIT Deshpande Center for Technological Innovation

Dec 2023

### Den Hartog Travel Award in Mechanics | MIT Mechanical Engineering Department

Jan 2023

### Out in STEM (oSTEM) Scholarship | Berkshire Hathaway Energy Foundation

Oct 2022

### Best Paper Award: 3<sup>rd</sup> Place | 54<sup>th</sup> North American Power Symposium

Oct 2022

### MIT MADMEC Sustainability Challenge: 2<sup>nd</sup> Place | MIT Materials Science & Engineering Department

Oct 2022

<b>Martin Family Society Fellowship for Sustainability</b>   MIT Environmental Solutions Initiative	Mar 2022
<b>Runner up</b>   MIT Entrepreneurship & Maker Skills Integrator (MEMSI) Hardware Startup Bootcamp	Jan 2022
<b>Best Business Plan at International Clean Energy Challenge 2019</b>   Upper Austria	Jul 2019
<b>Gates Cambridge Scholarship</b>   University of Cambridge and Bill & Melinda Gates Foundation	Mar 2018
<b>Dean's Honors List</b>   College of Engineering and College of Letters & Science, UC Berkeley	Fall 2014 - Spring 2018
<b>Phi Beta Kappa National Honor Society Member</b>	Mar 2018
<b>Ruhr Fellowship</b>   University Alliance Ruhr & TU Dortmund, Germany	Apr 2018
<b>43rd Annual Business Today International Conference Impact Challenge Finalist</b>   Princeton University	Nov 2017
<b>Robotics Institute Summer Scholars Acceptance (Declined Offer)</b>   Carnegie Mellon	May 2017
<b>Smart Cities Innovation Collider Winner</b>   Sutardja Center, Pear.VC, Bosch, and City Innovate Foundation	Apr 2017
<b>Dean's Startup Seed Fund Winner</b>   Haas School of Business, UC Berkeley	May 2017
<b>Pi Tau Sigma Mechanical Engineering Honor Society Member</b>	Sep 2016
<b>Tau Beta Pi National Engineering Honor Society Member</b>	Feb 2016
<b>Omicron Delta Epsilon Economics Honor Society Member</b>	Feb 2016

## PUBLICATIONS

**Vineet Jagadeesan Nair** et al. "Resilience of the Electric Grid through Trustable IoT-Coordinated Assets". Submitted to the *Proceedings of the National Academy of Sciences (PNAS 2024)*.

Luca Hartmann\*, **Vineet Jagadeesan Nair\***, and Anuradha M. Annaswamy. "Circuit-aware distributed optimal voltage control for distribution grids." *MIT "A+B" Applied Energy Symposium (MITAB 2024)*.

**Vineet Jagadeesan Nair**, and Anuradha M. Annaswamy. "A game-theoretic, market-based approach to extract flexibility from distributed energy resources." *Submitted to 5th IFAC Workshop on Cyber-Physical Human Systems (2024)*.

Lucas Pereira, **Vineet Jagadeesan Nair**, et al. "Accurate Federated Learning With Uncertainty Quantification For Distributed Energy Resource Forecasting Applied To Smart Grids Planning And Operation: The ALAMO Vision." *International Conference On Electricity Distribution (CIRED) 2024 Vienna Workshop*.

**Vineet Jagadeesan Nair**, Priyank Srivastava, and Anuradha M. Annaswamy. "Enhancing power grid resilience to cyber-physical attacks using distributed retail electricity markets." *15th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2024)*.

**Vineet Jagadeesan Nair**, and Anuradha M. Annaswamy. "Local retail electricity markets for voltage control and distribution grid services." *7th IEEE Conference on Control Technology and Applications (CCTA 2023)*.

**Vineet Jagadeesan Nair**, Venkatesh Venkataramanan, Rabab Haider, and Anuradha M. Annaswamy. "Hierarchical Local Retail Electricity Markets for Distributed Energy Resources." *IEEE Power and Energy Society General Meeting (PESGM 2023)*.

**Vineet Jagadeesan Nair**, Venkatesh Venkataramanan, Rabab Haider, and Anuradha M. Annaswamy. "A Hierarchical Local Electricity Market for a DER-rich Grid Edge." *IEEE Transactions on Smart Grid (2022)*.

Thomas Lee\*, **Vineet Jagadeesan Nair\***, and Andy Sun. "Impacts of Dynamic Line Ratings on the ERCOT Transmission System." *54th North American Power Symposium (NAPS 2022)*.

Priyank Srivastava, Rabab Haider, **Vineet Jagadeesan Nair**, Venkatesh Venkataramanan, Anuradha M. Annaswamy, and Anurag K. Srivastava. "Voltage regulation in distribution grids: A survey." *Annual Reviews in Control (2023)*.

**Vineet Jagadeesan Nair** and Lucas Pereira. "Improving accuracy and convergence of federated learning edge computing methods for generalized DER forecasting applications in power grids." *Tackling Climate Change with Machine Learning workshop at the 36th Conference on Neural Information Processing Systems (NeurIPS) (2022)*.

**Vineet Jagadeesan Nair** and Anuradha M. Annaswamy. "Local retail electricity markets for grid services in DER-rich distribution systems." *2022 Transactive Energy Theory Workshop, Pacific Northwest National Laboratory (PNNL)*.

Anuradha M. Annaswamy\* and **Vineet Jagadeesan Nair\***. "Human Behavioral Models Using Utility Theory and Prospect Theory." *In Cyber-Physical-Human Systems: Fundamentals and Applications*, UK: Wiley, in Press (2023).

**Vineet Jagadeesan Nair**, and Anuradha M. Annaswamy. "Local Hierarchical Electricity Markets for Distribution Grid Services like Voltage Control." *Poster presentation at the NREL Fifth Workshop on Autonomous Energy Systems (2022)*.

**Vineet Jagadeesan Nair**, Venkatesh Venkataramanan, Rabab Haider, and Anuradha M. Annaswamy. "Secure And Private Market-based Coordination of Grid Edge IoT Devices." *Invited presentation at INFORM 2021 Annual Meeting: Session on Data Analytics in Cyber-Physical Systems*.

Thomas Lee\*, **Vineet Jagadeesan Nair\***, and Andy Sun. "Impacts of Dynamic Line Ratings on Security-Constrained Economic Dispatch for Transmission Grids & Wholesale Electricity Markets." *Technical Presentation to Federal Energy Regulatory Commission (FERC) (2022)*.

**Vineet Jagadeesan Nair**, Yue Guan, Anuradha M. Annaswamy, H. Eric Tseng, and Baljeet Singh, "Sensitivity Analysis of Passenger Behavioral Model for Dynamic Pricing of Shared Mobility on Demand." *Communications in Transportation Research (2022)*. Under review.

**Vineet Jagadeesan Nair**, Anuradha M. Annaswamy. "Estimation of Cumulative Prospect Theory-based Passenger Behavioral Models for Dynamic Pricing & Transactive Control of Shared Mobility on Demand." Master of Science Thesis in Computational Science & Mechanical Engineering. *Massachusetts Institute of Technology (2021)*.

**Vineet Jagadeesan Nair**, Ioannis Lestas. "Optimal design and energy management of islanded, hybrid microgrids for remote, isolated off-grid communities with no external power exchange." Master of Philosophy Thesis in Energy Technologies. *University of Cambridge (2019)*.

Sean Anderson, and **Vineet Jagadeesan Nair**. "Optimal Charge Scheduling of Electric Vehicles." *Preprint (2018)*.