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 | 1st 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: 3rd Place | 54th North American Power Symposium *Oct 2022*
MIT MADMEC Sustainability Challenge: 2nd Place | MIT Materials Science & Engineering Department *Oct 2022*

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

PUBLICATIONS

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 2021Annual 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).*