VINEET JAGADEESAN NAIR

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EDUCATION

Massachusetts Institute of Technology | PhD in Computational Science & Mechanical Engineering | **GPA**: 5.0/5.0 *Jan '21 - May '25*
Thesis: Data-driven decision-making algorithms and markets for distributed energy resources in the future decarbonized power grid

Massachusetts Institute of Technology | SM in Computational Science & Engineering | **GPA**: 5.0/5.0 *Sep '19 - Jan '21*
Thesis: Estimating cumulative prospect theoretic passenger behavioral models for dynamic pricing & transactive control of shared mobility

University of Cambridge | MPhil in Energy Technologies | Gates Cambridge Scholarship *Sep '18 - Sep '19*
Thesis: Optimal design & energy management of islanded, hybrid microgrids for off-grid communities in sub-Saharan Africa

University of California, Berkeley | **GPA**: 3.85/4.0 | Dean's Honors List | Phi Beta Kappa *Aug '14 - May '18*
B.S. Mechanical Engineering (Honors), B.A. Economics | Distinction | Honor Societies: Tau Beta Pi, Pi Tau Sigma, Omicron Delta Epsilon
Minor in Electrical Engineering & Computer Sciences | Certifications in Human-Centered Design & Entrepreneurship & Technology

Programming: Python, Julia, MATLAB/Simulink, Java, JAX, R, PyTorch, TensorFlow, Fortran, Git, STATA, LaTeX

Reviewer for: IEEE Conference on Decision & Control, IEEE Transactions on Control of Networked Systems, NeurIPS Tackling Climate Change with Machine Learning Workshop, ACM e-Energy Conference, IEEE Transactions on Control Systems Technology, IEEE International Conference on Automation Science & Engineering, International Journal of Electrical Power & Energy Systems, International Federation of Automatic Control World Congress, IEEE Transactions on Automatic Control, American Control Conference

RESEARCH EXPERIENCE

Graduate Research Assistant | Active Adaptive Control Lab, MIT Mechanical Engineering Department *Sep '19 - present*
- Advised by Dr. Anuradha Annaswamy, thesis committee: Prof. Andy Sun & Prof. Kamal Youcef-Toumi
- Applying optimization, game theory, machine learning & control tools to model power grids & electricity markets
- Designed new local market structures & algorithms to better coordinate & compensate distributed energy resources (DERs)
- Modeled dynamic pricing for shared, mobility-on-demand services using cumulative prospect theory
- Worked with external partners including Ford, Siemens, Shell, GE, PNNL, NREL, Dept. of Energy & Princeton University
- Managed global collaborations with faculty in Portugal, Spain, Switzerland, & Brazil
- Helped with proposal writing & coordination to secure $4 million+ in grant funding from US DOE & MIT Energy Initiative

Visiting Researcher | Universidad Politécnica de Madrid, Madrid, Spain *Oct '23 - present*
- Implement novel electricity markets & distributed optimization algorithms using blockchain infrastructure & smart contracts

Computational Scientist PhD Resident | [Google] X, the moonshot factory, Mountain View, CA *May - Dec '23*
- Built improved inverter models & power system simulators for the grid with Project Tapestry
- Applied scientific, physics-informed machine learning to enhance the speed & accuracy of transient dynamic numerical simulations
- Improved stochastic optimization model for power system planning with hydro & renewables to study value of battery storage

Graduate Research Intern | National Renewable Energy Laboratory (NREL), Golden, CO *May - Aug '22*
- System modeling & 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 '20*
- Developed a bilevel optimization framework & market mechanism for grid integration of DERs along with demand response

Graduate Student Researcher | Control Group, Cambridge University Engineering Department *Nov '18 - Aug '19*
- Researched the optimal design, energy management, dispatch, & control of hybrid, islanded microgrids, supervised by Dr. Ioannis Lestas

Mechanical & Process Engineering Intern | Applied Materials, Santa Clara, CA *May - Aug '17*
- Developed a more accurate, real-time & cost-effective method for monitoring levels of solid chemicals inside process chambers
- Drafted 3D models, detail drawings, collaborated with suppliers to implement alternative sensors & measurement techniques

Honors Undergraduate Researcher | UC Berkeley *Jan '17- May '18*
- Advised by Prof. Duncan Callaway, Prof. Kameshwar Poolla, & Prof. Claire Tomlin
- Designed & prototyped low-cost energy monitors, scaled up to produce 80+ units for field trials in Nicaragua
- Researched user incentives & programmed sensor networks to optimize electricity use & improve behavioral energy efficiency

- Studied optimal electric vehicle charge scheduling from a hybrid systems perspective

Cal Energy Corps Research Intern | Academia Sinica, Taipei, Taiwan | Berkeley Energy & Climate Institute *Jun - Aug '16*
- 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 & Environmental Engineering, UC Berkeley *Jan - Jun '16*
- Investigated & modeled temperature effects on airflow patterns & mixing times of gaseous pollutants, under Prof. William Nazaroff
- Independently designed & completed pilot experiment studying ultrafine particle emissions from dust & hot surfaces

PROFESSIONAL EXPERIENCE

Artificial Intelligence (AI) Fellow | MIT-Pillar AI Collective *Jan- Jun '24*
- Customer discovery to explore commercial applications of my research in timeseries forecasting & physics-informed ML for power systems
- Participated in the National Science Foundation (NSF) Innovation Corps (I-Corps) Spark and Fusion programs at MIT

MIT Delegate & UNFCCC Observer | COP28, Dubai, United Arab Emirates *Oct - Dec '23*
- Represented MIT & observed international negotiations at the 2023 United Nations Climate Change Conference of the Parties

Research Consultant for Innovation Challenge | Avangrid, Orange, CT *May - Oct '21*
- Worked with Avangrid's Smart Grids Innovation team to implement a distributed energy resources management system (DERMS) pilot
- Developed a hybrid/federated software architecture & decision-making method for DERMS, to enhance cybersecurity & interoperability

Thriving Earth Exchange Community Science Fellow | American Geophysical Union (AGU) *Jan '21 - Nov '23*
- Worked with scientists, community leaders, legislators, gas & power utility representatives, environmental advocates, & local citizens
- GIS data collection, infrastructure planning, & environmental impact assessment to build an energy plan for Otsego County, New York

Energy Management Intern at DEW21 (Energy & Water Authority) | Dortmund, Germany *Jul - Aug '18*
- Modeled & optimized hourly/daily price forward curves to predict natural gas prices in European markets, five years into the future

External Consultant | BERC Innovative Solutions Consulting *Jan '16 - Jun '17*
- **Electric Power Research Institute**: Identified key drivers for H_2 production, storage, transport, & usage for iron & steel decarbonization
- **Amazon Web Services**: Analyzed technical, financial, & policy issues for battery storage (with renewables) in Amazon data centers

TEACHING & MENTORSHIP

AI/ML Instructor | MIT International Science & Technology Initiatives, Lima, Peru *Oct '24 - present*
- Develop and teach 3-week intensive course on machine learning and data science for early & mid-career professionals in Lima, Peru

Technical Curriculum Developer & Lead Instructor | MIT International Science & Technology Initiatives *Nov '23 - Jan '24*
- Developed curriculum & taught high school course on climate change, clean energy & decarbonization in South Africa & Botswana

Data Science & Machine Learning Instructor | MIT International Science & Technology Initiatives, Montevideo, Uruguay *Jan '23*
- 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, & hyperparameter tuning
- Mentored teams of students & professionals working on diverse applied ML startups & research projects

Research Mentorship and Supervision | MIT International Science & Technology Initiatives
- Luca Hartmann (visiting master's student, ETH Zurich): Distributed model predictive voltage control with circuit dynamics *Sep '23 - Aug '24*
- Danielle Knutsen (MIT undergraduate): Dataset curation and synthetic data generation for future DER-rich grid studies *Sep '24 - present*
- Jose Vargas (MIT undergraduate): Probabilistic forecasting of DER power injections & flexibility with uncertainty *Sep '24 - present*

PUBLICATIONS

Vineet Nair. "Enhanced physics-informed neural networks for transient simulations of high-order power grid dynamics", Submitted to the 12th Bulk Power System Dynamics and Control Symposium (IREP 2025) and Sustainable Energy, Grids and Networks journal.
Vineet Nair et al. "Resilience of the Electric Grid through Trustable IoT-Coordinated Assets." Accepted to the Proceedings of the National Academy of Sciences (PNAS 2025).
Vineet Nair, "Enhanced Physics-informed Neural Networks for high-order power grid dynamics." NeurIPS Workshop on Tackling Climate Change with Machine Learning (2024).
Vineet Nair, "Multiobjective Optimization-Based Design & Dispatch of Islanded, Hybrid Microgrids for Remote, Off-grid Communities in Sub-Saharan Africa." Submitted, under review (2024).
Vineet Nair et al. "Federated Learning Forecasting for Strengthening Grid Reliability & Enabling Markets for Resilience." International Conference On Electricity Distribution (CIRED) 2024 USA Workshop.
Luca Hartmann*, **Vineet Nair*** et al. "Circuit-aware distributed optimal voltage control for distribution grids." MIT "A+B" Applied Energy Symposium (MITAB 2024).

Vineet Nair, & Anuradha M. Annaswamy. "A game-theoretic, market-based approach to extract flexibility from distributed energy resources." 5th IFAC Workshop on Cyber-Physical Human Systems (CPHS 2024).
Lucas Pereira, **Vineet Nair**, et al. "Accurate Federated Learning With Uncertainty Quantification For Distributed Energy Resource Forecasting Applied To Smart Grids Planning & Operation: The ALAMO Vision." International Conference On Electricity Distribution (CIRED) 2024 Vienna Workshop.
Vineet Nair, et al**.** "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 Nair, & Anuradha M. Annaswamy**.** "Local retail electricity markets for voltage control & distribution grid services." 7th IEEE Conference on Control Technology & Applications (CCTA 2023).
Vineet Nair et al**.** "A Hierarchical Local Electricity Market for a DER-rich Grid Edge." IEEE Transactions on Smart Grid (2022)**.**
Thomas Lee*, **Vineet Nair*** et al. "Impacts of Dynamic Line Ratings on the ERCOT Transmission System." 54th North American Power Symposium (NAPS 2022).
Priyank Srivastava, Rabab Haider, **Vineet Nair** et al. "Voltage regulation in distribution grids: A survey." Annual Reviews in Control (2023).
Vineet Nair & Lucas Pereira. "Improving accuracy & 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).
Anuradha M. Annaswamy* & **Vineet Nair***. "Human Behavioral Models Using Utility Theory & Prospect Theory." In Cyber-Physical-Human Systems: Fundamentals & Applications, UK: Wiley, in Press (2023).
Vineet Nair et al, "Sensitivity Analysis of Passenger Behavioral Model for Dynamic Pricing of Shared Mobility on Demand." Under review.
Vineet Nair. "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 Nair, Ioannis Lestas. "Optimal design & 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, **Vineet Nair**. "Electric vehicle charge scheduling on highway networks from an aggregate cost perspective." Preprint (2018).

PRESENTATIONS & TALKS

Vineet Nair & Anuradha Annaswamy. "Maximizing Security and Resilience to Cyber-attacks in a Power Grid." MIT Energy Initiative Future Energy Systems Center Fall Workshop (2024).
Vineet Nair. "Towards a grittier grid: Data-driven decision-making for distributed energy resources." Stanford University seminar (2024).
Lucas Pereira, **Vineet Nair**, et al. "Machine learning-based time series forecasting for distributed energy resources in power grids to enhance resilience." 18th Annual Graduate Climate Conference (2024)
Vineet Nair. "Data-driven distributed optimization, markets, and control for an IBR-rich grid edge." NSF Workshop on Enabling Cyber-Resilient Distribution Systems with Edge Inverter-Based Resources (IBR), MIT (2024).
Vineet Nair. "Better Decision Making & Coordination for Future Power Grids." Invited seminar at Universidad Politécnica de Madrid (2024).
Vineet Nair et al. "Hierarchical Local Retail Electricity Markets for Distributed Energy Resources." IEEE Power & Energy Society General Meeting (PESGM 2023)**.**
Vineet Nair & Anuradha M. Annaswamy. "Local retail electricity markets for grid services in DER-rich distribution systems." Transactive Energy Theory Workshop, Pacific Northwest National Laboratory (PNNL) (2022).
Vineet Nair, & 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 Nair et al**.** "Secure & 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 Nair***, & 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).

PROJECTS

Selected Programming & Computational Projects | UC Berkeley, University of Cambridge, MIT *Jan '18 - present*

- Implemented novel convex relaxations to solve the mixed-integer power grid reconfiguration optimization problem
- Used natural language processing & deep neural networks for future stock price predictions based on textual news data
- Extended sparse regression techniques to discover partial differential equations & denoised data via dynamic mode decomposition
- Implemented a numerical model in MATLAB to simulate traffic flows on highways & 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 & coordinate EV charging along highways
- Implemented various Java data structures to build a basic version of Google Maps, an auto grader, & an interactive, 2D game

Selected Controls, Modeling, & Design Projects | UC Berkeley, University of Cambridge, MIT *Aug '14 - May '18*

- Designed & built an automated, voice-controlled coconut processor as part of senior year capstone mechatronics project
- Designed & built a voice-controlled, miniature car using Python, Arduino, & proportional control schemes in negative feedback
- Designed feedback control systems for magnetic levitation & a self-erecting inverted pendulum, implemented via MATLAB/Simulink
- Designed & 3D printed a mini-windmill to maximize structural strength & stability, built control system for optimal power output
- Designed & prototyped versatile, kinetic lighting structures based on tensegrity soft robots with programmable motion & color schemes

HONORS & AWARDS

Stanford Energy Postdoctoral Fellowship Semi-Finalist | Stanford University Precourt Institute for Energy *Dec '24*
Cyber-physical Human Systems (CPHS'24) Fellowship | International Federation of Automatic Control (IFAC) *Oct '24*
Stanford University Postdoctoral Recruitment Initiative in Sciences and Medicine (PRISM) award *Sep '24*
Conference Travel Grant Award | MIT Graduate Student Council *Mar '24*
MIT-Pillar AI Collective Fellowship | Pillar VC & MIT Deshpande Center for Technological Innovation *Dec '23*
Den Hartog Travel Award in Mechanics | MIT Mechanical Engineering Department *Jan '23*
Out in STEM (oSTEM) Scholarship | Berkshire Hathaway Energy Foundation *Oct '22*
Best Paper Award: 3rd Place | 54th North American Power Symposium *Oct '22*
MIT MADMEC Sustainability Challenge: 2nd Place | MIT Materials Science & Engineering Department *Oct '22*
NREL Workshop on Autonomous Energy Systems Travel Grant | National Renewable Energy Lab *July '22*
Martin Family Society Fellowship for Sustainability | MIT Environmental Solutions Initiative *Mar '22*
Runner up | MIT Entrepreneurship & Maker Skills Integrator (MEMSI) Hardware Startup Bootcamp *Jan '22*
International Clean Energy Challenge Winner | Upper Austria *Jul '19*
Ruhr Fellowship | University Alliance Ruhr & TU Dortmund, Germany *Apr '18*
43rd Annual Business Today International Conference Impact Challenge Finalist | Princeton University *Nov '17*
Robotics Institute Summer Scholars Acceptance | Carnegie Mellon *May '17*
Smart Cities Innovation Collider Winner | Sutardja Center, Pear.VC, Bosch, & City Innovate Foundation *Apr '17*
Dean's Startup Seed Fund Winner | Haas School of Business, UC Berkeley *May '17*

LEADERSHIP, TEAMWORK & ACTIVITIES

Finance lead | MIT Global Startup Workshop (GSW), Warsaw, Poland *Oct '24 - present*
Impact Officer & AI x Climate/Health Project Lead | Global Shapers Cambridge Hub, World Economic Forum *Sep '23 - present*
Graduate Student Representative | MIT Corporation Joint Advisory Committee on Institute-Wide Affairs *Aug '22 - Aug '23*
Co-President | MIT Energy & Climate Club *Apr '22 - May '23*
Content & Operations Team Member | MIT Global Startup Workshop (GSW), Athens Greece *Oct '21 - Mar '23*
Technical Research Seminar Organizer | MIT International Science & Technology Initiatives (MISTI) *Sep - Nov '22*
Elite Summer School in Robotics, Automation & Entrepreneurship | Innovation Centre Denmark *Aug '22*
Co-Managing Director | 2022 MIT Energy Conference *May '21 - Apr '22*
Co-Director of Applicant Experience | 2021 Climate & Energy Prize (CEP) @ MIT *Sep '20 - Apr '21*
Young Professionals Affinity Group Team Lead | Clean Energy for Biden (CE4B) *Jun - Nov '20*
Graduate Student Leadership Incubator Fellow | MIT 2019-20 Cohort *Sep '19 - Sep '20*
Engage for Change Fellow | Cambridge Hub & University of Cambridge Environment & Energy Team *Jan - Apr '19*
Undergraduate Student Representative At-Large | The Green Initiative Fund, UC Berkeley *Aug '17 - May '18*
Project Manager & Consultant | Bay Area Environmentally Aware Consulting Network (BEACN) *Sep '15 - May '18*