Rupa Kurinchi-Vendhan

Computer Vision Researcher for Sustainability and Conservation

@ rupak272@mit.edu (973) 652-3498 https://rupakv.com rupakurinchi-vendhan RupaKurinchiVendhan

Education

Doctorate of Philosophy in Electrical Engineering and Computer Science

The Massachusetts Institute of Technology

September 2024 – Present

Advisor: Sara Beery

Bachelor of Science

The California Institute of Technology

September 2020 – June 2024

- Major: Computer Science
- Awarded study abroad opportunity at the University of Cambridge, St. Catharine's College for Michaelmas Term 2022-23

Work Experience

Coral Gardeners – Benthic Classification for Coral Restoration

Computer Vision Researcher

March 2023 – January 2024

- Developed a transformer-based benthic classification architecture, which takes processed aerial drone imagery as input and identifies pixels as coral cover, rocks, rubble, sand, algae, etc. Model achieves up to 93% accuracy.
- The drone-to-map methodology will be used to inform restoration efforts by providing actionable, specific evidence of unhealthy reefs where corals should be planted.
- Collaborated with the Coral Gardeners to host hands-on restoration workshops for 34 local students in French Polynesia to hear about coral reefs, robotics, and citizen science data collection initiatives.

Computational Vision Laboratory – Species Distribution Modeling

Undergraduate Researcher

December 2021 – June 2023

Advisor: Pietro Perona

- During the academic year, used the GeoCLEF Life 2020 dataset to create a land cover classification model which identifies landscapes such as open ocean and deciduous forests from satellite imagery with 95% accuracy.
- Independently extended this work for species distribution modeling. Explored using high-resolution satellite imagery and citizen science species observation data to infer the joint distribution of species as a function of their geographic location.

Apple – Atlas Packing for Volumetric Rendering

Technology Investigation Intern

June 2022 – September 2022

- Within the Technology Development Group (TDG), designed and implemented a novel algorithm for texture/bin packing which improves computational and power demands by reducing image atlas size by 20%. This will improve the efficiency of the scene and video rendering pipeline for the recently-released Apple Vision Pro.
- Selected from internship cohort to present work to Head of TDG and member of Apple's advisory board, Mike Rockwell.

NASA – Estimating Solar Potential for Washington, D.C.

DEVELOP National Program Intern

September 2021 – November 2021

- Partnered with the Washington DC Department of Energy & Environment (DOEE) and a team of geospatial researchers to create solar potential maps to inform solar panel installations for neighboring communities outside of DC at a 1-ft resolution.
- Independently developed a vision-based model for estimating roof tilt from LiDAR-derived digital surface models and satellite images to provide more accurate urban solar potential estimates.
- Using GIS tools for data visualization, processing, and analysis, we demonstrated that the median potential per building in the study area will be 14.7 MW 2025.
- Our software packages and code library have been made available to the DOEE to reproduce our results and provide further insights to their solar energy planning.
- As the Impact Lead for this project, led discussions with the DOEE to ensure our investigation targeted their specific research questions.
- Presented to leadership of NASA's Earth Science Division at the DEVELOP National Symposium.

Netlab – WiSoSuper: Benchmarking Super-Resolution Models for Wind and Solar Data

Research Fellow

June 2021 – September 2021

Advisors: Steven Low and Dava Newman

- Modified and identified novel deep learning-based super-resolution models, and applied them to satellite data to achieve 5x super-resolution of wind speeds and solar irradiance fields for informing short-term, local energy planning.
- Published datasets and modules for benchmarking assessment and spatial analysis for wind and solar data fields.
- Accepted at NeurIPS CCAI Tackling Climate Change with Machine Learning 2021 Workshop.

Publications and Reports

- Kurinchi-Vendhan, R., Gray, D., & Cole, E. (2023). BenthIQ: a Transformer-Based Benthic Classification Model for Coral Restoration. In review, *arXiv pre-print arXiv:2311.13661*.
- Kurinchi-Vendhan, R., Lütjens, B., Gupta, R., Werner, L., & Newman, D. (2021). WiSoSuper: Benchmarking Super-Resolution Methods on Wind and Solar Data. *NeurIPS CCAI Tackling Climate Change with Machine Learning 2021 Workshop*.
- Cronin, E.*, Fernando, A.*, James, J.*, & Kurinchi-Vendhan, R.*, (2021). Washington, D.C. & Maryland Energy: Estimating Solar Potential Using NASA POWER Data to Inform Renewable Energy Policy. *NASA Technical Reports*.

Presentations

- Kurinchi-Vendhan, R. BenthIQ: a Transformer-Based Benthic Classification Model for Reef Restoration. *Berkeley AI Research (BAIR) Climate Initiative, University of Berkeley*. November 2023.
- Kurinchi-Vendhan, R. Mapping Corals: Reef Restoration and Citizen Science in French Polynesia. *California Institute of Technology International Education Week*. November 2023.
- Kurinchi-Vendhan, R. BenthIQ: a Transformer-Based Benthic Classification Model for Reef Restoration. *California Institute of Technology Doris S. Perpall Speaking Competition*. October 2023.
- Kurinchi-Vendhan, R. WiREDiff: a Wind Resolution-Enhancing Diffusion Model. *Advanced Topics in Machine Learning Project Showcase*. June 2023.
- Kurinchi-Vendhan, R. Atlas Packing for Volumetric Rendering. *Apple Board of Technology Directors*. September 2022.
- Kurinchi-Vendhan, R. WiSoSuper: Benchmarking Super-Resolution Methods on Wind and Solar Data. *NeurIPS CCAI Tackling Climate Change with Machine Learning 2021 Workshop Poster Session*. December 2021.
- Cronin, E.*, Fernando, A.*, James, J.*, & Kurinchi-Vendhan, R.* Estimating Solar Potential Using NASA POWER Data to Inform Renewable Energy Policy for Washington, D.C. *NASA Earth Science DEVELOP National Symposium*. November 2021.

Teaching Experience

Data, Algorithms, and Society

Teaching Assistant

September 2023 – March 2024

Professors: Claire Ralph and Hillary Mushkin

Department of Computing and Mathematical Sciences, California Institute of Technology

- Taught lectures for 22 students on algorithmic design that avoids bias.
- Organized and assisted team projects in AI for social good, from refugee monitoring to disaster response planning.
- Led discussions with teaching staff on student experience and course organization and content.

Learning Systems I & II

Teaching Assistant & Head Teaching Assistant

March 2023 – June 2024

Professor: Yaser Abu-Mostafa

Department of Computing and Mathematical Sciences, California Institute of Technology

- Hosted review sessions for 154 students on fundamental topics in machine learning and artificial intelligence.
- Assist teams to achieve multi-label classification that identify pathologies in chest radiographs. Generated and formatted the radiograph dataset, and created leaderboard for project competition amongst students.
- Led weekly TA meetings to discuss student progress and plan/organize coursework and assignments.

Awards

- **Mabel Beckman Leadership Award** | *June 2024*
- **Doris S. Perpall Speaking Competition 3rd Place Finalist** | *February 2024*
- **Samuel P. and Frances Krown Fellowship** | *June 2023*
- **Advocating Change Together (ACT) Award** | *May 2023*
- **Rise Teaching Award** | *May 2023*
- **Mari Peterson Ligocki Memorial Award for Community Service, Semi-Finalist** | *April 2023*
- **Jack E. Froehlich Memorial Award for Academic Excellence, Semi-Finalist** | *April 2023*

Leadership & Service

Caltech Y

President of Student Executive Committee

September 2022 – June 2024

- Coordinated community service events: produced and donated crocheted blankets for Project Linus, and hosted professional development workshops, science talks, and lab tours for black students in Southern California through Young Legends.
- Participated in and organized trips to local nature reserves and the LA River for environmental cleanups and to D.C. for a Science Policy Symposium with AI policy writers and government leaders at NOAA.
- As a member of the Board of Directors, made executive decisions regarding funding and mission of the non-profit.

Advocacy Committee

Diversity Representative & Senior Advocate

January 2023 – June 2024

- Voiced student concerns related to issues in diversity, equity, and inclusion. Advocated for administration to remove dead names in official campus communications and provide work-study support for students with demonstrated financial in research positions.
- Advocated for Title IX support for students and hosted yearly awareness and confidence workshops for young female researchers in male-dominated fields.
- Served as a campus resource for mental health support and hosted monthly decompression events for students.

Reading Partners

Volunteer

September 2021 – June 2024

Through the California-based children's literacy non-profit, volunteered 5 hours a week at the local elementary school in Pasadena to read to first-grade students struggling with phonetic reading skills.

Rise Program

Volunteer

September 2020 – June 2024

Mentored and worked with underprivileged students in Pasadena Unified School District struggling with topics in math and science. Volunteered at Girls who Code summer online workshop for 17 middle school-level students from Southern California.