Rupa Kurinchi-Vendhan

Machine Learning Researcher for Sustainability and Social Good

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

Education

Bachelor of Science

The California Institute of Technology

September 2020 – Present

- Major: Computer Science
- Awarded study abroad opportunity at the University of Cambridge, St. Catharine's College for Michaelmas Term 2022-23
- Relevant Courses: Learning Systems, Machine Learning & Data Mining, Decidability & Tractability, Algorithms, Algorithms and Society, Data Science, Vision and Large Language Models, Advanced Topics in Machine Learning
- GPA: 4.2/4.0

Work Experience

Coral Gardeners – Benthic Classification for Coral Restoration

Computer Vision Researcher

March 2023 – Present

- Independently developed a novel transformer-based multi-label benthic classification model, which takes processed aerial drone imagery as input and identifies pixels as coral cover, rocks, rubble, sand, algae, etc. The composition mapping algorithm achieves up to 5% performance improvements from other state-of-the-art attention-based techniques.
- 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 work with the Coral Gardeners Awareness Program 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.
- Paper under review at International Conference on Learning Representations (ICLR) 2024.

Computational Vision Laboratory

Undergraduate Researcher

December 2021 – Present

Advisor: Pietro Perona

With iNaturalist data, building upon a pretrained ImageNet model with presence-only data and spatiotemporal priors to geographically map the habitats of a given species with 95% accuracy. Model can be used for land cover classification and species distribution modeling in ecological and wildlife monitoring applications.

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 in Python which improves computational and power demands by reducing image atlas size by 20%.
- Codebase integrated with existing scene and video rendering pipeline for the recently-released Apple Vision Pro.

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.
- Using GIS tools and Python for data visualization, processing, and analysis, we drew data from LiDAR-derived digital surface models and satellite images to predict average annual solar potential at a 1-ft resolution. Demonstrated that the median potential per building in the study area is 14.7 MW each year.

- Our software packages and code library will be made available to the DOEE to reproduce our results and provide further insights to their solar energy planning.

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 (implemented in PyTorch, Tensorflow, and Keras), 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

- Kurinchi-Vendhan, R., Gray, D., Cole, E., & Perona, E. (2023). BenthIQ: a Transformer-Based Benthic Classification Model for Coral Restoration. arXiv preprint.
- 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. 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 Compeition. October 2023.
- Kurinchi-Vendhan, R. WiSoSuper: Benchmarking Super-Resolution Methods on Wind and Solar Data. NeurIPS CCAI Tackling Climate Change with Machine Learning 2021 Workshop. 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 – Present

Professors: Claire Ralph and Hillary Mushkin

Department of Computing and Mathematical Sciences, California Institute of Technology

- Taught lectures for roughly 22 students on impactful algorithmic design and identifying bias within datasets used to train machine learning models.
- Organized and assisted team projects for applying AI to issues with societal impact, from refugee monitoring to disaster response resource allocation.
- Led discussions with teaching staff on student experience and course organization and content.

Learning Systems I & II

Head Teaching Assistant

March 2023 – Present

Professor: Yaser Abu-Mostafa

Department of Computing and Mathematical Sciences, California Institute of Technology

- Hosted review sessions for roughly 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

- **Doris S. Perpall Speaking Competition Outstanding Presentation Award** | October 2023
- **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

Student Executive Committee President

September 2022 – Present

- Coordinated community service events in collaboration with Project Linus (produced 3 crocheted blankets for young children suffering from trauma), Young Legends (hosted professional development workshops, science talks, and lab tours for black students in Southern California each semester), and the local Union Station Meal Shelter for the homeless.
- Participated in and organized trips to Costa Rica for native turtle and plant conservation 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, organization, and mission of the non-profit.

Peer Advocates

Senior Advocate

March 2022 – Present

Served as a campus resource for mental health support and hosted monthly decompression events for students.

Title IX Program

Senior Advocate

March 2022 – Present

Advocated for Title IX support for campus undergraduates and hosted yearly awareness and confidence workshops for young female researchers in male-dominated fields.

Advocacy Committee

Diversity Representative

January 2023 – Present

Voiced student concerns and hosted campus outreach programs related to issues in diversity, equity, and inclusion. Advocated for the removal of dead names in official campus communications and providal of work-study support for students with demonstrated financial need to have paid research positions.

Reading Partners

Volunteer

September 2021 – Present

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 – Present

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.