

TARUN SHARMA

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WORK EXPERIENCE

- Intern, Monterey Bay Aquarium Research Institute (MBARI) June 2023 – Aug 2023
- Compared multiple self-supervised and semi-supervised computer vision approaches for making use of unannotated data for animal detection in real world underwater datasets exhibiting long tail distributions.
 - Achieved a 100 % increase in balanced accuracy for classification of animals when unlabeled data is used for contrastive pretraining.
 - Demonstrated the robustness of these results on two datasets collected from different underwater vehicles. Currently working towards scaling and integration.
- Intern, SAP Labs, Bangalore, India Jan 2017 – June 2017
- Worked on the thematic segmentation of text data using recurrent neural networks in order to automatically break up company onboarding and training videos into short chapters for maximizing engagement.
 - Proposed a strategy to combine the results of our machine learning model with additional contextual cues. This prototype project resulted in a company patent.
- Intern, MadStreetDen, Chennai, India May 2015 – Aug 2015
- Worked on using machine vision to make a navigational assistive system for the visually impaired that would run on a smartphone. Used traditional image processing algorithms such as dense optic flow and motion parallax cues to estimate approaching obstacles from a single camera. Also worked on object identification using feedforward neural networks and face recognition algorithms.
 - We were successfully able to demonstrate a working prototype with real-time obstacle detection and classification using a single camera resulting in a published paper.
- Research Assistant, Brown University Aug 2017 – June 2018
- Worked in the lab of Professor Thomas Serre to study memory guided changes in attention in children by analyzing eye tracker video data using computer vision methods such as object detection. This involved multiple rounds of collecting data, training computer vision pipelines, evaluating, bootstrapping, and refining performance.
 - Worked with a team on deployment and active maintenance of a computer vision pipeline for the automated behavioral analysis of mice for ALS research on the university cluster.
 - Worked on a range of other computer vision projects like automated analysis of zebrafish behavior on a Raspberry Pi, predicting action potentials from video data, and comparing computer and human visual saliency maps. Resulted in publishing 3 papers and 1 preprint.
- Research Intern, Brown University May 2016 – Aug 2016
- Compared performance of different deep neural networks trained to reconstruct 3D surface normal maps at different resolutions using rendered data. Used visualization tools to investigate representations learned.

EDUCATION

- Caltech, Pasadena Sept 2018 – Present
PhD in Computation and Neural Systems GPA: 4.2/4.0
Research: Computer vision, animal behavior, engineering, neuroethology
- PESIT, Bangalore, India Aug 2013 – May 2017
B.E in Computer Science and Engineering GPA: 9.4/10.0
Relevant Courses: Design and Analysis of Algorithms, Advanced Machine Learning, Software Engineering, Advanced Data Structures.

SKILLS

Skills: Computer vision, machine learning, deep learning, NLP, data analysis, animal behavior.
Languages and Technologies: Python, Java, Matlab, LATEX, Inkscape, Blender, Unity.
Frameworks and Libraries: PyTorch, Tensorflow, Keras, OpenCV, ROS, NumPy, Scikit-learn, Matplotlib.
Cloud Platforms: AWS Sagemaker, AWS EC2.
Hardware: Raspberry Pi and add-on boards, sensors and cameras; Arduino and IMUs, CircuitPython, I2C protocol, G-code.

ACADEMIC PROJECTS

- Ant monitoring using computer vision, Prof. Joe Parker 2023-Present
- Working on the design, assembly, modification and deployment of custom Raspberry Pi based multi-sensor field camera units positioned in front of ant colonies in the Angeles National Forest.
 - Using weak supervision, object detection and multi-object tracking to gain insights into ant behavior and ecology with minimal human labeling.
- Flight and gaze stabilization system of fruit flies, Prof. Michael Dickinson 2018-2023
- Worked on modifying and testing a rotating experimental arena consisting of a servo motor, IMU sensors and wing and head tracking cameras.
 - Used a multi-slice scan of a fly head to create a 3D model in Blender and generated synthetic rendered data to predict 3D head position from a single view.
 - Worked on data collection and subsequent analysis using computer vision pose estimation, edge-based wing tracking algorithms and Fourier transforms to analyze and quantify temporal data, to provide direct evidence that the magnitude of head and wing stabilization behavioral response is a direct function of the number of mechanosensory cells silenced.

PAPER PUBLICATIONS

- Elijah Cole, Suzanne Stathatos, Bjorn Lutjens, **Tarun Sharma**, Justin Kay, Jason Parham, Benjamin Kellenberger, Sara Beery, (2023) **Teaching Computer Vision for Ecology**. arXiv:2301.02211
- Amso, D., Govindarajan, L., Gupta, P., Placido, D., Baumgartner H., Lynn, A., Gunther, K., **Sharma, T.**, Veerabadran, V., Thakkar, K., Kim, S.C, Serre, T., (2021) **Using Computational Analysis of Behavior to Discover Developmental Change in Memory-Guided Attention Mechanisms in Childhood**. Preprint PsyArXiv, doi:10.31234/osf.io/gq4rt
- Corfas, R.A, **Sharma, T.**, Dickinson, M.H, (2019) **Diverse Food-Sensing Neurons Trigger Idiothetic Local Search in Drosophila**. Current Biology, doi:10.1016/j.cub.2019.03.004
- Kotri, J., **Sharma, T.**, Kejriwal, S., Dasari, Y., Abinaya, S., (2019) **Thematic Segmentation of Long Content using Deep Learning and Contextual Cues**. US Patent. Patent number: US 10,339,922 B2
- Govindarajan, L., **Sharma, T.**, Colwill, R., Serre, T., (2018) **Neural Computing on a Raspberry Pi: Applications to Zebrafish Behavior Monitoring**. Proceedings of VAIB 2018, Corpus ID: 52950335
- Linsley, D., Linsley, J.W, **Sharma, T.**, Meyers, N., Serre, T., (2018) **Learning to predict action potentials end-to-end from calcium imaging data**. IEEE Xplore, doi:10.1109/CISS.2018.8362319
- Linsley, D., Eberhardt, S., **Sharma, T.**, Gupta, P., Serre, T., (2017) **What Are the Visual Features Underlying Human Versus Machine Vision?** Proceedings of ICCV Workshops 2017, pp. 2706-2714
- Suresh, S., **Sharma, T.**, Prashanth, T.K, Subramaniam, V., Sitaram, D., Nirupama, M., (2016) **Towards quantifying the amount of uncollected garbage through image analysis**. Proceedings of ICVGIP 2016, doi:10.1145/3009977.3010061
- **Sharma, T.**, Apoorva, J.H.M, Lakshmanan, R., Gogia, P., Kondapaka, M., (2016) **NAVI: Navigation aid for the visually impaired**. IEEE Xplore, doi:10.1109/CCAA.2016.7813856

AWARDS

- [Chen Graduate Innovator Grant](#) (2020), Chen Institute, Caltech
- Runner up at “What the Hack 2.0” (2014), SAP Labs India
- Best Out of the Box Idea (2015), SimpliLearn Solutions India
- Certificate of Recognition (2014), Microsoft Corporation India for computer vision [app with 30k+ downloads](#).
- Certificate of Appreciation (2015), MIT Media Labs and [L.V Prasad Eye Institute](#)

LEADERSHIP ROLES AND TEACHING EXPERIENCE

- Co-organizer of [NeurIPS Workshop on Computational Sustainability: CompSust \(2023\)](#), NeurIPS
- President of [Neurotechers](#) (2022 – 2023), Caltech
- Co-organizer and TA for [Computer Vision for Ecology Summer School \(2022 and 2023\)](#), Caltech
- TA for [BE/Bi 106: Comparative Biomechanics \(2021\)](#), Caltech

PRESENTATIONS AND INVITED TALKS

- Analyzing data using Machine Learning (2023), [DataSAI for Neuroscience Summer School](#), Caltech
- Machine Learning for Conservation (2022), [HumanITech class](#), Georgia Tech
- Monitoring Social Insect Activity with Minimal Human Supervision (2022), [CompSust](#), Caltech
- Naturalistic behavior repertoires of the praying mantis (2021), Chen Graduate Innovator Symposium, Caltech
- Towards Quantifying the Amount of Uncollected Garbage through Image Analysis (2016), ICVGIP, India