Dhruv Sheth

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EDUCATION

- **California Institute of Technology (Caltech)** — Pasadena, CA
  B.S., Computer Science; GPA: 4.22 / 4.00 — *2023-2027*
  Relevant Coursework: Projects in ML (CS 163)*****, ML Systems (CS 156ab)*****, Algorithms (CS 038), Computing Systems (CS 24)*****, Software Design (CS 003), Data Structures (CS 002), Decidability and Tractability (CS 021), Applied Linear Algebra (ACM 104, Ma1b)*****, ODE (Ma 2)*****, Multivariable Calculus (Ma 1c)
  * currently taking

SKILLS SUMMARY

- **Languages:**   Python, C, C++, Java
- **Frameworks:**   PyTorch, TensorFlow, NumPy, Open3D, OpenCV, ROS2, Git, TensorRT, FastAPI
- **Simulation:**   Mujoco, Unity MLAgents
- **Hardware:**   OAK-D, Intel RealSense, Zed

EXPERIENCE

- **Burdick Robotics Group, Caltech**
  Dr. Jane Chen Summer Undergraduate Research (SURF) Fellow — *June 2024 - September 2024*
  - Simulation and Perception team for DARPA Learning Introspective Control (LINC).
  - Designed ***segmentation-conditioned cropping*** module with **perspective warping** using Video Object Segmentation (VOS) network with *PyTorch*, *TriMesh*, *Open3D*; **improves SOTA** FoundationPose performance for 6 DoF tracking, recovers from inaccuracies.
  - Implemented **GTSAM** for filtering tracking data with non-linear factor graph.
  - Optimized VOS using TensorRT and gained **20% speed improvement** on 3/5 modules. Moved to Docker container to push for deployment
  - Developed Unity HDRP simulation **with MuJoCo physics**, RGBD+IMU sensors **replicating RealSense D457**, ROS2 interface. Created additional Unity environment for training **hybrid SDF**.
  - Implemented **Docker deployment** for arm64 (AGX Orin) and x86/64, CI/CD pipeline with ROS2. Reduced feature testing time by **83%** with sim2real swapping.
  - Multi-camera feed using ROS2, NanoSAM for dynamic prompting. Used *Cutie* VOS
  - **Mentor:** Dr. Joel Burdick, slides

- **AMBER Bipedal Robotics Lab, Caltech**
  Student Researcher under Albert Li — *Jan 2024 - March 2024*
  - Worked on improving robustness for 6D pose estimator for cube (argus)
  - Integrated depth data into pose estimator simulation pipeline in Unity using shaders and **MLAgents low level API** for large-scale data generation with RGBD augmentation.
  - Trained 5 layer MLP (Finetuned ResNet-50) with RGBD input from 2 Zed cameras (sim) using *PyTorch* and *Wandb* that reduced loss by **14.5%** compared to RGB-only dataset
  - Learnt in depth about global registration algorithms (ICP, Teaser), NeRF, SDF for another project

- **Schepens Eye Research Institute (SERI), Harvard Medical School**
  Student Researcher at Gang Luo's Lab under Prof. Ayush Kumar — *March 2022 - Feb 2023*
  - Analyzing gaze behavior in patients with Homonymous Hemaniopia. co-authored a preprint on findings
  - Employed a **Faster R-CNN Inception v2 model** on custom eye-gaze dataset to track gazed objects for behavioral understanding. Conducted an ablation study on temporal consistency over different object detection frameworks such as YOLO v4 DarkNet, MobileNet v2 SSD.
  - Conducted large-scale data analysis on **32 minutes** of street-view video gazed by viewer with eye-gaze data using KDE plots, temporal gaze graphs, MF-DFA algorithm to calculate hurst's exponent.
  - Used a saliency model with **Attentive-ConvLSTM** to estimate deviation of diseased eye-gaze from standard eye-fixations. Integrated Topological Data Analysis into saliency model for weighted gaze-deviation calculation.
  - **Supervisor:** Dr. Gang Luo, **Collaborators:** Dr. Ayush Kumar, Dr. Srinivas Pundlik

- **Luxonis Corporation**
  Software Engineering Intern — *March 2021 - October 2021*
  - Worked on developing and deploying depthai python SDK on OAK-D
  - Migrated multiple **OpenVINO quantized models** into SDK examples repository by converting them into depthai custom blob format for use with OAK-D boards. Wrote documentation for updates and answered users' queries on forum
  - Implemented **EfficientNet-B0** model in PyTorch format on OAK-D by writing custom processing script to classify 1000 classes at **28 FPS**. Implemented model conversion script to convert from PyTorch to intermediate OpenVINO representation and then converted to depthai deployable *blob* format

- Worked on luxonis' second tangent - [commute guardian](), an application to deploy depth-based tracking using **MobileNet SSD** on custom dataset
- **Supervisor:** Brandon Gilles

- **EdgeImpulse**
  Software Intern Jan 2021 - Dec 2022
  - Beta-tested most software features on the EdgeImpulse dashboard before release, tested for edge cases through deployment on edge boards, wrote extensive documentation for all features
  - Extended **edgeimpulse cli** to linux and debian based systems. Assisted users on [forum]() with software concerns, debugging and technical queries
  - Trained quantized models using EI Dashboard for custom-use cases and deployed on embedded boards such as **Sony Spresense, Arduino Portenta, Himax, Particle**
  - **Supervisors:** Jan Jongboom, Adam Benzion, David Tischler

PROJECTS

- **Cursor++ with shared context**: AI-powered code editor with context sharing, OpenAI swarm for Mixtore of Experts, FastAPI for backend, Pinecone for vector database, and RAG implementation. Built on Continue (open-source Cursor alternative) using Python and TypeScript, collaboration for large organizations - [project link]()
- **Jetpack Joyride Clone in C**: Developed a jetpack joyride clone in pure C with multiple functionalities such as file storage, probabilistic difficulty, passability, scrolling background, animation and game UI. Developed using sdl2 and emscripten (WebAssembly) - [project link]()
- **HapticCV: depth-assisted bicycle navigation**: Developed a real-time obstacle detection on OAK-D for cyclists using stereo depth estimation, object tracking and haptic feedback using neosensory buzz - [project link]()
- **Gelāre: prototyping platform for assistive robotics**: Developed platform using real-time computer vision with RGBD sensors and deployed models quantized for embedded devices. Implemented a **CNN-based FOMO architecture**, processing RGB and Stereo Depth data under **3MB RAM** and **1mW power at 30FPS**. Utilized this platform to create an assistive robotic feeding application – [project link]().
- **EmotiConnect**: Developed a Swift iOS app on Apple Watch to listen to conversations on the background and decode emotions. Used OpenAI Whisper for Speech to Text, AWS S3 for storing clips to process, AWS Lambda for processing with OpenAI gpt3.5 turbo and Amazon API Gateway to send emotion response back to Apple Watch in real time – [Video](), [Github]().

PUBLICATIONS

[1] Sudharsan, B., **Sheth, D.**, Arya, S., Rollo, F., Yadav, P., Patel, P., Breslin, J. G., & Ali, M. I. (2021). ElastiCL: Elastic Quantization for Communication Efficient Collaborative Learning in IoT. *Proceedings of the 19th ACM Conference on Embedded Networked Sensor Systems (SenSys '21).*

[2] **Sheth, D.**, Sudharsan, B., Breslin, J. G., & Ali, M. I. (2022). Poster Abstract: Embedded ML Pipeline for Precision Agriculture. *2022 21st ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN)*

TALKS AND PRESENTATIONS

1. Lightning talk at *North American Plant Phenotyping Network (NAPPN 2022) conference:* "Spatio-temporal generation of morphological Plant features for yield prediction before harvest from Visual Image input using Progressively Growing GANs." [PrePrint]()

2. [Video poster]() at *tinyML Asia 2021 Conference:* "Plant Growth and LAI Estimation using quantized Embedded Regression models for high throughput phenotyping"

HONORS AND AWARDS

- Dr. Jane Chen SURF Fellow
- 3rd Grand Award at ISEF'22 (International Science and Engineering Fair)
- Schmidt Futures RISE Global Winner
- [Grand Prize Finalist]() ($1.6k) in OpenCV AI Competition 2023
- BL4S (Beamline for Schools by CERN): Top 25 for particle physics
- [Grand Prize]() ($1.5k) in Neosensory Competition.
- [3rd Place]() ($1k) in Arm Devsummit Competition.
- [UN Impact Prize]() for Embedded ML Challenge

EXTRACURRICULAR

- **Caltech Air and Outer Space (CAOS) club**: Software team: Worked on ROS2 integration of computer vision stack using realsense with other modules for the URC challenge
- **Caltech Robotic Manipulation club**: (Sep 2024) co-started grasping and manipulation efforts at Caltech to compete in Robotic Grasping and Manipulation Competition at ICRA'25