





Yaadhav Raaj

Robotics • Vision • Engineer

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Raaj brings 4 years of research and industry experience in modeling and solving perception / computer vision problems for Underwater Robots, Industrial Robots, AR/VR applications and Self-Driving. He has lead end-end perception pipelines (Hardware Integration, Data Collection, Model Training, Efficient Inference and Deployment) which has been deployed into the real world, and his work has *generated revenue* for the various companies and research groups he has worked in.

Education

- Carnegie Mellon University – (Master of Science in Robotics) – In Progress** Aug 19 – May 21
- Coursework: Computer Vision, Path Planning, SLAM, Reinforcement Learning
- Research: Human and Car Pose Estimation, Adaptive Lidar / Light Curtains for Self-Driving Vehicles
- National University of Singapore - (BEng. (Hons) in Computer Engineering)** Aug 11 – Feb 16
- Coursework: Analog and Digital Signal Processing, VLSI, Parallel Programming
- Research: Computer Vision and Robot Localization

Research / Industry Experience

- CMU Robotics Institute – (Graduate Student - Pittsburgh, PA)** Aug 19 – May 21
Lead: [Dr. Srinivas Narashiman \(CMU\)](#)
- Working on detection and tracking algorithms using a kind of adaptive LIDAR called [Programmable Light Curtains](#)
- Setup a Stereo/LIDAR/Light Curtain system, developed algorithms for adaptive LIDAR's for automotive applications, and trained deep learning models on our custom dataset from scratch. Pending submission to CVPR 2021.
- Uber ATG – (Software Engineering Intern - Pittsburgh, PA)** June 20 – Aug 20
Lead: [Skanda Shridhar \(Uber ATG\)](#)
- Built upon the [MultiXNet](#) Architecture to make a Path Relative Metric and equivalent Spatio-Temporal Path Relative Field developed by my team, end-end differentiable
- Wrote custom Pytorch + CUDA modules to accelerate the metric. System currently *deployed* at production.
- CMU Robotics Institute - (Research Engineer - Pittsburgh, PA)** Feb 18 – May 19
Lead: [Dr. Yaser Sheikh \(CMU / Facebook Reality Labs\)](#) and [Gines Hidalgo \(CMU / Epic Games\)](#)
- Core Developer on the 2D Human Pose Detector called [OpenPose](#) (20k Stars on Github)
- Developed the Recurrent Spatio-Temporal Affinity Field (STAF) concept for real time multi-person tracking (CVPR 2019) and joint Hand/Body/Face face tracking (ICCV 2019)
- Ported Gradient/Jacobian Computations for 3D Pose Tracking / SLAM into Pytorch + CUDA
- TUM CREATE - (Robotics Engineer - Singapore)** Jan 16 – Jan 18
Lead: [Dr. Suraj Nair \(TUM / SpeedCargo\)](#) and [Dr. Alois Knoll \(TUM\)](#)
- Worked on the Gude/ABB industrial robot platform, automating the palletization and depalletization of aviation cargo. This project has now spun off to a startup ([SpeedCargo](#)) with significant funding
- Lead Vision Engineer, Developed and deployed cargo measurement and tracking via pointcloud opt and mesh reconstruction
- System *deployed* at the world's best airport (Singapore Changi Airport)
- Measurement Algorithm was *accepted* to ACCV 2016
- Bumblebee Robotics - (Software Developer - Singapore)** Jan 15 – Jan 17
Lead: [Dr. Marcelo Ang \(NUS\)](#) and [Goh Eng Wei \(NUS\)](#)
- Developed algorithms for localizing objects underwater, fusing Sonar, Camera, IMU and DVL sensors on BBAUV and BBASV
- This project has now spun off to a startup ([BeeX](#)) with *deployments* around Singapore
- Helped team win 2nd place at [AUVSI RoboSub 2015](#) in San Diego, and 4th place at the [AUVSI RobotX 2016](#) in Hawaii
- My Vision Fusion algorithm was *accepted* to IEEE Oceans 2016 and is *patent pending*

Publications

- Exploiting and Refining Probabilistic Depth Estimates with RGB and Triangulating Light Curtain Fusion** Pending
{Pending submission to CVPR 2021}
{[Yaadhav Raaj](#), Siddharth Ancha, David Held, Srinivasa G. Narasimhan} [\[teaser\]](#)
- Active Perception using Light Curtains for Autonomous Driving** June 20
{ECCV 2020 - Spotlight}
{Siddharth Ancha, [Yaadhav Raaj](#), Peiyun Hu, Srinivasa G. Narasimhan, David Held} [\[pdf\]](#) [\[video\]](#)
- Single-network whole-body pose estimation** Sep 19
{ICCV 2019}
{Gines Hidalgo, [Yaadhav Raaj](#), Haroon Idrees, Donglai Xiang, Hanbyul Joo, Tomas Simon, Yaser Sheikh} [\[pdf\]](#) [\[video\]](#)
- Efficient Online Multi-Person 2D Pose Tracking with Recurrent Spatio-Temporal Affinity Fields** Jun 19
{CVPR 2019 – Oral}
{[Yaadhav Raaj](#), Haroon Idrees, Gines Hidalgo, Yaser Sheikh} [\[pdf\]](#) [\[video\]](#)
- Adapting the Search Subspace of a Particle Filter using Geometric Constraints** May 17
{Nikhil Somani, [Yaadhav Raaj](#), Suraj Nair, and Alois Knoll} [\[pdf\]](#) [\[video\]](#)
- Precise Measurement of Cargo Boxes for Gantry Robot Palletization in Large Scale Workspaces using Low-Cost RGB-D Sensors** Nov 16
{13th Asian Conference on Computer Vision (ACCV2016) - Taipei, Taiwan - Poster}
{[Yaadhav Raaj](#), Suraj Nair, and Alois Knoll} [\[pdf\]](#) [\[video\]](#)
- Sep 16

3D Object Localization using Forward Looking Sonar and Optical Camera via Particle Filter Calibration and Fusion

{IEEE Oceans 2016 - Monterey, California, USA - *Oral*}
{Yaadhav Raaj, Alex John, Tan Soon Jin} [\[pdf\]](#) [\[video\]](#)

Design And Implementation Of Bumblebee ASV 1.0 [\[pdf\]](#) [\[video\]](#)

Jun 16

Design and Implementation Of Bumblebee AUV 3.0 [\[pdf\]](#) [\[video\]](#)

{Robonation Journal} {One of several authors}

Awards/Volunteer Work

Changi Aviation Challenge 2 Finalist - (Singapore)

Jan 17

- Our company was one of the finalists in the Aviation Challenge, securing a 2 Million dollar grant [\[video\]](#)

AUVSI RobotX 2016 - (Honolulu, Hawaii)

Dec 16

- Beat top teams around the world to win 4th place at the AUVSI RobotX 2016 [\[video\]](#)

AUVSI Robosub 2015 - (San Diego, CA)

Aug 15

- Beat top teams from Cornell, Caltech to win 2nd place at the AUVSI Robosub 2015 [\[video\]](#)

Student Volunteer at SIGGRAPH 2015 - (Los Angeles, CA)

Aug 15

- Volunteered at the 42nd International Conference on Computer Graphics (SIGGRAPH) LA

Volunteer Work with YMCA Singapore - (Nepal)

Dec 15

- Volunteered with YMCA Singapore - [Team Nirman](#), helping rebuild schools in Nepal after earthquake.

NUS iCreate App Challenge - (Singapore)

Aug 12

- Won 4th prize at the iCreate App Developer Challenge hosted in my college. [\[video\]](#)

Developer Skills

Programming Languages:

Proficient: C, C++, Python, CUDA, OpenCL, MATLAB
Familiar: Objective-C, C#, Javascript, PHP, Bash, Kubernetes,

Software Tools:

Proficient: OpenCV, Caffe, Pytorch, PCL, ROS, QT Framework, Git, CARLA
Familiar: RL, ABB Robot Studio, Beckhoff TwinCAT, 3D Studio MAX, Meshlab, EagleCAD

Hardware Platforms:

X86: Any AMD/NVIDIA/Intel system on Ubuntu/OSX/Windows
ARM/Other: NVIDIA TX2, Xilinx Zed FPGA, STM32F4, Atmega328P with Linux or Chibi OS

Others

Languages:

Proficient: English and Tamil
Familiar: Mandarin Chinese

Interests:

Mainly water sports: kayaking, canoeing, dragonboating, scuba-diving. Part of college team in junior years
Music: play different instruments, including drums, electric guitar, and tabla