Nitheesh K Lakshminarayana

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Experience

Nimble Robotics, Sr. Research Engineer, Computer Vision – San Francisco, CA Jan 2023 —Present

AutoGrasp and AutoPack - automated picking and packing based on visual perception for robotic warehouses

- Responsible for end-to-end development of the perception stack including data collection, annotation, training and scalable deployment of the model for robot edge inference on TensorRT accelerators achieving $\approx 200msec$ inference latency in production systems. Developed an in-house MLOPs platform for this purpose that processes TBs scale robot data per day.
- Re-designed and architected the Nimble's perception model for robotic picking systems - from indivisual ConvNet-based detection and affordance prediction models for each warehouse into a unified SKU-agnostic ViT-based multi-head model for all warehouses.
- Achieved $\approx 96\%$ grasp success rate on $10K+$ SKUs with operational load of $\approx 15K$ pick-pack cycles per day across 100+ robot fleet.
- Designed and developed a novel multi-view camera based dimension estimation tool for inbound process at Nimble's warehouses. Achieved $\leq 1cm$ error in dimension estimation for $10K+$ SKUs.

Visuomotor Policy Control - for robotic packing tasks in warehouses

- Developed a 3D SpaceMouse based UMI-style real-time demonstration collection platform for visuomotor policy learning. Actively being used to collect demonstrations by human operators for policy learning.
- Developed a novel system for remote inference server based asynchronous action execution pipeline for real-time inference & robot control from visuomotor policies. Achieved $100ms$ action execution latency on Nvidia Jetson Xavier based robots for diffusion and flow-based (Pi0, SmolVLA) based policies for item *"ease-in"* and *"overflow correction"* tasks during packing.
- Currently working on representation learning to generalize visuomotor policies to unseen items.

CMU R-PAD Lab – Mujin Inc, Research Collaborator – Pittsburgh, PA & Tokyo, Japan Jan 2022—Dec 2022

- Project - Unseen/Novel object detection & pose estimation using RGB-D fusion for robotic bin-picking in 3PL warehouses, advised by Prof. David Held, CMU and Jose Jeronimo Moreira Rodrigues, Mujin.
- Created Blender-based BOP-like synthetic RGB-D dataset for instance segmentation in bin-picking task. Comprised of 20 objects in 3 packing scenarios (tight, semi-ordered, randomly dropped) to simulate ZIVID sensor data.
- Implemented a clustering based U-Net architcture trained on this synthetic data and integrated into production system using zero-copy IPC strategies for real-time robotic perception pipeline at Mujin's 3PL warehouse to solve the problem of *first-pick*.

Intel Corporation

Research & Development Engineer – Bangalore, India Aug 2017—Jul 2021

Research and Academic Collaborations

- Created **India Driving Dataset (IDD)** - world's first open dataset on Indian driving conditions (http://idd.insaan.iiit.ac.in/), in collaboration with IIIT-H, targeted at autonomous navigation in unconstrained environments.
- Released an open-source ROS-based infrastructure and evaluation pipelines for large-scale multi-modal (Stereo & Mono Cams, LiDAR, GPS, IMU) data capture from electric cars, targeted at Indian AD scenarios (https://github.com/intel/driving-data-collection-reference-kit).
- Improved LiDAR based 3D object detection (AVOD, PointRCNN) accuracy by $\approx 10\%$ on IDD dataset by fusing sparse point-clouds from LiDARs and stereo cameras.
- Investigated self-supervised learning techniques involving jigsaw and rotation, based on intrinsic dimensionality reduction using DeepMDS for image classification achieving 71.9%mAP (3rd rank in FASSL global Challenge at ICCV'19 - team Arkenstone) on VOC07 dataset.
- Formulated Localization and Constrained-Environment challenge's problem statement and evaluation criteria for *"AutoNUE"* workshop at ECCV 2018 and ICCV 2019.

Product Development

- Led engineering team of 3 to design and develop a Gstreamer and OpenVINO based media processing pipeline for Driver Monitoring System (DMS) integrated with Intel's Mobileye module for Indian road conditions.
- Demonstrated DMS prototype at multiple national conferences (like Computer Vision Forum, India, 2019). Presented MVP plan and strategy to senior management resulting in $1MM product development funding.

System Software Engineer – SF Bay area, USA Sep 2014—Jun 2017

- Developed platform SDKs for Intel's wearable (Curie) module included in Xiaomi's RunMi smart shoes, and Oakley's Radar Pace smart eyewear showcased in CES 2016.

Linux System Engineer – Bangalore, India Jul 2012—Aug 2014

- Programmed Linux kernel power management drivers, built Voltage Regulator Framework for 2 PMICs on x86 mobile platform, and Module Level DVFS to deliver Intel's Cherrytrail platform.

Education

Carnegie Mellon University - Robotics Institute, School of Computer Science — Pittsburgh, PA
Master of Science in Computer Vision (MSCV) — Sept 2021—Dec 2022

Visvesvaraya Technological University - PES Institute of Technology — Bangalore, India
Bachelor of Engineering in Computer Science — Sept 2008—Jun 2012

Publications

- **Nitheesh K. Lakshminarayana**, "Large Scale Multimodal Data Capture, Evaluation, and Maintenance Framework for Autonomous Driving Datasets", *Workshop on Autonomous Navigation in Unconstrained Environments, ICCV*, 2019
- **Nitheesh K. Lakshminarayana** and Shreesh Mohalik and Anbumani Subramanian, "Evaluation of Sparse LiDAR Data for 3D Object Detection in Driving Scenarios", *Internal Technical Report*, 2019
- **Nitheesh K. Lakshminarayana** and Anbumani Subramanian, "Ensuring Quality in Creating AD Datasets", *Intel Software Professionals Conference*, 2018

Skills

Programming Languages: Python, Rust, C, C++, Java
Frameworks & Libraries: PyTorch, OpenCV, ROS, Ray
Tools & Technologies: Docker, Kubernetes, Git, MLflow, Jupyter, Linux
Sensors & Hardware: UVC & GiGE Mono/Stereo cams, VLP/HDL LiDARs, x86 platforms, Arduino, Raspberry Pi
Computer Vision / AI/ML: Multi-view 3D Geometry, Object Detection & Segmentation, Visuo-motor policy learning
Software Engineering: Linux system services & libraries, Software Design & Deployment, MLOps & DevOps