# Ajay Unagar

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*Experienced Computer Vision Researcher seeking full-time roles*

## Experience

**Applied Research Scientist, Computer Vision,** *Geomagical Labs* | Palo Alto, CA *Nov 2021 - Now*

- Shipping computer vision algorithms supporting indoor re-imagination tool IKEA Kreativ, used by millions of customers
- Improved SoTA **Monocular-Depth-Estimation** algorithm by training on synthetic data, and integrating geometry priors. This improved downstream geometry detection algorithms and improved occlusion experience for Kreativ users
- Released **3D surface detection** feature to Kreativ, allowing users to stack furniture on existing surfaces, offering wider product range.
- Built a generic **Room layout estimation** algorithms by fusing line detection with geometric optimization, improving metrics by **30%** for in-the-wild captures. This allowed advanced scene interaction for customers of IKEA Kreativ
- **Mentored interns** developing efficient depth estimation network and ported them to iOS devices for real-time depth based guidance

**Masters Project Intern,** *IBM Research* | Zurich, Switzerland *Jun 2020 - Dec 2020*

- Developed a **Continual Learning (CIL)** solution to train medical tissue-image classification, where data can't be stored due to legal complications. This method reduced catastrophic forgetting by **15%** compared to other methods when trained continually.

**Research Assistant,** *IMS Lab* (Prof. Olga Fink) | Zurich, Switzerland *May 2020 - Sept 2021*

- Trained an actor-critic algorithm via **Reinforcement Learning (RL)** to predict parameters for battery discharge model, that is an order of magnitude faster than traditional KF based methods and improve accuracy by over **50%**.

**Data Scientist,** *ZS Associates* | Pune, India *July 2017 - July 2019*

- Combined **Deep Learning** (*1D CNN* ) and **Optimization** (*Genetic Algorithms*) techniques to design optimal marketing sequence increasing sales upto **$200M** for top Pharmaceutical client.
- Built a **ChatBot** for Sales representatives of Pharma companies, increasing their efficiency by **10%** during conversation with a physician. The chatbot converted natural language into SQL queries and answered basic analytics questions from internal database.

## Publications & Patents [Google Scholar]

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|---|---|
| ISMAR'22 | **Robust Planar Optimization for General 3D Room Layout Estimation**, KN Lianos, L Puig, A Unagar, S Jiddi |
| CVPR'21 | **Back to the Feature: Learning Robust Camera Localization from Pixels to Pose**, PE Sarlin*, A Unagar*, et al. |
| NeurIPS'20W | **Leaning to Calibrate Battery Models in Real-time with Deep Reinforcement Learning**, A Unagar, Y Tian, et al. |
| CVPR'20W | **6-DoF Camera Pose Refinement using Feature-Metric Optimization**, A Unagar, P Lindenberger, N Tselepidis |
| US Patent | **Method, apparatus, and computer-readable medium for room layout extraction**, |
| US Patent | **Method, apparatus, and computer-readable medium for foreground object deletion and inpainting**, |

## Education

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|---|---|---|
| ETH Zurich | **MS in Computational Science and Engineering (Focus: Robotics)**, 5.8/6.0 | *2019-21* |
| IIT Roorkee | **BTech in Civil Engineering (Minor: Computer Science)**, 8.9/10 | *2013-17* |

## Skills

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|---|---|
| **Programming** | Python, C/C++, Matlab, Git, Scripting (Bash), PyTorch, OpenCV, CUDA |
| **Computer Vision** | Deep Learning, Photogrammetry, Multi-View reconstruction, Visual Localization, SLAM, Reinforcement Learning |

## Projects

**3D dollhouse generation from RGB videos (for non-LiDAR phones)** *2023*

- Improved open-source 3D reconstruction algorithms by fine-tunning on inhouse and synthetic datasets.
- Trained a generic 3D plane detection algorithm on generated voxel density maps, and optimized using geometric constraints.
- Estimated types of doors and windows using unsupervised text-to-image matching, resulting in full 3D dollhouse.

**MSc Thesis: Learning path-planning in a Digital Twin for legged robots** [RSL, ETH Zurich] *Feb'21 - Sept'21*

- Developed a path planning for *ANYMAL* that calculates navigation costs by simulating motions in a digital twin of an environment.
- Using simulated costs ANYMAL robot can plan a safe path between locations that are **50-100m** apart. This method was presented at **NVIDIA GTC 2021** showing effectiveness of Isaac Gym in robot learning.
- Trained a navigation cost predictor using simulated costs, such that *ANYMAL* can avoid new obstacles in real-time with **90%** accuracy.

**Deep-direct visual localization using dense feature optimization** [CVG, ETH Zurich] *Feb'20 - Dec'20*

- Improved SOTA camera pose estimation (by **4%**) by minimizing dense feature alignment loss using Levenberg-Marquard optimization. This method reached **2nd place** in Autonomous Vehicle Challenge at **CVPR'20 Workshop**.
- Furthermore, trained an end-to-end camera pose prediction network by integrating differentiable LM optimization on top of dense feature prediction network. This work was accepted at **CVPR'21** and has amassed **>200 citations**.

## Awards & Responsibilites

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| Reviewer | **ICLR 2022, NeurIPS 2022, NeurIPS 2023, ICLR 2024, ICML 2024, NeurIPS 2024**, | *2022-Now* |
| CVPR'20W | **2nd Place in Autonomous Vehicle Challenge**, at CVPR 2020 VisLocOdom Workshop | *2020* |
| ETH Week | **Most Inspiring project award among 32 teams**, a design thinking competition at ETH Week | *2019* |
| ZS Assoc | **Seed funding to scale from idea to prototype**, at ZS internal Sharktank competition | *2018* |
| ZS Assoc | **Runner-up at Hackathon for building chatbot to answer queries from PubMed articles**, ZS Hackathon | *2017* |