

Joshua(Yuchen) Cao

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⚙️ SKILLS

Programming **C++, Python**, Matlab, C#, JavaScript, HTML/CSS, Swift, SQL
Key Knowledge **SLAM, 3D Vision, Path Planning, Non-linear Optimization, NeRF**, Generative AI, NLP, CG
Develop Tools **Pytorch, OpenCV, OpenGL, AWS, ROS**, Spark, CUDA, SwiftUI, React.js, Docker, Git, k8s

🎓 EDUCATION

Carnegie Mellon University Sep 2021 - Now
MS. in Computational Design(Computer Vision Track) Pittsburgh, PA

University of Chinese Academy of Sciences Sep 2016 - July 2020
MS. in Computer Science Shanghai, China

👜 EXPERIENCE

APEX(EzPT) July 2022 - Aug 2022
Internship, Computer Vision Engineer & iOS Developer Remote, USA

- Built **Google MediaPipe** and **KNN** for human pose estimation, classification, and rep counting in an iOS app to work in real-time. Coded a pipeline with **OpenCV** and **PyTorch**, to generate a new dataset from raw capture.

Robot Labs, Carnegie Mellon University Sep 2021 - Now
Research Assistant, Advisor: Prof. Daniel Cardoso Llach and Prof. Katerina Fragkiadaki Pittsburgh, PA

- Amazon Alexa Prize: SimBot Challenge
 - Trained **T5** text-to-text and **MaskRCNN** vision model for Alexa Virtual Assistant to parse language prompts into API-level machine instructions in a simulated household environment.
 - Researched **shortest path** methods to navigate among rooms in the Alexa virtual environment.
- ReAC: Husky Ground Robot
 - Built ground-robot **ROS** system with Velodyne-16 and XSens-IMU, configured onboard 2D **Gmapping** and 3D **LIO-SAM** visual odometry, **Dijkstra*** and **DWA** path planner for self-navigation and object avoidance.
 - Simulated scenes in **Nvidia Isaac Sim** for training the model of **point cloud augmentation** and **pedestrian detection**.

Mobile Perception Lab Sep 2016 - Dec 2020
Part-time, Software Engineer, Advisor: Prof. Laurent Kneip Shanghai, China

- Developed an On-board ROS-like intermediate **OS** between **UAV SDK** and RGB sensor, to run computer vision algorithm.
- Built a SLAM system with **SIFT** Feature Extraction, 7/8 Points Matching, and **Levenberg-Marquardt** Optimization.
- Researched relocalization problem of robot hijack with a prebuilt map, by **Kalman filter** and **MaskRCNN**.
- Modelled Camera Optical Algorithm to synthesize semantic SLAM dataset with ground truth and benchmark.
- Developed a **VAE** with **RGBD-SLAM** to generate complete models from partial continuous observation.

📄 PUBLICATIONS

Incremental Semantic Localization using Hierarchical Clustering of Object Association Sets ACCV 2022
Lan Hu, Zhongwei Luo, Runze Yuan, Yuchen Cao <https://arxiv.org/abs/2208.13210> Sep 2022

Representations and Benchmarking of Modern Visual SLAM Systems Sensors Journal
Yuchen Cao, Lan Hu and Laurent Kneip. <https://www.mdpi.com/1424-8220/20/9/2572> Mar 2020

Dense Object Reconstruction from RGBD Images with Embedded Deep Shape Representations ACCV Workshop
Hu, Lan, Yuchen Cao, Peng Wu and Laurent Kneip. <https://arxiv.org/abs/1810.04891> Oct 2018

💡 SELECTED PROJECTS

Computer Science projects website: <https://caoyuchen.github.io/cs/>

NeRF-based 3D Style Transfer | *Learning-based Vision & Graphics* April 2022 - Jan 2023

- Experimented NeRF-W and CUDA-based **Instant-ngp**, researched Artistic Radiance Fields with **3D style transfer**.
- Developed a web App with **OpenCV** and **ColMap** to process uploaded video on the server and feedback rendered video.