Joshua(Yuchen) Cao

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Skills

Programming	**C++**, **C#**, **Python**, **JavaScript**, **HTML/CSS**, Matlab, Swift, PHP, SQL
Key Knowledge	**Deep Learning**, **SLAM**, **Generative AI**, **NeRF**, **3D Vision**, **Distributed System**, **Database**, CG
Develop Tools	**Pytorch**, **TensorFlow**,**OpenCV**, **OpenGL**, **AWS**, **ROS**, **SwiftUI**, **React.js**, CUDA, Docker, Git, Spark, 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, advised by Prof. Laurent Kneip *Shanghai, China*

Experience

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

- Developed Pose Estimation with **OpenPose** and **Google MediaPipe**, Pose Classification and Rep Counting with **KNN** in **Colab**.
- Replanted above algorithms in iOS app, configured with **Firebase** and **Google Function**, to work in real-time with phone camera.
- Built dataset and groundTruth pipeline with **OpenCV** and **PyTorch**, simplified process for producing new dataset and exercises.

Robot Labs, Carnegie Mellon University Sep 2021 - Dec 2022
Research Assistant, Advisor: Prof. Katerina Fragkiadaki *Pittsburgh, PA*

- Amazon SimBot Challenge to build next-generation virtual assistant with **Alexa**, **Amazon EC2**, **S3**, **DynamoDB**, and CV, NLP models.
- Built **Husky ground-robot** system with 2D **Gmapping**, **Dijkstra*** and **DWA**, and 3D **LIO-SAM** for path planning, navigation.
- Constructed simulating environment with **Nvidia Isaac Sim**, for **Reinforcement Learning** algorithm training.

EF Education First Jan 2019 - Jan 2020, June 2021 - Aug 2021
Full Stack Engineer, Contractor *Remote, China*

- IWB book series: Designed & developed an interactive web for kid education with **React.js**, **Django** and **WebGL**.
- GoalMap: Developed a questionnaire for data collection and market strategy with **Salesforce**, **Bootstrap**, **Node.js** and **MySQL**.

Mobile Perception Lab, ShanghaiTech University Sep 2016 - Dec 2020
Research Assistant, Advisor: Prof. Laurent Kneip *Shanghai, China*

- Built a SLAM system with **SIFT & Harris Feature Extraction**, **7/8 Points Matching**, and **LevenBerg-Marquardt Optimization**.
- Revised **Particle & Kalman filter** and **MaskRCNN** to relocate pose with semantic information under a robot hijack case.
- Modelled **Camera Optical Algorithm** to synthesize realistic and semantic SLAM dataset with ground truth and criterion benchmark.
- Developed a **Variational Auto-Encoder** with **RGBD SLAM** to generate complete models from partial continuous observation.

Selected Projects

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

Amazon Alexa Prize: SimBot Challenge / *Computer Vision & NLP, Human-robot Interaction* Jan 2023 - now

- Improved the virtual assistant robot, debugged by **CloudWatch** and **Amazon S3**. Optimized navigation to masked objects, parser of voice instruction into multiple actions, and strategies to search objects outside sight, and improved the user experience.
- Trained and fine-tuned the **Object Segmentation** vision model and **T5 Text Parser** to cluster the coref instructions from Alexa.

NeRF-based 3D Style Transfer / *Computer Vision & Graphics, Deep Learning* April 2022 - Jan 2023

- Built **Poisson Blending** and **Neural Style Transfer** to stylize image, Revised **CycleGAN** & **StyleGAN** to synthesize content-aware image.
- Used CUDA-based **Instant-ngp** to get faster training and removed artifacts, researched **Artistic Radiance Fields** for 3D style transfer.

Scotty3D / *Computer Graphics, Software Development* Sep 2021 - Dec 2021

- Contributed to the software development with **ImGui** and **OpenGL**. Developed **Half-Edge** to enable 3D vertex, edge and face editing.
- Coded the **BVH** to speed up **Path Tracing**, **BSDF** for material, **Skinning** to align mesh with skeleton, **Inverse Kinematics** for animation.

Publications

Incremental Semantic Localization using Hierarchical Clustering of Object Association Sets **ACCV 2022**
4th Author *https://arxiv.org/abs/2208.13210* *Sep 2022*

Representations and Benchmarking of Modern Visual SLAM Systems **Sensors Journal**
1st Author *https://www.mdpi.com/1424-8220/20/9/2572* *Mar 2020*

Dense Object Reconstruction from RGBD Images with Embedded Deep Shape Representations **ACCV Workshop**
2nd Author *https://arxiv.org/abs/1810.04891* *Oct 2018*