Joshua(Yuchen) Cao

Pittsburgh, PA (412) 954-8151 caoyuchen.joshua@gmail.com Github LinkedIn

Education

Carnegie Mellon University **Sep 2021 - now**
MS. in Computational Design *Pittsburgh, PA*

- **System Courses**: Computer System, Distributed System, Parallel Computing, Cloud Computing
- **Research Courses**: Computer Graphics, Learning-based Image Synthesis & Recognition, Computer Photography, PBR

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

- **System Courses**: Operating System, Control Theory, Algorithm and Data Structure
- **Research Courses**: SLAM, Computer Vision, Machine Learning, Deep Learning, Convex Optimization, Robotics

Experience

EzPT **July 2022 - Aug 2022**
Internship of Computer Vision Engineer & iOS Developer *Remote, USA*

- Used Google MediaPipe and TensorFlow network & OpenCV for real-time Pose Estimation and Classification, to assist Physical Therapist exercise. App development includes SwiftUI for iOS, backend with Firebase BaaS with Cloud Function.
  Technologies Used: Swift, Python, Google MediaPipe, OpenCV, Tensorflow, Firebase, Google Cloud

Carnegie Mellon University **Sep 2021 - Dec 2022**
Research Assistant *Pittsburgh, PA*

- Researched RGBD-based SLAM for Surface Defact Detection on Robotic Arm with Prof. Joshua Bard.
- Researched Path Planning, Pedestrian Detection and Tracking, 3D LOAM on Ground Robotics with Prof. Daniel Cardoso.
  Technologies Used: C++, ROS, Linux, Lego-LOAM, LIO-SAM, RGBD-SLAM, A*, Djikstra*, DWA

ShanghaiTech University **Oct 2016 - Dec 2020**
Research & Teaching Assistant *Shanghai, China*

- Researched Object Detection, DJI SDK, Reinforcement Learning on UAV with Prof. Xiaopei Liu.
- Researched Multi-Sensor SLAM, Object Segmentation, 3D Reconstruction, Synthesized Dataset with Prof. Laurent Kneip.
- Assisted teaching Linear Algebra and SLAM course.
  Technologies Used: C++, Python, Matlab, Pytorch, SLAM, Reinforcement Learning, MASK-RCNN, Auto-Encoder, ROS, DJI SDK

EF Education First **Jan 2019 - Dec 2020**
Internship of Full Stack Engineer *Remote, China*

- Independently designed & developed a children-oriented English education webpage: IWB book series by React.js and Node.js.
- Full stack project based on Salesforce, an interactive questionnaire for data collection and market strategy: GoalMap.
  Technologies Used: jQuery, JavaScript, Bootstrap, React.js, Node.js, HTML, CSS, Salesforce

Skills

Theory Knowledge	**Deep Learning**, **SLAM**, **Media Generation**, **3D vision**, Computer Graphics
Programming	**C++** == **C#** == **Python** == **JavaScript** == **Swift** > Matlab > PHP
Develop Tools	**Pytorch**, **TensorFlow**,**OpenCV**, **OpenGL**, Cuda, **SwiftUI**, **ROS**, **React**, **AWS**, **GCP**, WebGL, threeJS, p5
Design Tools	**Blender**, **Unity**, **Ableton Live**, **PS**, C4D, Figma, WebFlow, Miro, Jira, Unreal, Rhino, LR, Ai, Premiere
Communication	Chinese (Native), **English** (proficient), Japanese (listening and speaking)

Publications

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

- Synthesized Realistic dataset and groundTruth for SLAM task, Benchmark for Evaluation.

Dense object reconstruction from RGBD images with embedded deep shape representations **ACCV Workshop**
Second Author *https://arxiv.org/abs/1810.04891* *Oct 2018*

- AutoEncoder-based 3D reconstruction from partial SLAM mapping.

Incremental Semantic Localization using Hierarchical Clustering of Object Association Sets **ACCV**
Second Author *https://arxiv.org/abs/1810.04891* *Sep 2022*

- 3D semantic object detection based relocalization.

Projects

Personal CS projects website: https://caoyuchen.github.io/cs/

SLAM systems & Robotics

Multi-Sensor SLAM algorithm

- A fundamental SLAM system with tracking, mapping and pose optimization in Matlab. It includes SIFT & Harris feature extraction, 78 points, homography method, and LevenBerg-Marquardt average error for pose optimization. Github: SLAM-basicframe
- Benchmark for semantic SLAM algorithm, including dataset, ground truth, and evaluation methods. Github: SSS-dataset
- Probability estimation method based on particle filter for top-view 2D road scenario and MaskRCNN, used for re-localization
- Lidar-based LOAM with Pedestrian detection and tracking, path planning system.
- Auto-Encoder based 3D Reconstruction
  Technologies Used: ORB-SLAM, KinectFusion, C++, ROS, Matlab, Pytorch, LOAM, AutoEncoder, MaskRCNN

3D vision, Robotics, VR/AR

- 2D Incision with Schunk Arm Robot. Used PyCAM and ROS RVIZ to adjust joints and links coordination. Web: RobArm Project
- Path Planning with DJI SDK. Built TX1 and Raspberry Pi3 as an intermediate system for DJI M600.
- Flight VR project. Configured 720 degrees 8 GoPro on Drone, and stitched the synced stream into VR via AutoPano.
- SIST building 3D reconstruction. Used Faro to capture dense point cloud, with CloudCompare to alignment and merging.
  Technologies Used: ROS, C++, DJI SDK, AutoPano, VR

Computer Vision & Graphics

GAN, NeRF, Deep Learning

- Traditional CV methods of gradient SSD for RGB channel alignment and image trimming; CycleGAN in content-aware image synthesis; Poisson Blending in image blending; StyleGAN in style transfer. Github: Learning-based Image Synthesis
- NeRF-based 3D architecture reconstruction, with sparse input of raw image and 5D camera ray parameters, generate consistent video frames and 3D models. Github: NeRF-based-3D
  Technologies Used: Pytorch, GAN, NeRF

Pose Estimation and Tracking

- Combined Google MediaPipe and KNN into iSO app, to real-time track and classify different exercise, and count the repetitions.
  Technologies Used: Python, TensorFLow, OpenCV, MediaPipe, Swift

CG, ray-tracing, rendering

- CMU 15662 projects: Draw SVG, MeshEdit, RayTracing, Animation: Github: Scotty3D.
  Technologies Used: C++, OpenGL

Computer System & Architecture

computer system

- CMU 15213 projects, Stack & Disassemble, Malloc(heap) implementation, Cache Simulator, I/O redirection, Web Proxy: Github: CMU15513.
  Technologies Used: C++, GDB

Game & Web Development

game, interactive media

- 48 hours GGJ 2D puzzle game based on Unity3D: Dr.Dox Quest for Time.
- Advanced Game Studio project, asymmetric split-screen multi-players game. Cooperation, Puzzle Solving, Surviving: Penumbra.
- Website development for interactive teaching tools: IWB.
- 3D animated webs by three.js and WebGL: Dreamatic.
  Technologies Used: Unity3D, Blender, Ableton Live 11, Jira, Miro

Hobbies

Photography & Screenwriting & Cinematography

- Instagram: https://www.instagram.com/joshua_cyc 500px: https://500px.me/caoyuchen
- Certificate Of Screenwriting from USC(1.5 years). Pieces: “Golden Sun & Silver Moon”, “Batman: The Great Normal”, “The Trace”.

Digital Music & 3D Art

- SoundCloud: https://soundcloud.com/joshua-rain-24806913 Personal Portfolio: https://caoyuchen.github.io/portfolio/