

# Joshua(Yuchen) Cao

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## 🎯 INTERESTS

**Research:** Learning-based media synthesis (GAN, NeRF). CV+CG, 3D Reconstruction, Mobile Perception.

**Engineer:** Front/back-end, iOS app/Unity game development, Machine Learning/Computer Vision/SLAM research engineering.

## 🎓 EDUCATION

**Carnegie Mellon University**

*MS. in Computational Design*

**Sep 2021 - now**

*Pittsburgh, PA*

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

**University of Chinese Academy of Sciences & ShanghaiTech University**

*MS. in Computer Science*

**Sep 2016 - July 2020**

*Shanghai, China*

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

## 💼 EXPERIENCE

**EzPT**

*Computer Vision Engineer & iOS Developer*

**July 2022 - Aug 2022**

*Remote, USA*

- Using **Google MediaPipe** and **TensorFlow** network & **OpenCV** for real-time **Pose Estimation**, assist Physical Therapist exercise.
- **SwiftUI** iOS development, **Firebase** BaaS with **Cloud Function** for data communication with front-end iOS and Web.

**Carnegie Mellon University**

*Research Assistant*

**Sep 2021 - Aug 2022**

*Pittsburgh, PA*

- Research **Robotic Arm**, **RGBD-based Localization and Mapping**, **Surface Defect Detection** in DFab with Prof. Joshua Bard.
- Research **Path Planning**, **Pedestrian Detection**, **3D Lidar-based SLAM**, **Ground Robotics** with Prof. Daniel Cardoso.

**ShanghaiTech University**

*Research & Teaching Assistant*

**Oct 2016 - Dec 2020**

*Shanghai, China*

- Research drone, **Object Detection**, **DJI SDK**, **Reinforcement Learning** in UAV-LAB with Prof. Xiaopei Liu.
- Research **Multi-Sensor SLAM**, **Object Segmentation**, **3D Reconstruction**, **Synthesized Dataset** with Prof. Laurent Kneip.
- Assist teaching Linear Algebra and SLAM course.

**EF Education First**

*Full Stack Engineer Internship*

**Jan 2019 - Dec 2020**

*Remote, China*

- Independently design & develop 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.

## ⚙️ SKILLS

**Theory Knowledge**

**Deep Learning, SLAM, Media Generation, 3D vision, Computer Graphics**

**Programming**

**C++ == C# == Python == JS == Swift > Java == Matlab > PHP**

**Develop Tools**

**Pytorch, TensorFlow, OpenCV, OpenGL, Cuda, SwiftUI, ROS; React, JQuery, WebGL, threeJS, p5, NoSQL**

**Design Tools**

**Blender, Unity, Ableton Live, PS, C4D, Unreal, Rhino, LR, Ai, Premiere**

**Communication**

**Chinese (Native), English (proficient), Japanese (listening and speaking)**

## 📖 PUBLICATIONS

**Representations and Benchmarking of Modern Visual SLAM Systems**

*First Author* <https://www.mdpi.com/1424-8220/20/9/2572>

**Sensors Journal**

*Mar 2020*

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

**Dense object reconstruction from RGBD images with embedded deep shape representations**

*Second Author* <https://arxiv.org/abs/1810.04891>

**ACCV Workshop**

*Oct 2018*

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

## 💡 PROJECTS

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

### SLAM(Simultaneous Localization and Mapping) systems

*Traditional 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. <https://github.com/CaoYuchen/SLAM-basicframe>
- Benchmark for semantic SLAM algorithm, including dataset, ground truth, and evaluation methods. <https://github.com/CaoYuchen/SSS-dataset>
- Probability estimation method based on particle filter for top-view 2D road scenario and MaskRCNN, used for re-localization

### Learning-based Image Synthesis

*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. <https://github.com/CaoYuchen/16726>
- NeRF-based 3D architecture reconstruction, with sparse input of raw image and 5D camera ray parameters, generate consistent video frames and 3D models. <https://github.com/CaoYuchen/NeRF-based-3D>

### Robotics Development

*3D vision, ROS, VR/AR*

- 2D Incision with Schunk Arm Robot. Use PyCAM and ROS RVIZ to adjust joints and links coordination. <https://robotics.shanghaitech.edu.cn/node/114>
- Path Planning with DJI SDK. Building TX1 and Raspberry Pi3 as an intermediate system for DJI M600.
- Flight VR project. Configuring 720 degrees of 8 GoPro on Drone, and stitching the synced stream into one Omni-direction file for VR presentation via AutoPano.
- SIST building 3D reconstruction. Using Faro to capture dense point cloud, using CloudCompare to alignment and merging.

### Computer Graphics

*CG, ray-tracing, rendering*

- CMU 15662 projects: Draw SVG, MeshEdit, RayTracing, Animation: <https://github.com/CaoYuchen/Scotty3D>.

### Computer System & Architecture

*computer system*

- CMU 15213 projects, Stack & Disassemble, Malloc(heap) implementation, Cache Simulator, I/O redirection, Web Proxy: <https://github.com/CaoYuchen/CMU15513>.

### Game & Web Development

*game, interactive media*

- 48 hours GJJ 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](#).

## 🎮 HOBBIES

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### 📷 Photography & Screenwriting & Cinematography

- Instagram: [https://www.instagram.com/joshua\\_cyc](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/>