

JUNPENG HU

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EDUCATION

TECHNICAL UNIVERSITY OF MUNICH

Munich

M.Sc. in Robotics, Cognition, Intelligence

Oct. 2021 – July. 2024

- Relevant Courses: Robotics, Robot Motion Planning, Machine Learning, Introduction to Deep Learning, Autonomous System, Vision-Based Navigation
- Grade: 1.5/1.0 (1.0 is the best possible score)

KARLSRUHE INSTITUTE OF TECHNOLOGY

Karlsruhe

Candidate for M.Sc. in Technical Mathematics (deregistered)

Oct. 2020 – Sept. 2021

- Relevant Courses: Machine Vision, Behavior Generation for Vehicles, Cognitive Automobile Lab, Topological Data Analysis, Numerical Linear Algebra for High-Performance Computation
- Grade: 1.3/1.0 (1.0 is the best possible score)

TONGJI UNIVERSITY

Shanghai

B.Eng. in Traffic Engineering

Sept. 2015 – Jun. 2019

- Thesis: Short-circuit Current Calculation of Traction Motor for Mains Train based on Active Front-end Converter.
- Grade: 88/100

RESEARCH EXPERIENCE

Thesis: Diffusion Model of Deformable Deep Implicit Templates for Semantic Scene Completion

Munich

Advised by Dr. Haoang Li, Supervised by Prof. Daniel Cremers

Oct. 2023 – Jun. 2024

- Integrated shape completion method based on the SOTA generative models with deep implicit functions into the semantic scene completion pipeline, including instance segmentation, pose estimation, and shape completion.

Physically-Based Photometric Bundle Adjustment in Non-Lambertian Environments

Munich

(Accepted by IROS 2024) Advised by Dr. Haoang Li, Supervised by Prof. Daniel Cremers

Oct. 2022 – Mar. 2024

<https://sites.google.com/view/haolangli/projects/nlb-pba>

- Investigated methods of utilizing material and illumination information to enhance direct SLAM system.
- Reviewed existing methods of inverse rendering, especially those considering spatial-temporal consistency.
- Developed physically based rendering shaders and data generation pipeline with Unity3D and NVIDIA-Optix.
- Formulated an illumination representation based on superpixel and light probes for the SLAM system.
- Designed and trained a neural network for illumination estimation task and reached SOTA performance.

ENGINEERING EXPERIENCE

Robot Application Intern

Munich

Agile Robots AG

Sept. 2022 – Current.

- AR interaction with robot arm: Robot simulation in Unity3D for pick-and-place tasks with interaction in HoloLens.
- Researched NeRF-based 3D reconstruction for transparent objects.
- Photorealistic synthetic dataset generation for transparent object scene within Blender.
- UGV simulation in Isaac sim with multi-sensors. <https://youtu.be/Z1SzVrzhqcM?si=tGCm4oOIulbSs9zy>
- Five-finger hand grasping data collection in VR simulation (Meta Quest 2): Implemented a five-finger hand grasping demo in Unity3D to collect ground truth data. <https://youtu.be/PrZKjPjg7Jk>
- Teleoperation of robot arms via VR headset (Meta Quest 2): Collected hand/controller poses from VR headset to directly control the real-world robot arms. <https://www.youtube.com/watch?v=KUo9faMcIZM>
- Vision-based Grasping Generation Pipeline: Multi-modal object detection via vision language model, model-free 6D pose estimation and object tracking.

OTHER PROJECTS

Tiny Ray-tracing Renderer

Self-study Project

- Developed a hardware ray-tracing rendering engine based on Nvidia-Optix SDK
- Implemented real-time visualization windows with mouse interaction based on OpenGL.
- Gained hands-on experience in handling 3D objects, different materials, textures, and image-based lighting (IBL) in the rendering pipeline.

Multi-modal 3D Features for 3D Object Detection in Autonomous Driving

Practical Course, TUM Computer Vision Group

- Researched SOTA architectures for sensor fusion methods of camera and LiDAR in autonomous perception tasks.
- Designed a new sensor fusion frame of BEV detection based on SOTA depth completion works of 2D images.
- Implemented and trained the model on nuScenes Dataset and analyzed the performance.

Visual-Inertial Tracking using Preintegrated Factors

Practical Course, TUM Computer Vision Group

- Implemented ORB-SLAM system.
- Studied state-of-the-art methods for sensor fusion methods of IMU and cameras and the corresponding implements in the SLAM system.
- Implemented the sensor fusion algorithm to improve the stability and scale observability of visual odometry in the ORB-SLAM system.

MyNet

Self-study Project

- Aimed to develop a C++ deep learning framework from scratch.
- Using gtest, gflag, glog during development, FlatBuffers for data serialization, and OpenBLAS for CPU computing.
- Using Bazel for compiling (CMake version in progress).

CuSpCluster

Numerical Linear Algebra for High-Performance Computation, KIT

- Aimed to implement a C++ GPU accelerated parallel K-means clustering on sparse data (CSR matrix).
- Designed different CUDA kernel functions and analyzed their performance with Google Benchmark and Nvidia Nsight System.

SKILLS

C++, Python, Linux, ROS, C#, CUDA, Unity3D, Isaac sim, Docker, Pytorch, OpenCV, GLSL, MetaXR