Yiren LU

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EDUCATION

Case Western Reserve University   Cleveland, OH, USA

Ph.D. in Computer Science   2024/01 – present

University at Buffalo, State University of New York   Buffalo, NY, USA

M.S. in Computer Science and Engineering   2022/08 – 2023/12

ShanghaiTech University   Shanghai, China

B.Eng. in Computer Science   2017/09 – 2021/08

- **Third Prize**, 2019 Contemporary Undergraduate Mathematical Contest in Modeling

PUBLICATIONS

- S. Su, Y. Du, T. Fu, **Y. Lu**, M. Wen, C. Wang, "iPCR: Self-Supervised Point Cloud Registration with Imperative Learning", submitted to **ECCV 2024**.
- F. Tai, S. Su, **Y. Lu**, W. Chen, "iSLAM: Imperative SLAM.", IEEE Robotics and Automation Letters (**RA-L**), 2024.
- **Lu, Y**., Wei, H. (2023). End to End Face Reconstruction via Differentiable PnP. In: Karlinsky, L., Michaeli, T., Nishino, K. (eds) Computer Vision - **ECCV 2022 Workshops**. ECCV 2022. Lecture Notes in Computer Science, vol 13805. Springer, Cham.
- X. Zhi, J. Hou, **Y. Lu**, L. Kneip and S. Schwertfeger, "Multical: Spatiotemporal Calibration for Multiple IMUs, Cameras and LiDARs," 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), Kyoto, Japan, 2022, pp. 2446-2453.
- J. Cai, J. Hou, **Y. Lu**, H. Chen, L. Kneip and S. Schwertfeger, "Improving CNN-based Planar Object Detection with Geometric Prior Knowledge", 2020 IEEE International Symposium on Safety, Security, and Rescue Robotics (**SSRR**), 2020, pp. 387-393.

WORK EXPERIENCES

Tencent   Shenzhen, China

Computer Vision Algorithm Engineer Intern, Interactive Entertainment Group (IEG)   2021/07 – 2022/06

Fast 3D Motion Capture Pipeline for Live Streaming

- Constructed a 30 fps real-time Multiview motion capture system for live streaming with latency less than 1s.
- Utilized mediapipe as 2d keypoint detector and applied triangulation to get 3d coordinate of each keypoint.
- Leveraged optimization methods such as SMPLify and SCOPE to regress body SMPL parameters, and used information of previous frame to speed up the optimization process.
- Extracted the minimal-ik module from minial-hand to calculate hand MANO parameters..

RESEARCH EXPERIENCES

Cross-view Consistent Inpainting in 3D Gaussian Splatting (to be submitted to ACM MM2024)   2023/06 – now

VULab, Case Western Reserve University.

Research Assistant (Supervisor: Prof. Yu Yin)

- Utilize Depth Image Based Rendering (DIBR) to propagate one inpainted view to the rest of the training set, to produce view-consistent inpainting and achieve state-of-the-art performance considering PSNR and LPIPS.
- Leveraged off-the-shelf depth estimation method to generate smooth yet reasonable depth map and align them with the sparse depth produced by SFM to improve DIBR performance.
- Applied depth prior during the DIBR projection process to deal with occlusion and de-occlusion issue.
- Proposed a DIBR based Multiview segmentation method that outperform state-of-the-art method OR-NeRF.

Unsupervised Visual Inertial Odometry with Pose Graph Optimization   2023/03 – now
SAIR Lab, University at Buffalo.
Research Assistant (Supervisor: Prof. Chen Wang)
- Designed a two branch network to extract information from image and IMU input respectively, and utilized PGO to fuse the ouput of image and IMU branch.
- Leveraged LSTM for IMU denoise and preintegrated the denoised IMU data to get the predicted IMU pose.
- Applied flow-based VO (currently TartanVO) as image branch.
- Utilized the result of PGO as pseudo label to supervise the training of image and IMU branch.

Object Removal in Neural Radiance Field   2022/09 – 2022/12
Visual Computing Lab, University at Buffalo.
Research Assistant (Supervisor: Prof. Junsong Yuan)
- Utilized object-decompsite NeRF to get the spatial location of objects and removed the object by rejecting the samples in that region in rendering process.
- Compared several image inpainting methods including PConv, MSTand etc to perform content generation.
- Utilized partial mask to find the exact region that is obscured, and introduced video object tracking to track the masked region in different views.
- Applied color constraints to make the generated content consistent with the outside content.

End-to-End Face Reconstruction via Differentiable PnP   2022/05 – 2022/08
ECCV 2022 WCPA workshop challenge, 3rd prize.
- Designed a two-branch network to deal with the Face Reconstruction and Facial Landmark Detection task.
- Applied the Gaussion Negative Log Loss(GNLL) to improve the accuracy of Facial Landmark Detection.
- Contructed a 250 dimension PCA space for canonical 3d mesh and utilized VDC and fWPDC loss to regress 3d mesh. Finally achieved a SOTA performance with 1.68mm mean error on ARKit dataset.
- Utilized the differentiable Epro-PnP to overcome the training problem of the previous PnP methods, and reached a SOTA performance on head pose estimation with an MAE of 0.81 and 3.86 on Rotation and Translation respectively.

Improving CNN-based Planar Object Detection with Geometric Prior Knowledge   2019/07 – 2020/08
The MARS Lab, School of Information Science and Technology, ShanghaiTech.
Research Assistant (Supervisor: Prof. Sören Schwertfeger)
- Computed 2D homography matrices to wrap source images into target view to compensate for the CNN detector.
- Conducted dataset collection of the first open-source RGB-D hazmat dataset, which contained 360 RGB images and 360 depth maps with a resolution of 1280*720.
- Wrapped back the bounding box estimated by YOLO from the canonical view to the original view through the homography matrix.
- Conducted the real-robot experiment, which showed that our algorithm performed 10% better than one-stage YOLOv3, and at the same time achieved only1.5s delay (almost real-time).

Multical: Spatiotemporal Calibration for Multiple IMUs, Cameras and LiDARs   2020/07 – 2021/07
The MARS Lab, School of Information Science and Technology, ShanghaiTech.
Research Assistant (Supervisor: Prof. Sören Schwertfeger)
- Designed an algorithm to calculate the transformation between LiDAR and the arbitrary target using the geometric and intensity information captured by LiDAR. Finally reached a 0.71mm transformation error and 0.003rad rotation error in real word when estimating the pose of the AprilGrid Board.
- Conducted the real world temporal calibration experiment, which showed a 0.003ms time offset error when there was a 3ms artificial delay on IMU data.
- Constructed the calibration platform with four cameras and two LiDARs, and was responsible for data collection.
- Used Gazebo to simulate the data collection process.

TECHNICAL SKILLS

Computer Vision: OpenCV, PCL, Open3D, ffmpeg.
ML/DL: PyTorch, TensorFlow, SKlearn, Pandas, Numpy, Scipy.
Robotics: ROS, PyPose, Gazebo, Rviz.