RUI ZHU

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RESEARCH INTERESTS

- **Scene Understanding:** Physically-based 3D material and lighting estimation; inverse rendering
- **3D Vision & Geometry:** Shape reconstruction, depth estimation, semantic SLAM;

EDUCATION

Ph.D. Student in Computer Science, UC San Diego La Jolla, CA, USA *Sep.2018 - Present*

M.S. in Robotics, Carnegie Mellon University Pittsburgh, PA, USA *Aug.2015 - Aug.2017*

- **Overall GPA:** 4.0/4.0
- **Selected Courses:** Computer Vision, Visual Learning and Recognition, Computer Graphics, Machine Learning, Convex Optimization, Mechanics of Manipulation, Deep Reinforcement Leaning and Control

B.Eng. in Information Engineering, Southeast University Nanjing, Jiangsu, P.R.China *Aug.2011 - Jun.2015*

- **Overall GPA:** 3.82/4.0 (90.11/100)

PUBLICATIONS

1. **IRISformer: Dense Vision Transformers for Single-Image Inverse Rendering in Indoor Scenes** **Rui Zhu**, Zhengqin Li, Janarbek Matai, Fatih Porikli, Manmohan Chandraker. *IEEE Conference on Computer Vision and Pattern Recognition* **(CVPR)**, 2022 **(Oral)**

2. **Physically-based Editing of Indoor Scene Lighting from a Single Image** Zhengqin Li, Jia Shi, Sai Bi, **Rui Zhu**, Kalyan Sunkavalli, Milo Haan, Zexiang Xu, Ravi Ramamoorthi, Manmohan Chandraker. *European Conference on Computer Vision* **(ECCV)**, 2022

3. **PhotoScene: Physically-Based Material and Lighting Transfer for Indoor Scenes** anonymous. *IEEE Conference on Computer Vision and Pattern Recognition* **(CVPR)**, 2022 Yu-Ying Yeh, Zhengqin Li, Yannick Hold-Geoffroy, **Rui Zhu**, Zexiang Xu, Milo Haan, Kalyan Sunkavalli, Manmohan Chandraker.

4. **OpenRooms: An Open Framework for Photorealistic Indoor Scene Datasets** Zhengqin Li, Ting-Wei Yu, Shen Sang, Sarah Wang, Meng Song, Yuhan Liu, Yu-Ying Yeh, **Rui Zhu**, Nitesh Gundavarapu, Jia Shi, Sai Bi, Hong-Xing Yu, Zexiang Xu, Kalyan Sunkavalli, Milos Hasan, Ravi Ramamoorthi, Manmohan Chandraker. *IEEE Conference on Computer Vision and Pattern Recognition* **(CVPR)**, 2021 **(Oral)**

5. **Single View Metrology in the Wild** **Rui Zhu**, Xingyi Yang, Yannick Hold-Geoffroy, Federico Perazzi, Jonathan Eisenmann, Kalyan Sunkavalli, Manmohan Chandraker. *European Conference on Computer Vision* **(ECCV)**, 2020

6. **Deep Keypoint-Based Camera Pose Estimation with Geometric Constraints** **Rui Zhu***, You-Yi Jau*, Hao Su, Manmohan Chandraker. *International Conference on Intelligent Robots and Systems* **(IROS)**, 2020

7. **ApolloCar3D: A Large 3D Car Instance Understanding Benchmark for Autonomous Driving** Xibin Song, Peng Wang, Dingfu Zhou, **Rui Zhu**, Yuchao Dai, Hao Su, Hongdong Li, Ruigang Yang. *IEEE Conference on Computer Vision and Pattern Recognition* **(CVPR)**, 2019

8. **Learning Depth from Monocular Videos using Direct Methods** Chaoyang Wang, Jose Miguel Buenaposada, **Rui Zhu**, Simon Lucey. *IEEE Conference on Computer Vision and Pattern Recognition* **(CVPR)**, 2018

9. **Object-Centric Photometric Bundle Adjustment with Deep Shape Prior** **Rui Zhu**, Chaoyang Wang, Chen-Hsuan Lin, Simon Lucey. *IEEE Winter Conference on Applications of Computer Vision* **(WACV)**, 2018

10. **Rethinking Reprojection: Closing the Loop for Pose-aware Shape Reconstruction from a Single Image** **Rui Zhu**, Hamed Kiani, Chaoyang Wang, Simon Lucey. *International Conference on Computer Vision* **(ICCV)**, 2017 **(Spotlight)**

11. **Semantic Photometric Bundle Adjustment on Natural Sequences** **Rui Zhu**, Chaoyang Wang, Ziyan Wang, Chen-Hsuan Lin, Simon Lucey. arXiv preprint, 2017

12. **The Conditional Lucas & Kanade Algorithm** Chen-Hsuan Lin, **Rui Zhu**, Simon Lucey. *European Conference on Computer Vision* **(ECCV)**, 2016

13. **Structure from Category: A Generic and Prior-less Approach** Chen Kong, **Rui Zhu**, Hamed Kiani, Simon Lucey. *International Conference on 3D Vision* **(3DV)**, 2016

RESEARCH & INDUSTRY EXPERIENCE

- **Nvidia Research**, Santa Clara, USA *Jun. 2021 - Sep. 2021*
  Non-patch based Dense Transformers for Scene Understanding
  Research Intern - Chao Liu, Ben Eckart, Jan Kautz
- **Microsoft Vision MR Team**, Seattle, WA, USA *Jun. 2020 - Sep. 2020*
  Semantic Stereo Estimation
  Research Intern - Sudipta Sinha, Victor Fragoso
  - Disparity and semantics estimation from stereo image pair, via learning to refine disparity from geometric methods as well as mutual constraints between disparity and semantics.
- **Adobe Research**, San Jose, CA, USA *Jun. 2019 - Sept. 2019*
  Scene Scale Estimation from a Single Image
  Research Intern - Kalyan Sunkavalli, Yannick Hold-Geoffroy, Federico Perazzi
  - Single image absolute scale estimation, for applications of scene understanding and virtual object insertion.
- **Baidu Research**, Sunnyvale, CA, USA *May. 2018 - Sept. 2018*
  Car Model Fitting for Autonomous Driving Applications
  Research Intern - Prof. Ruigang Wang & Dr. Peng Wang
  - 6DoF car pose and shape estimation from single image, and the dataset ApolloCar3D.
- **Argo AI**, Pittsburgh, PA, USA *Feb. 2018 - May 2018*
  3D Object Detection from Front-view LiDAR data
  Research Engineer in Computer Vision - Prof. Deva Ramanan & Prof. Simon Lucey
  - Deep model fitting in RGB-D data with deep fundamental bundle adjustment.
- **Carnegie Mellon University**, Pittsburgh, PA, USA *Mar. 2017 - Nov. 2017*
  Semantic Photometric Bundle Adjustment with Shape Prior [2][3]
  Research Associate in CI2CV Lab; Advisor - Prof. Simon Lucey
  - The first approach for semantic object-centric PBA on natural sequences which gives the global 6DoF camera poses of each frame and the dense 3D shape, with PBA-like accuracy but denser depth maps;
  - Introduce the learned shape prior from deep learning into the Visual SLAM (PBA) pipeline.
- **Carnegie Mellon University**, Pittsburgh, PA, USA *Sep. 2017 - Nov. 2017*
  Learning Single Image Depth Predictor from Monocular Sequences [4]
  Research Associate in CI2CV Lab; Advisor - Prof. Simon Lucey & Prof. Jose Miguel Buenaposada
  - We show that the depth CNN predictor can be learned without a pose CNN predictor, by incorporation of a differentiable implementation of DVO, along with a novel depth normalization strategy

- Substantially improves performance over state of the art that use monocular videos for training, and even comparable to binocular methods.

- **Carnegie Mellon University**, Pittsburgh, PA, USA *Sep. 2015 - Mar. 2017*
  Shape Reconstruction from a Single Image [1][6]
  Graduate Research Assistant; Advisors - Prof. Simon Lucey
  - Shape reconstruction from a single image (1) in non-rigid case with compressive shape prior (2) with deep learning with reprojection error for domain adaptation.

- **Carnegie Mellon University**, Pittsburgh, PA, USA *Sep. 2015 - Mar. 2017*
  The Conditional Lucas & Kanade Algorithm [5]
  Graduate Research Assistant; Advisors - Prof. Simon Lucey
  - Efficient tracking and alignment with connection to Supervised Descent Method and Lucas & Kanade Algorithm;

- **Southeast University**, Nanjing, P.R.China *May 2013 - May 2015*
  Undergraduate Research Assistant; Advisors - Prof. Lu Tang & Prof. Qiao Wang
  - Facial landmarks registration with Supervised Descent Method (SDM), and gaze detection;
  - Facial expression classification system based on Action Units;
  - A robotic arm and hand control system with gesture recognition.

TALKS & PRESENTATIONS

- **Rethinking Reprojection: Closing the Loop for Pose-aware Shape Reconstruction from a Single Image**
  International Conference on Computer Vision **(ICCV)**, Venice, Italy, Oct. 2017
- **Shape Prior Meets Geometry in Single and Multi-view Shape Reconstruction**
  Master Thesis, Carnegie Mellon University, Pittsburgh, USA, Aug. 2017

ACADEMIC SERVICE

- Conference reviewer for CVPR'18'19'20'21, ICCV'19'21, ECCV'20, WACV'20'21, AAAI'2021, ACCV'2021, NeurIPS'20'21, ICRA'21.
- Journal reviewer for IEEE Signal Processing Letters.

HONORS & AWARDS

- Powell Fellow and Jacobs School of Engineering Fellowship at UCSD (2019-2021) *2019 - 2021*
- National Scholarship of China (3/281 or Top 2%) *Sep. 2014*
- President Scholarship of Southeast University (Top 1%) *Sep. 2013*
- Southeast University ISE Department – Zhengbao Corporation Fellowship (Top 1%) *Jun. 2013*
- Award for Merit Student of Southeast University (Top 5%) *Sep. 2013*

SKILLS

- **Programming Language:** MATLAB, C++, JAVA, Python, Objective-C
- **Software and Platforms:** TensorFlow, PyTorch, OpenCV