Kaixuan Wang

Computer Vision & Robotics
Focusing on 3D Vision for Robotics

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Education

- **Hong Kong University of Science and Technology (HKUST)** — Hong Kong
  Ph.D. student — *Sep. 2016 – Present*
- **South East University (SEU)** — Nanjing, China
  Bachelor of Automation; GPA: 4.206 (1/27) — *Sep. 2012 – July. 2016*

Research Projects

- **HKUST** — Hong Kong
  Ph.D. Student — *2016 - Present*
  - **Monocular Depth Estimation**:
    Developing a system that can estimate the dense depth map for every image frame from a moving monocular camera with known camera poses. The system can generate dense depth maps in real-time for 3D reconstruction, UAV autonomous flights, etc. Both pinhole and fisheye cameras are supported so that the system can be deployed to a variety of platforms. Two papers are presented at IROS 2018. Project webpage:
    Pinhole-Fisheye-Mapping: github.com/HKUST-Aerial-Robotics/Pinhole-Fisheye-Mapping
    Open-Quadtree-Mapping: github.com/HKUST-Aerial-Robotics/open_quadtree_mapping
  - **Deep Multi-view Depth Estimation**:
    Using a deep network to estimate dense depth maps from a number of multi-view images. The network is designed to have the flexibility of traditional methods that can support more than two images and different camera intrinsic parameters. Efficiency is another advantage compared with prior learning-based works that it can estimate depth maps in real-time. The project has been used to support other researchers' work to reconstruct complex environments. The papers is presented at 3DV 2018 (oral). Project webpage:
    MVDepthNet: github.com/HKUST-Aerial-Robotics/MVDepthNet
  - **Dense Surfel Fusion**:
    In this project, a depth fusion system is developed to fuse depth maps into a dense 3D model. Surfels are used to represent the environment so that the system achieves both memory and computation efficiency. Using an efficient map deformation method, the system achieves global consistency and supports loop closures from SLAM systems. The system can even reconstruct KITTI-scale models in real time without any GPU acceleration. The paper is accepted by ICRA 2019. Project webpage:
    DenseSurfelMapping: github.com/HKUST-Aerial-Robotics/DenseSurfelMapping
  - **Deep Multi-view Structure-from-Motion *(under review)***:
    In this project, a deep network is proposed to estimate camera poses and depth maps given a set of images. Multi-view geometry is exploited that both the camera poses and optical flow between images are jointly estimated. Multiple optical flow and camera poses are further fused into one depth map of the reference image. Benefiting from the careful design, common numerical problems of triangulation are avoided, and the fusion can take arbitrary image pairs. Project webpage:
    Flow-Motion-Depth: https://github.com/HKUST-Aerial-Robotics/Flow-Motion-Depth
  - **Learning depth and motion from videos *(in progress)***:
    In this project, we are exploiting the multi-view geometry constraints in monocular videos to learn both depth maps and object motion. By explicitly constraining pixel observations in adjacent frames and exploiting the sparsity of independent objects, the network learns the geometry of the scene, the camera ego-motion and the motion of dynamic objects.
- **AI-Lab of ByteDance** — Beijing, China
  Intern — *2019.04 - 2019.07*
  - **Depth Estimation for Mobile Devices**: Developing algorithms to estimate depth maps for smartphones such that AR (augmented reality) with occlusion can be achieved. The method is capable of being deployed to platforms with different types of sensors, such as ToF, stereo, and monocular cameras.
- **DJI** — Shenzhen, China
  Intern — *2019.11 - Present*
  - **Perception team**: Algorithms development.

- **SEU** Nanjing, China
  Undergraduate Student *2015 - 2016*
  - **Formation Tracking Control**: Design methods to control multiple agents to formation track a family of given concentric spheres when the communication topology is directed.

Publications

- **HKUST**:
  - K. Wang, F. Gao and S. Shen. Real-time scalable dense surfel mapping. In Proc. of the IEEE International Conference on Robotics and Automation (ICRA), Montreal, Canada, May 2019.
  - W. Ding, W. Gao, K. Wang and S. Shen. An Efficient B-spline-Based Kinodynamic Replanning Framework for Quadrotors. In IEEE Transactions on Robotics (T-RO), 2019.
  - K. Wang and S. Shen. MVDepthNet: real-time multiview depth estimation neural network. In Proc. of the 6th international conference on 3D Vision (3DV). Verona, Italy, September 2018. *Oral*.
  - K. Wang and S. Shen. Adaptive baseline monocular dense mapping with inter-frame depth propagation. In Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Madrid, Spain. October 2018.
  - K. Wang, W. Ding and S. Shen. Quadtree-accelerated real-time monocular dense mapping. In Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Madrid, Spain. October 2018.
  - F. Gao, L. Wang, K. Wang, W. Wu, B. Zhou, L. Han, and S. Shen. Optimal trajectory generation for quadrotor teach-and-repeat. IEEE Robotics and Automation Letters (RAL), 4(2), pp.1493-1500, January 2019.
  - Y. Ling, K. Wang and S. Shen. Probabilistic dense reconstruction from a moving camera. In Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). Madrid, Spain. October 2018.
  - W. Ding, W. Gao, K. Wang and S. Shen. Trajectory replanning for quadrotors using kinodynamic search and elastic optimization. In Proc. of the IEEE International Conference on Robotics and Automation (ICRA), pages 7595-7602, Brisbane, Australia, May 2018.
- **SEU**:
  - Y. Chen, K. Wang and Y. Zhang. Spherical formation tracking control of second-order nonlinear agents with directed communication. 547-552. 10.1109/ICCA.2016.7505334.
  - Y. Chen, K. Wang, Y. Zhang, C. Liu and Q. Wang. A geometric extension design for second-order nonlinear agents formation surrounding a sphere. 4868-4873. 10.1109/CCDC.2016.7531865.