Zhongyang Ren

https://zhong-yang.ren | zhongyangren@hnu.edu.cn | github.com/ZhongyangRen

EDUCATION

Hunan University   Changsha, Hunan, China
M.Eng. in Electrical Information, advised by Prof. Yi Zhou, School of Robotics   *Aug. 2022 – Jun. 2025 (expected)*

Shandong Normal University   Jinan, Shandong, China
B.Eng. in Computer Science and Technology (GPA: 86/100)   *Sep. 2018 – Jun. 2022*

Core courses: Data Struture(94), Digital Image Processing(99), Computer Architecture(95), Computer Network(93), Advance Mathematics(I:93, II:93, III:87), Computer Vision Technology(90), UAV Modeling and Control(95)

PUBLICATION

Zhongyang Ren[*], Bangyan Liao[*], Delei Kong, Jinghang Li, Peidong Liu, Laurent Kneip, Guillermo Gallego, Yi Zhou. **Motion and Structure from Event-based Normal Flow**. In Proceedings of the European Conference on Computer Vision (ECCV 2024, [*] denotes equal contribution).

Abstract: Recovering the camera motion and scene geometry from visual data is a fundamental problem in the field of computer vision. Its success in standard vision is attributed to the maturity of feature extraction, data association and multi-view geometry. The recent emergence of neuromorphic event-based cameras places great demands on approaches that use raw event data as input to solve this fundamental problem. Existing state-of-the-art solutions typically infer implicitly data association by iteratively reversing the event data generation process. However, the nonlinear nature of these methods limits their applicability in real-time tasks, and the constant-motion assumption leads to unstable results under agile motion. To this end, we rethink the problem formulation in a way that aligns better with the differential working principle of event cameras. We show that the event-based normal flow can be used, via the proposed geometric error term, as an alternative to the full flow in solving a family of geometric problems that involve instantaneous first-order kinematics and scene geometry. Furthermore, we develop a fast linear solver and a continuous-time nonlinear solver on top of the proposed geometric error term. Experiments on both synthetic and real data show the superiority of our linear solver in terms of accuracy and efficiency, and indicate its complementary feature as an initialization method for existing nonlinear solvers. Besides, our continuous-time non-linear solver exhibits exceptional capability in accommodating sudden variations in motion since it does not rely on the constant-motion assumption.

EXPERIENCE

Teach Assistant   Sep. 2024 – Present
RO10005: Robotics Engineering Advanced Practice   *Advised by Prof. Yi Zhou*
Research on Geometric Model Fitting on Event Data   Mar. 2023 – Present
                                                                                        Advised by Prof. Yi Zhou

- Developed a normal flow constraint with a geometric connection to event data, overcoming partial observation issues.
- Proposed two solvers for a family of motion-and-structure estimation problems using sparse event-based normal flow as input.
- Achieved state-of-the-art accuracy in rotational motion estimation, differential homography estimation, and 6 DoF tracking with depth prior.

Research on Hyperspectral Image Super-Resolution   Dec. 2021 – May 2022
Undergraduate Thesis   *Advised by Associate Prof. Kai Zhang and Renwei Dian*

- Fused hyperspectral and multispectral images to achieve hyperspectral image super-resolution.
- Combined internal and external priors and used ADMM to solve the optimization problem.
- Achieved satisfactory results and released a Chinese patent.

Remote Intern (Game Design and Programming)   Sep. 2019 – Feb. 2020
Project Leader and Programmer   *Reworld: https://www.reworlder.com/*

- Co-founded HelloGame Studio at Shandong Normal University, serving as Associate Leader.
- Programmed and deployed the game "Jungle Break" on the "Reworld" platform. (Skills used: Lua)
- Led, designed, and programmed the game "Prisoner" and deployed it on the "Reworld" platform.

AWARDS

- Excellent Student Scholarship(First Class), Hunan University

- Second Prize(3%) in National Undergraduate Mathematical Contest in Modeling

- Provincial First Prize(10%) in Lanqiao Cup Programming Contest

- Excellent Student, Shandong Normal University

- Excellent Student Scholarship(First Class), Shandong Normal University

TECHNICAL SKILLS

Programming Languages: MATLAB, C++, Python, Java

Libraries & Tools: PyTorch, NumPy, OpenCV, Git, Docker, ROS, LaTeX