Learning Structure-And-Motion-Aware Rolling Shutter Correction
Bingbing Zhuang¹, Quoc-Huy Tran², Pan Ji², Loong Fah Cheong¹, Manmohan Chandraker²,³
¹National University of Singapore, ²NEC Labs, ³UC San Diego

1. Introduction

Problem: Rolling shutter (RS) cameras are very popular due to its low-cost advantage. However, they adopt a sequential exposure mode, causing image distortion when captured during camera motion.

2. Contributions

Difficulties: removing such distortion exactly needs recovering both the intra-frame camera motion and 3D structure.
- Complexity of RS geometry
  Two-view approach → [Dai et al. CVPR17], [Zhuang et al. ICCV17]
- Degeneracy of RS geometry
  [Alb et al. ECCV16], [Ait-Aider et al. ICCV09]

Contributions:
- RS two-view SfM in pure translation is degenerate.
  — Data-driven with CNN to overcome the geometrical complexity and degeneracy.
- A geometrically meaningful way to synthesize large-scale training data
- Identify a geometric ambiguity that arises for training.

3. Critical configuration: RS two-view SfM in pure translation

Proposition. RS two-view geometry for pure translational camera motion is degenerate.
➢ one cannot tell if the two images are captured with a RS or GS camera based on 2D correspondences only.
➢ Even RS is known a priori, there are infinitely many solutions for the per-scanline camera position and depth.

4. Structure-and-motion-aware rolling shutter correction

Overview
- Network architecture
- Training data generation
- Image resizing to get training data with same size? No, image cropping.

5. Experiments

Result: Synthetic KITTI
- Baseline:
  - 2DCNN: [Purkait et al. ICCV17]
  - 2DCNN: [Ait-Aider et al. CVPR17]
- Input
  - MH
  - 2DCNN
  - Ours
- Result: Real data
- Input
  - MH
  - 2DCNN
  - Ours
- Example image