Unrolling the Shutter: CNN to Correct Motion Distortions

Vijay Rengarajan, Yogesh Balaji, and A.N. Rajagopalan, Indian Institute of Technology Madras, Chennai, India
apvijay.github.io/rs_rect_cnn

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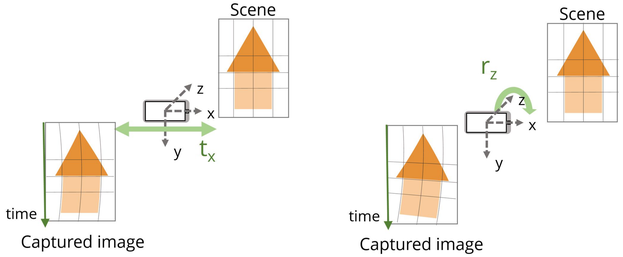
1 Goal

Correct rolling shutter distortions from a single image



Most mobile phone (CMOS sensor) cameras employ row-wise light acquisition

Camera motion even during short exposure causes local geometric distortions known as the rolling shutter effect

Each image row is associated with a camera pose

2 Challenges

Lack of multiple images to exploit correspondences

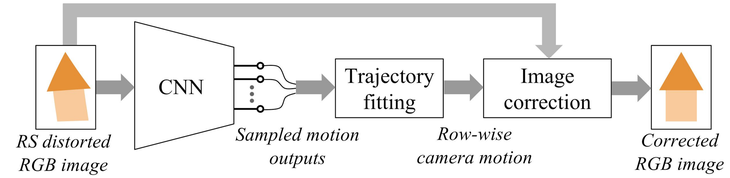
What features to extract from the image to decode camera trajectory?

Existing works use scene-specific algorithms

Urban scenes: Rengarajan et al. (CVPR 2016)

Faces: Heflin et al. (Conf. Biometrics 2010)

3 Our idea



Use a CNN to map the distorted image space to the motion space

CNN input: Rolling shutter image (256x256 RGB)

CNN output: Motion values (15 t_X samples, 15 r_Z samples corresponding to equally spaced rows)

Fit a polynomial trajectory to get row-wise camera poses

Correct the distorted image using inverse warping

Why regress on motion rather than on the corrected image?

No new or better information in the image is sought

Rolling shutter causes geometric distortions (not photometric)

Training

Generate synthetic rolling shutter images and create image-motion pairs

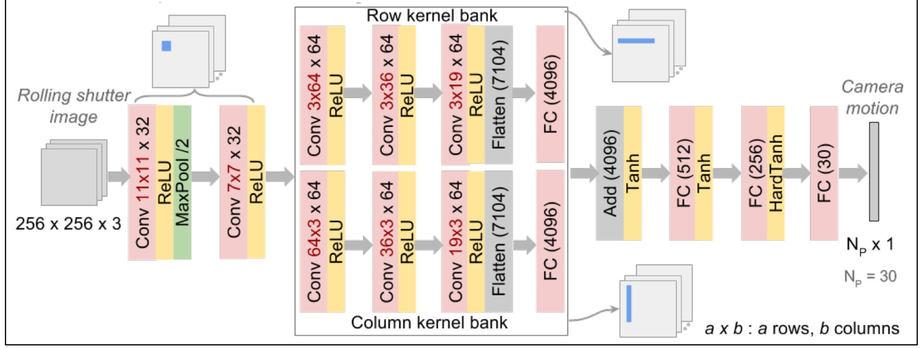
Urban dataset: SUN, Zurich, Oxford
Face dataset: LFW

4 RowColCNN architecture

Use long rectangular kernels instead of square kernels

Temporal motion information is present along image columns

Information from image rows helps to reinforce row-wise motion



5 Results

We thank Google for the conference travel grant.