Position-aware and Symmetry Enhanced GAN for Radial Distortion Correction

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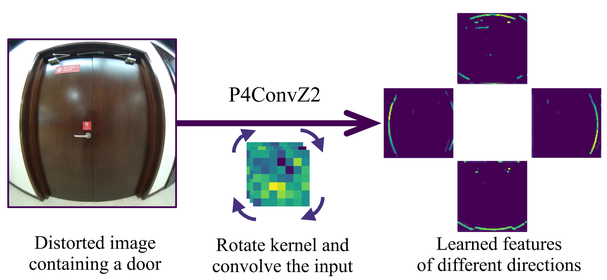
ICPR 2020 25th INTERNATIONAL CONFERENCE ON PATTERN RECOGNITION ONLINE 10 | 15 January 2021
IAPR Technically Co-Sponsored by IEEE COMPUTER SOCIETY

1. Motivation and Contribution

Motivation:

★ Texture far from the image center has strong distortion while that near the image center only has little distortion.

★ On the other hand, images taken under structured scenes have many lines, these linesare more likely to be centrosymmetric with each other.



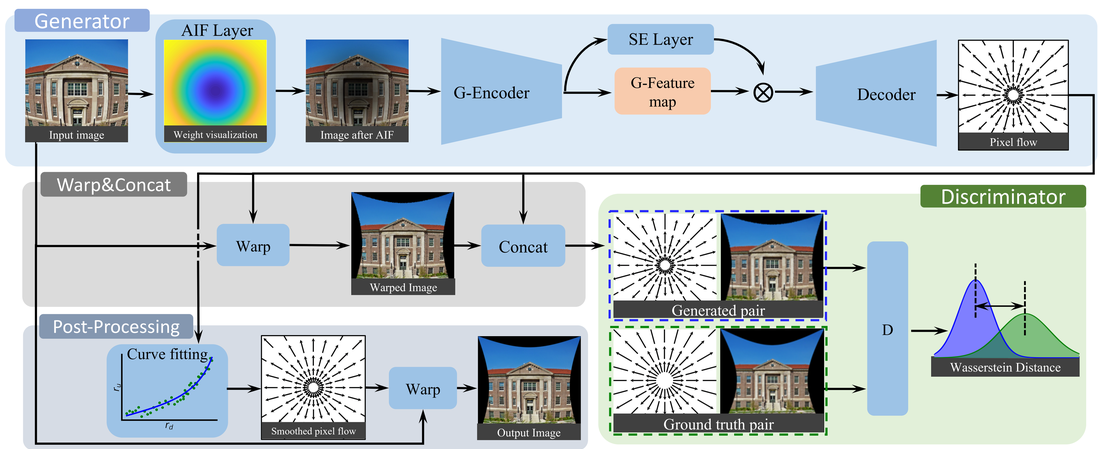
Contribution:

★ We propose a novel framework based on GAN for radial distortion correction, where rotation symmetry enhanced convolution kernels are applied to learn geometry features explicitly.

★ We develop a position-aware AIF layer to fully exploit the properties of radial distortion.

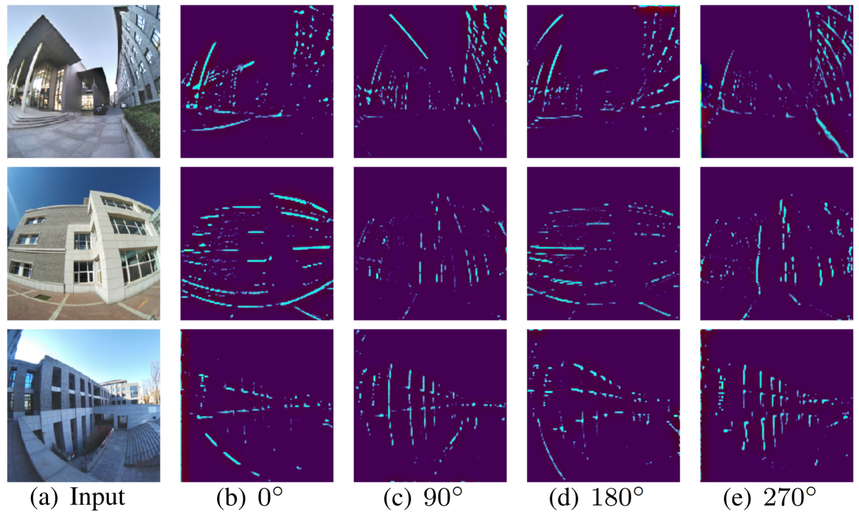
★ Further experiments show that our method outperforms previous methods in both synthetic and real distortion images.

2. Overview



★ We first input the distorted image to the AIF layer and get an intensity adjusted image. Then, the intensity adjusted image is input to G-Encoder to extract different direction features. These learned features are recalibrated using SE-layer. The generator outputs a pixel flow used to correct the distorted image. Finally, the quality of the pixel flow and the warped image are judged by a discriminator to make it indistinguishable from the ground truth.

3. Visualization of Feature Maps

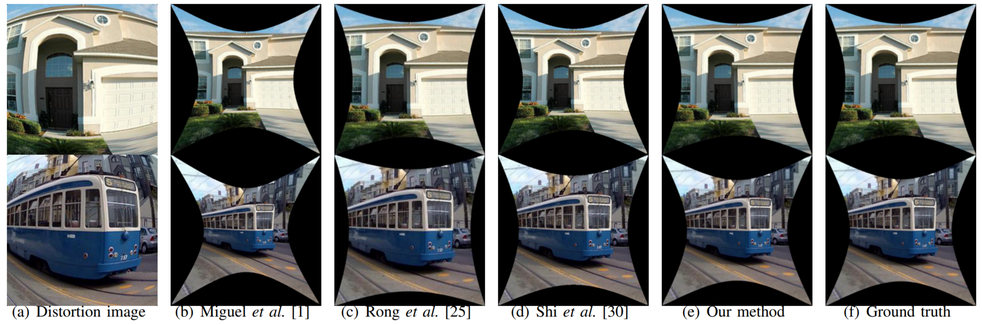


(a) Input (b) 0° (c) 90° (d) 180° (e) 270°

★ 0°, 90°, 180° and 270° denote the results of convolution using the same set of kernels that are rotated by 0, 90, 180 and 270 degrees, respectively. From the results, we can see that G-CNN can learn features of different orientations explicitly. These learned features are essential for radial distortion under the assumption of 'plumb-line'.

4. Compared with Previous Methods

Method	#Params (M)	Dataset [25]
Rong *et al.* [25]	70.66	6.71
Shi *et al.* [30]	11.21	4.98
Miguel *et al.* [1]	–	5.46
Pixel2pixel [20]	54.41	6.22
Unet [26]	54.41	6.27
Ours	**2.90**	**3.54**



(a) Distortion image (b) Miguel *et al.* [1] (c) Rong *et al.* [25] (d) Shi *et al.* [30] (e) Our method (f) Ground truth

★ Experiments on public dataset show that our method outperforms other state-of-the-arts while has fewer network parameters.