Image Deraining – white paper

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saiwa

simple artificial intelligence web application

Image Deraining is one kind of image restoration algorithms that removes raining artifacts from images. In applications like video surveillance and self-driving cars, one has to process images and videos containing undesirable raining artifacts that may affect performance of the processing algorithm. Therefore, pre-processing steps to remove these artifacts is crucial. At saiwa, we provide two image denoising options, both deep learning based: multi-stage progressive image restoration network (**MPRNet**) and density-aware image de-raining method using a multistream dense network (**DID-MDN**). Below you may find a brief review of both networks structure.

Multi-stage progressive image restoration network (**MPRNet**) is a three-stage CNN (convolutional neural network) for image restoration. MPRNet has been shown to provide high performance gains on several datasets for a range of image restoration problems including image deraining, deblurring, and denoising [1].

The three-stage structure of MPRNet shown in Figure 1 provides several key features:

1. An encoder-decoder for learning multi-scale contextual information in the first two stages

2. Preservation of fine spatial details of the input image by operating on the original image resolution in the last stage

3. A supervised attention module (SAM) that enables progressive learning

4. Cross-stage feature fusion (CSFF) to propagate multi-scale contextualized features from early to late stages.

For more technical details of the MPRNet architecture please refer to [1]. Figure 2 shows a few instances of image deraining using MPRNet method and saiwa Deraining service interface. We use an open-source implementation of MPRNet suggested by the original paper [2].
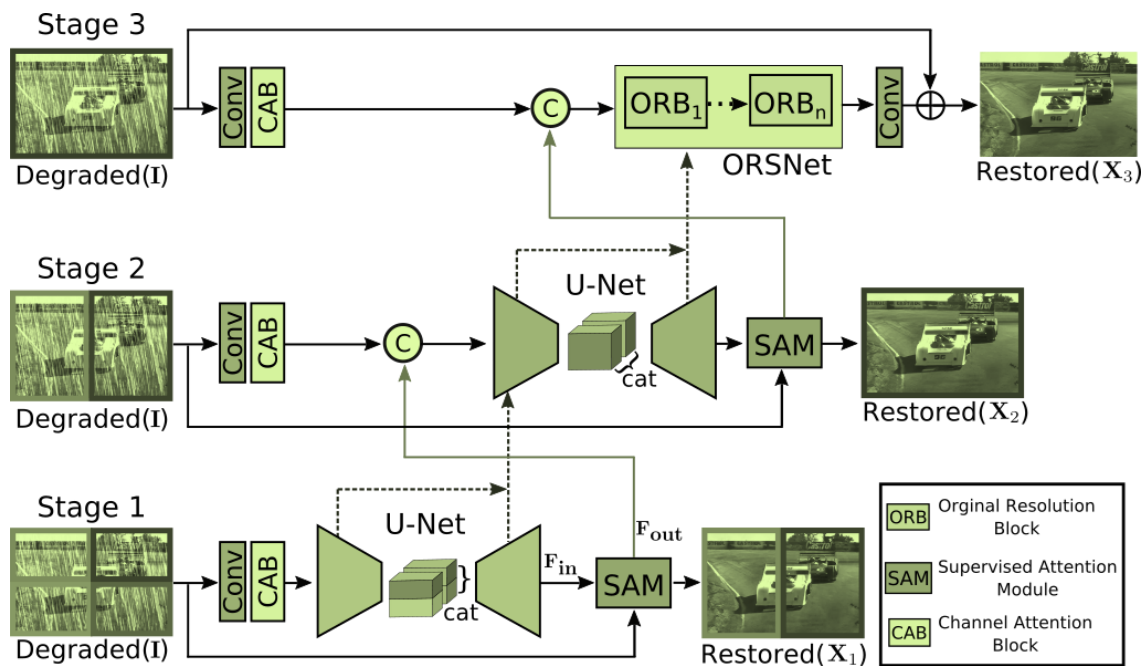

Figure 1. Multi-stage architecture for progressive image restoration of MPRNet (printed from [1])

Figure 2. Deraining results of MPRNet method using saiwa online demo.

Density-aware image de-raining method using a multistream dense network (**DID-MDN**) consists of two main stages: a residual-aware rain-density classification (i.e. heavy, medium or light) and a multi-stream densely-connected network rain streak removal. The DID-MDN two stage network architecture is represented in Figure 3. For more technical details, please refer to [3]. Figure 4 provides a few instances of image deraining using DID-MDN method and using saiwa demo interface. Note that saiwa employs an open-source implementation of DID-MDN algorithm suggested by the original paper [4].
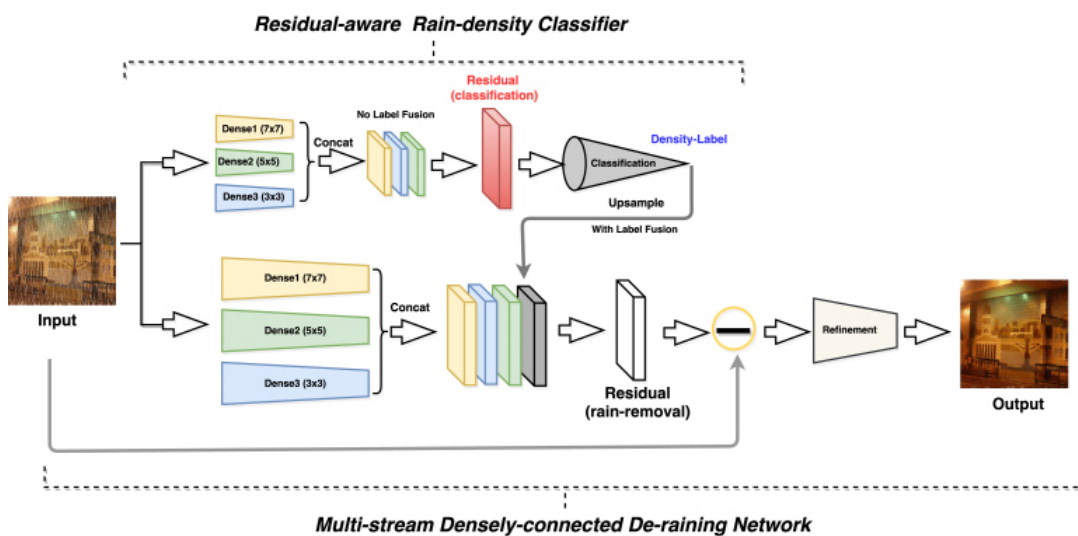

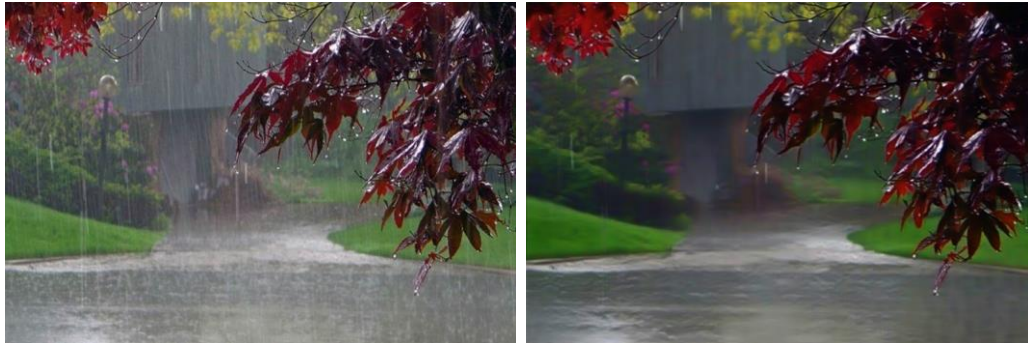Figure 3. An overview of DID-MDN architecture (printed from [3]).

Figure 4. Deraining results of DID-MDN method and using saiwa online demo.

References:

[1] Zamir, Syed Waqas, et al. "Multi-stage progressive image restoration." Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2021.

[2] https://github.com/swz30/MPRNet.

[3] Zhang, He, and Vishal M. Patel. "Density-aware single image de-raining using a multi-stream dense network." Proceedings of the IEEE conference on computer vision and pattern recognition. 2018.

[4] https://github.com/hezhangsprinter/DID-MDN.

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