|  |  |
| --- | --- |
| *IxLR* | input low-resolution image |
| *IyE* | estimated HR corresponding to *IxLR* |
| *IyHR* | true high-resolution image |
|  | reference image |
| ∂ | parameters of the image degradation function |
| *d ( )* | image degradation function |
| *g ( )* | super-resolution function |
| *δ* | parameters to the function *g* |
|   | downsampling operator |
|   | convolution operator |
|   | additive white Gaussian noise with a standard deviation of *σ* |
|   | blue kernel |
|  | regularization term |
|   | an ith pixel value of the image   |
| ,  | contrast and luminance of the image   |
| , .   | comparison functions of luminance, contrast, and structure |
|   | covariance between and  |
|   | high-level data representations in layer   |
|  | image classification network |
|  | maximum pixel value |
|  | total number of pixels in an image |
| , , | constants for stability |
| ,, | control parameters for SSIM function |
|   | scale factor |
|   | loss function |
| ,   | the adversarial loss function of least square-based cross-entropy generator and discriminator |
| ,  | the adversarial loss function of least square-based generator and discriminator |
| ,   | L1 and L2 pixel loss |
|   | L1 Charbonnier loss |
|  | Gram matrix representation |
| ,   | texture loss, total variation loss |