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Introduction and Motivation

- Can we overcome the limitation of a camera and, given the pixels, obtain a sharper image with increased resolution?

- Proposed to combine the stability of Example-based SISR and the adaptability of Self-example based SISR:

  Example-based SISR

  - Enhanced middle-resolution (MR) image
  - Input LR image
  - External examples

  Self-example based SISR

  - Final SR result
  - Desired HR image
  - Self-examples generated by MR image

Self-Example Random Forests

- Exploit non-local self-similar patterns using random forests.
- SRHRF generates a high quality middle-resolution (MR) image.
- The MR image is rescaled by a factor $s > 1/s$ to construct an image pyramid pair $(I_{l+1}, I_{l})^d$ for self-example learning.
  - Faithful similar structure, especially for large upscaling factor.
  - Sufficient number of training samples.

SR via Hierarchical Random Forests

- Learning LR-HR patch correspondences with a hierarchical random forests (SRHRF).
- Regression model fusion applied in random forests at each stage leading to 8 times more decision trees in a forest.
- Hierarchical structure further boosts performance.

Numerical Results

- Objective comparisons:
<table>
<thead>
<tr>
<th>Method</th>
<th>PSNR</th>
<th>SSIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SelfEx</td>
<td>35.86</td>
<td>0.70</td>
</tr>
<tr>
<td>SelfEx+</td>
<td>36.06</td>
<td>0.70</td>
</tr>
<tr>
<td>SRHRF</td>
<td>36.06</td>
<td>0.70</td>
</tr>
<tr>
<td>SRHRF+</td>
<td>37.49</td>
<td>0.70</td>
</tr>
<tr>
<td>SRHRF++</td>
<td>37.49</td>
<td>0.70</td>
</tr>
</tbody>
</table>

- Subjective comparisons:

  Ground-truth HR (PSNR)

  Ground-truth HR (SSIM)

  SelfEx [5] (0.61 dB)
  SRHRF [24.91 dB]
  SRHRF+ [27.02 dB]

Reference


The MR image can be rescaled by a factor larger than 1/s to generate the self-example image pyramid.