Superresolution Algorithms Test

- 4 Algorithms compared:
  - Almalence (PhotoAcute application)
  - Robust super-resolution
  - Normalized convolution
  - Iterated back-projection

- Test suite and ISO 12233 test pattern:
  http://lcavwww.epfl.ch/software/superresolution/
## Algorithms characteristics

<table>
<thead>
<tr>
<th></th>
<th>Almalence</th>
<th>Iterated back-projection</th>
<th>Robust super-resolution</th>
<th>Normalized convolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-Iterative</strong></td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Imaging-device pre-tuned</strong></td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Noise robustness</strong></td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+ (with additional pass)</td>
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<tr>
<td><strong>Speed</strong></td>
<td><strong>Very fast</strong> (100-400 Mul/Add per pixel)</td>
<td><strong>Slow</strong> (&gt;10000 Mul/Add per pixel)</td>
<td><strong>Slow</strong> (&gt;12000 Mul/Add per pixel)</td>
<td><strong>Very slow</strong> (singular value decomposition at every pixel)</td>
</tr>
</tbody>
</table>
References


- ISO 12233 Test Chart
- Sigma SD10
- Foveon sensor
- 4 frames
Robust Super-Resolution

Normalized Convolution

Iterated Back-Projection
- Street Scene
- Casio EX-F1
- Moving clouds
- 6 Images
Original crops

Almalence SR
Robust Super-Resolution

Normalized Convolution

Iterated Back-Projection
Single frame crop

2x interpolated (bicubic)
Almalence SR
Normalized Convolution
Summary

Among tested algorithms, Almalence Super Resolution is the only one that:

- Provides noticeable resolution increase with no annoying artifacts
- Can be tuned to specific imaging device for achieving the best results
- Is usable for real-life scenes (robust to noise)
- Can be used in mobile devices (fast, small memory footprint, 32-bit integer implementation, optimized for ARM)
- Thoroughly tested in real life (used in photo applications for both desktop computers and mobile phones, hundreds thousands users)

Implementations:
- High resolution zoom for mobile phones (BlessN900 application for Nokia N900 device)
- Superresolution for DSLR cameras (PhotoAcute Studio application for professional photographers)
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More information:
Whitepapers, examples, tests:
http://almalence.com/materials.html
Superresolution FAQ:
http://photoacute.com/tech/superresolution_faq.html
Example of Superresolution processing with PhotoAcute Studio:
http://photoacute.com/studio/examples/mac_hdd
Superresolution application – high quality zoom on mobile phones:
http://blessn900.com
Superresolution application – higher resolution for DSLR cameras:
http://photoacute.com/studio

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