Enhancement of Images Captured in Complex Lighting Environments for Visual Quality Improvement

Saibabu Arigela
Dr. Vijayan K. Asari

Objective
- To develop an adaptive technique which is capable of simultaneous enhancement of low lighting and overexposed regions in an image.

Technical Approach - Nonlinear image enhancement

Luminance enhancement
Design of a nonlinear transfer function tuned by the image statistics for automatic modification of the pixel intensities.

\[ I_{\text{enh}}(x, y) = q (I(x, y) - \mu) / \sigma \]

\( q \) is a parameter which is estimated adaptively for each pixel and its neighborhood.

Contrast enhancement
Application of a neighborhood dependent approach.
- Multi-scale Gaussian

Color restoration
Employing the color information in the original image.

Computational time
- Processor: Intel(R) 2 GHz
- RAM size: 12 GB
- Operating system: Windows 7 (64-bit)

<table>
<thead>
<tr>
<th>Enhancement Image size (pixels)</th>
<th>MATLAB</th>
<th>C++</th>
</tr>
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<tbody>
<tr>
<td>4008x2672</td>
<td>560 sec</td>
<td>0.429 sec</td>
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