Chapter 5: Quality of Images
Schematic overview of the interaction process by Janssen and Blommaert [342]
Images exhibiting different fidelity degrees

a) Original image  
b) Quantized image  
c) Compressed image
Example of image usefulness

a) A faithful image

b) A contrast enhanced image showing more details in the background
Images with decreasing degrees of naturalness with respect to a mental reference of skin color
Examples of image aesthetic. The images are shown according to the aesthetic votes given by the community of the DPChallenge (http://www.dpchallenge.com) Web site. The subject refers to the “Fan” contest.
How image content influences quality

a) The image could be considered of poor quality because the tree was not fully captured.

b) For a person hating spiders, the image may be not considered of good quality.

c) A blurred image can be considered of good quality if the content is important for the photographer.
Correspondences between dimension clusters and image quality models

<table>
<thead>
<tr>
<th>Model</th>
<th>Fun Model</th>
<th>QAC Model</th>
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<tbody>
<tr>
<td></td>
<td>Dimensions</td>
<td></td>
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<tr>
<td></td>
<td>Fidelity</td>
<td>Usefulness</td>
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<tr>
<td>Accuracy</td>
<td>X subjective</td>
<td>X subjective</td>
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<tr>
<td>Completeness</td>
<td>X subjective</td>
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<td>Redundancy</td>
<td>X subjective</td>
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<td>Readability</td>
<td>X subjective</td>
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<td>Accessibility</td>
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<td>Consistency</td>
<td>X subjective</td>
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<td>Trustworthiness</td>
<td>X subjective</td>
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</tr>
<tr>
<td>Usefulness</td>
<td>X fitness for use</td>
<td>X subjective</td>
</tr>
</tbody>
</table>
Examples of incompleteness due to different motivations

Intentional (Artistic)  Accidental
Example of minimality
Example of tradeoff between fidelity and usefulness
Example of how the perceptual quality is influenced by the visibility of the distortion. Gaussian noise is applied to the top (left-side) and bottom (right-side) regions of the image. The image on the right is typically perceived as having higher quality than the image on the left.
Objective image quality assessment approaches
Examples of image defects detected by no-reference metrics

(a) Original          (b) Colorfulness      (c) Contrast

(d) Blockiness       (e) Blurriness       (f) Grainess
Significant correlations between defects and image quality dimensions

<table>
<thead>
<tr>
<th>Defect → Quality Dimension</th>
<th>Colorfulness</th>
<th>Contrast</th>
<th>Blocking</th>
<th>Blurriness</th>
<th>Grainess</th>
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</thead>
<tbody>
<tr>
<td>Accuracy</td>
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<td></td>
<td>High negative correlation</td>
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<tr>
<td>Fidelity</td>
<td></td>
<td>High negative correlation</td>
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<tr>
<td>Naturalness</td>
<td>High non monotonic correlation</td>
<td>High non monotonic correlation</td>
<td>High negative correlation</td>
<td></td>
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<td>Usefulness</td>
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</tbody>
</table>
Taxonomy of the different image quality assessment techniques

Visual Information quality assessment

Direct

Subjective

Single stimulus

Stimulus comparison

Indirect

Precision

Functional constraints

Recall

Objective

Full-reference

Images comparison

No-reference

Preferential image attributes

Image artifacts

Reduced-reference

Image’s features comparison
Relationship between the image production workflow chain and the image quality assessment approaches

DATA ACQUISITION

Source ➔ Imaging ➔ Digital Image ➔ Validation ➔ Validated Image ➔ Processing ➔ Processed Image ➔ Transmission Media

DATA PROCESSING & STORAGE

Reduced Reference ➔ No Reference Subjective ➔ Full Reference Reduced Reference ➔ No Reference

Narrow Broad Domain Domain

Human System Task Constraints

To storage

Increase Usefulness Compression

To storage

Psychophysical Tests Task Performances

Rendering System Task Performances

FRUITION
Image workflow chain of a high-quality digital images archive