Evaluation of Face Image Quality Metrics in Person Identification Problem

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Quality assessment problem

Reference image

Distorted image (JPEG2000)
Quality assessment algorithms

ITU-R BT.500-11 – methodology for subjective quality assessment tests
Facial identification system

Facial image → Detection

[Quality assessment]

Discarding → Recognition
Facial image quality features

Texture
- Contrast
- Compression ratio
- Illuminance

Geometry
- Symmetry
- Pose
- Rotation
- Eye visibility

Facial image quality standards:
ISO/IES 19794-5, ICAO 9303

In practice:
Facial image quality assessment

- Based on learning to rank
- Feature fusion
  - Resolution
  - Sharpness
  - Symmetry
  - Symmetry of landmarks points
  - Other no-reference image quality metrics

Sharpness

\[ L(I) = \left| \frac{\partial^2 I}{\partial x^2} \right| + \left| \frac{\partial^2 I}{\partial y^2} \right| \]
**Symmetry**

\[ d(i) = \sum_{i} \min(H_i^L, H_i^R) \]

\[ S = \text{Symmetry}(I) = \frac{1}{N} \sum_{i=1}^{N} d(i) \]

Symmetry of landmarks points

\[ S = \frac{|d_{35} - d_{31}| + |d_{42} - d_{39}| + |d_{45} - d_{36}| + |d_{54} + d_{48}|}{w} \]

\( w \) – face bounding box width
NRQ LBP

Multiscale universal rotation invariant LBP with: \( r = 1, 2, 3; P = 8, 16, 24 \)

LBP histogram for distorted image (JPEG)

**Reference**

**JPEG**

LBP histogram

LBP histogram
LBP histogram for distorted image (JPEG2000)

Reference

JPEG2000

LBP histogram for Reference image

LBP histogram for JPEG2000 image
KFCD dataset

20 lx  130 lx  180 lx

10 test video sequences with different lighting conditions
Spearman rank correlation coefficient for FQA metrics

<table>
<thead>
<tr>
<th>Illuminance, lx</th>
<th>K</th>
<th>Resolution</th>
<th>Sharpness</th>
<th>S</th>
<th>NRQ LBP</th>
<th>BRISQUE</th>
<th>Symmetry</th>
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## TOP-3 ACCURACY OF FACIAL IMAGE QUALITY METRICS (KFCD DATASET)

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60PFCD dataset

60 persons
10 image for each person
60PFCD dataset
# Accuracy of FQA metrics on 60PFCD dataset

## TOP-1 ACCURACY OF FACIAL IMAGE QUALITY METRICS

<table>
<thead>
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<th>K</th>
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<th>S</th>
<th>NRQ LBP</th>
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## TOP-3 ACCURACY OF FACIAL IMAGE QUALITY METRICS

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Accuracy of FQA metrics on 60PFCD dataset

![Accuracy vs Number of classes graph](image)

- **RandomAccuracy**
- **TopAccuracy**
Conclusions

- Face image quality assessment metric based on learning to rank has higher top3 accuracy values on 60PFCD and FFCD datasets.

- The accuracy of the no-reference NRQ LBP metric depends on the luminance level. It performs well when luminance is more than 100 lx.
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