CAN NO-REFERENCE IMAGE QUALITY METRICS ASSESS VISIBLE WAVELENGTH IRIS SAMPLE QUALITY?

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Goal

The overall performance of iris recognition systems is affected by the quality of acquired iris sample images. However, iris sample quality of unconstrained imaging conditions is a more challenging issue compared to the traditional near infrared iris biometrics. In this paper, we investigate whether general purpose no-reference image quality metrics can assess visible wavelength iris sample quality. Towards this goal, we propose to 1) conduct the iris sample quality assessment by using no-reference IQMs, and 2) evaluate the performance of no-reference IQMs based on the performance of iris recognition system.

1. Experimental Setup

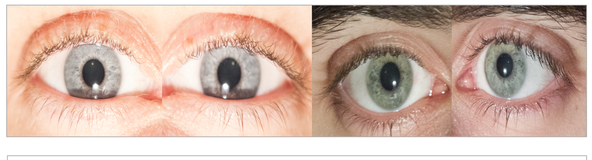

Fig.1 Iris samples from the database. The first two samples are from reflex camera and the last two are from smartphone.

- The iris recognition system used in this paper is OSIRIS (Open Source for IRIS) version 4.1 [1].
- The visible wavelength (VW) iris database used in this paper is part of the GC2 multimodality biometric database. The iris database contains 50 subjects, both left and right eyes are acquired by two different cameras: a Canon D700 camera with Canon EF 100mm f/2.8L Macro Lens (18 Megapixels) and a Google Nexus 5 smartphone embedded camera (8 Megapixels). 15 samples are taken for each camera per eye. In total, 1680 iris samples are selected from the database in order to avoid segmentation errors.
- We select commonly used 13 no-reference IQMs: BIQI, BLIINDS2, BRISQUE, ILNIQU2, JNBM, SSEQ, CONTRAST, DCTSP, PWN, AQI and AQIP, SSH, and SH.
- The methods used for the evaluation the performance of iris recognition system are: 1) fitted histogram of the comparison score; 2) Rank-ordered Detection Error Trade-off (DET) characteristics curve; and 3) Equal Error Rate (EER) [2].

2. Experimental Results

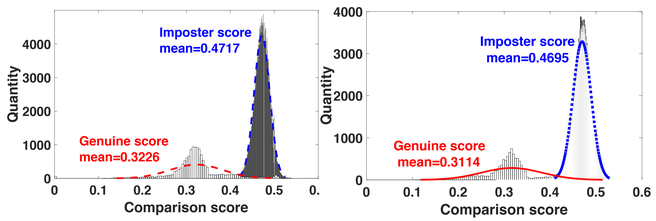

Fig.2 Fitted histogram of comparison score for reflex camera (left) and smartphone (right).

- The x axis represents the score and the y axis represents the quantity of the comparison.
- The histograms of the comparison score are obtained from the genuine and imposter comparisons for all image samples.
- The line plots correspond to the fitted normal distributions and the mean of the score.

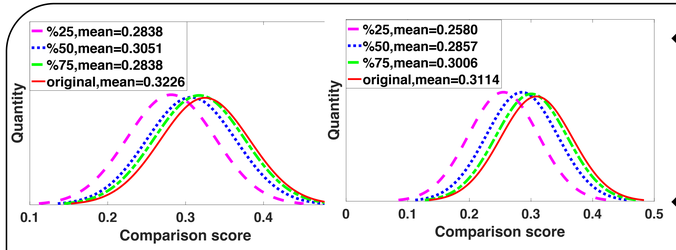

Fig.3 Change of the mean score when omitting low quality samples for AQIP (left) and BIQI (right) IQM.

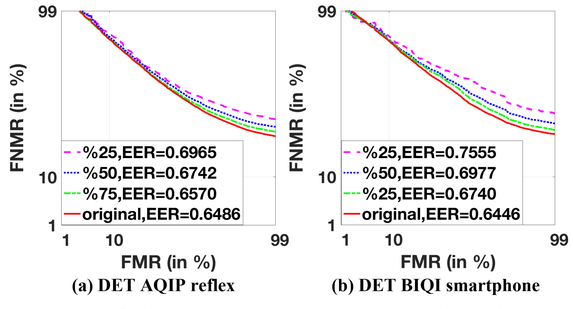

Fig.4 DET curves for both cameras with EER when omitting low quality samples.

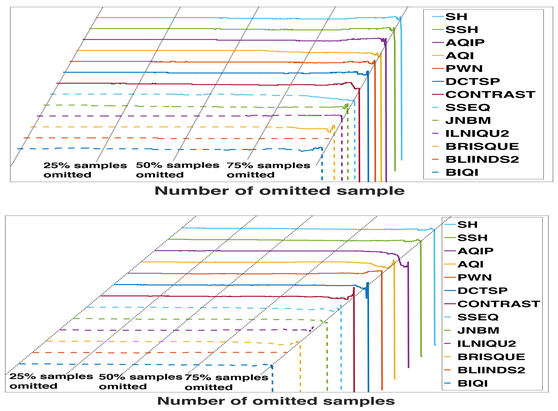

Fig.5 Change of EER when omitting low quality samples one by one.

- If a certain percentage of low quality samples are excluded from the dataset, the comparison score would decrease (in our case) and the EER (when False Match Rate (FMR) and False None Match Rate (FNMR) are equal) would decrease.
- We omit the percentile low quality samples and keep 75%, 50%, and 25% of high quality samples for each of the IQMs.
- If a DET curve is closer to the left-bottom point, it means that this set of data lead to a higher iris recognition performance.
- Meanwhile, the lower EER values the better system performance.
- We calculate EER values for both cameras by omitting lowest quality iris sample one by one until only one highest quality iris sample remains.
- The x axis represents the number of omitted low quality samples. The y axis represents the EER value. We slightly shift the plot to the right-top side for each IQM in order to show the results more clear.
- When we omit low quality iris samples, the EER value will decrease if the IQMs can predict iris sample quality.

3. Conclusions and future works

By looking at EER values, only BIQI and SSEQ increase the performance when keeping 75% of the high quality samples for reflex camera; only CONTRAST and PWN increase the performance when keeping 50% and 75% of the high quality samples for smartphone. Since all these IQMs are designed for natural images but VW iris images are different, so it can be the reason for the low performance. The contribution of this work can be used for the development of quality assessment methods for contactless biometric modalities.

[1] G. Sutra, B. Dorizzi, S. Garcia-Salicetti, and N. Othman, "A biometric reference system for iris, osiris version 4.1," Telecom Sud Paris, France, Tech. Rep, 2012.
[2] P. Grother and E. Tabassi. Performance of biometric quality measures. IEEE transactions on pattern analysis and machine intelligence, 29(4), 2007.

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