A Bayesian Model for Predicting Face Recognition Performance Using Image Quality

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Verification Experiment

Verification Experiment 1

Verification Experiment 2

Proposed Face Recognition System

Proposed Model

For each verification experiment, we combine the image quality \( q \) and recognition performance \( r \) to represent a single point in the Quality-Performance (QR) space.

This QR space is modeled using a Probability Density Function \( P(q,r) \)

\[
P(q,r) = \sum_{k=1}^{K} p_k N((q,r); \mu_k, \Sigma_k)
\]

In this paper, we model the Probability Density Function \( P(q,r) \) using a Mixture of Gaussians.

Dataset:
- MultiPIE (neutral expression, 5 camera, 5 flash)
- Training: 129 subject common in all four sessions
- Testing: remaining 208 subjects

Model:
- number of mixture components (K) = 5
- diagonal covariance matrix parameterization
- model parameters learned using EM

Image Quality Assessor (IQA):
- quality assessment tool included in a commercial face recognition system SDK

For clusters 3, 5 we observe large difference between true verification performance before facial comparison has taken place. This allows to capture “best” possible facial image samples for enrollment

(b) Fusion of results from multiple face recognition algorithms

(c) Dynamically tune recognition system parameters (for example: decision threshold) in order to maintain acceptable level of performance

Conclusion:

This study has shown that the proposed data driven model can predict face recognition performance based solely on the quality of probe and gallery image.