Fusing Gabor and LBP Feature Sets for Kernel-based Face Recognition

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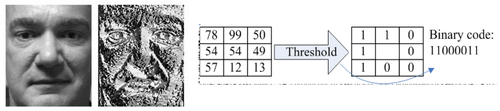
Overview

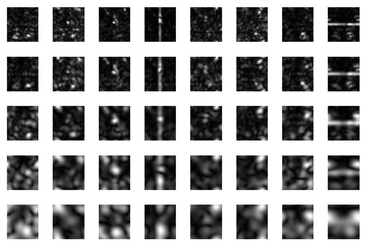
Main claim : reliable face recognition requires decisions based on several kinds of visual information and hence benefits from the fusion of several kinds of visual features.

- We combine two popular feature sets – Gabor wavelets and Local Binary Patterns (LBP) – with robust illumination normalization and a kernelized discriminative feature extraction method (KDCV).
- This gives state of the art performance on several challenging face databases.
- The two feature sets are complementary – combining them reduces error rates by 30% relative to either feature set alone.
- We tested both feature-level and decision-level fusion – both work well but decision-level fusion was best.

Feature Sets

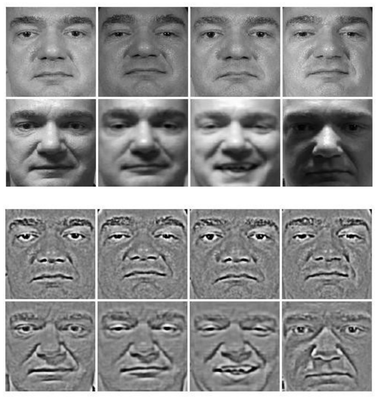


LBP – morphological feature that captures fine details of facial texture & appearance (d = 15104)



Gabor – linear filter bank that encodes facial shape and appearance over a range of coarser scales (d=10240)

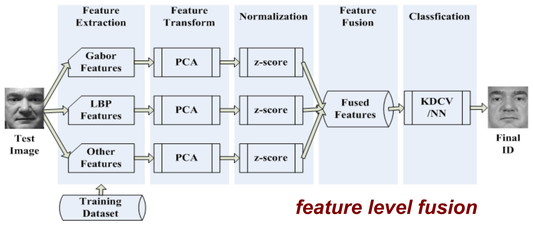
Illumination Normalization



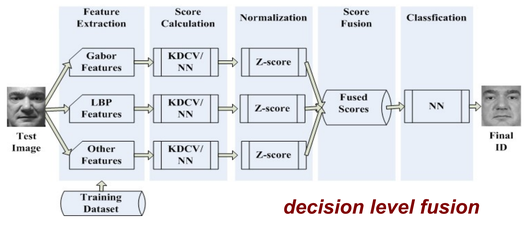
Stages – gamma compression, difference of Gaussian filtering, robust contrast normalization, highlight suppression

– see our oral this afternoon for details

Fusion Architectures and Classifier



feature level fusion



decision level fusion

- Z-score is a variance based normalization that corrects for the relative scaling of the different feature vectors.
- Discriminative Common Vectors (DCV) finds the distance from the sample to the affine subspace of feature space spanned by (the training examples of) each class (i.e., person). The sample is assigned to the Nearest Neighbour class.
- The kernelized version KDCV uses a (Gaussian) kernel based feature space for nonlinear dimensionality reduction.

Results

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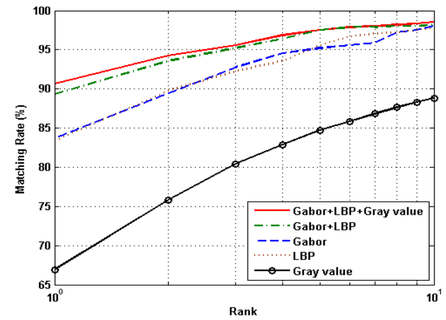
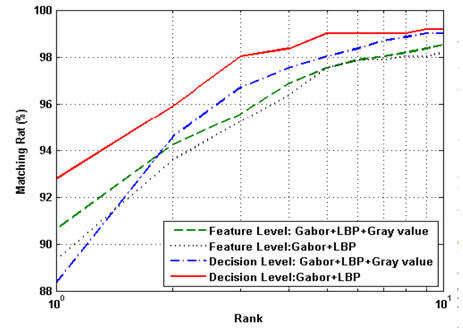
Influence of different feature sets



Feature-level fusion vs. decision-level fusion



1. (Not shown) preprocessing significantly improves performance of both LBP and Gabor features.
2. LBP and Gabor have similar performance. Fusing them significantly improves performance.
3. For robust features, decision-level fusion is better than feature-level fusion.

FERET

Method	fb	fc	dup1	dup2
Fisherfaces	94	73	55	31
Ahonen – LBP	96	82	59	52
Phillips – FERET	97	79	66	64
Zhang – LGBPHS	**98**	97	74	71
Gabor + LBP	**98**	**98**	**90**	**85**

fb – expression
fc – gender, ethnicity, illumination
dup1 / dup1 – age/time

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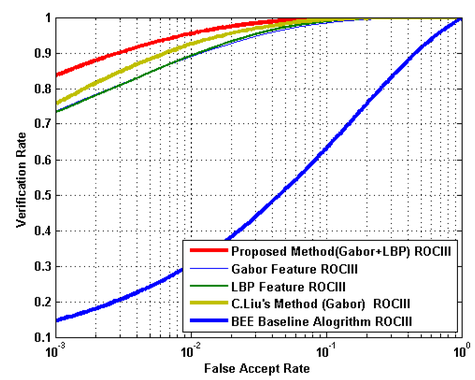

6,388 image training set from C.Liu, PAMI 28(5), 2006

References

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