



Supervised-learning Based Face Hallucination for Enhancing Face Recognition

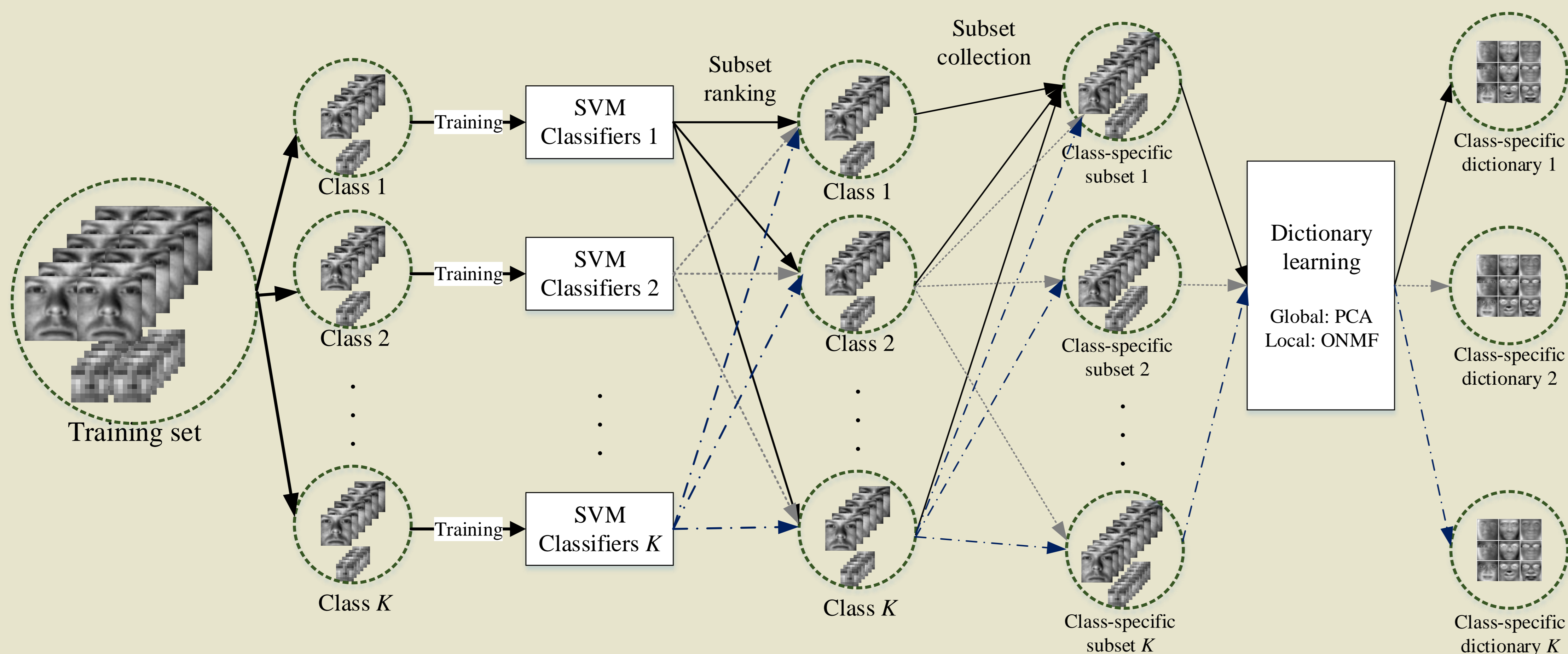
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I. Introduction

We present a two-step supervised face hallucination framework based on **class-specific dictionary learning**. Since the performance of learning-based face hallucination relies on its training set, an inappropriate training set (e.g., an input face image is very different from the training set) can reduce the visual quality of reconstructed high-resolution (HR) face significantly.

II. Class-Specific Dictionary Learning



Let the face images be $I_T = (\underbrace{i_1, i_2, \dots, i_L}_{\text{LR face}}, \underbrace{i_{L+1}, \dots, i_{H+L}}_{\text{HR face}})$

Maximize the similarity value R_c in I_c for **class-specific dictionary learning** by finding $R_c^* = \max_c \sum_n r_{n,c}, \forall n$. Then define the ranking scores as follows

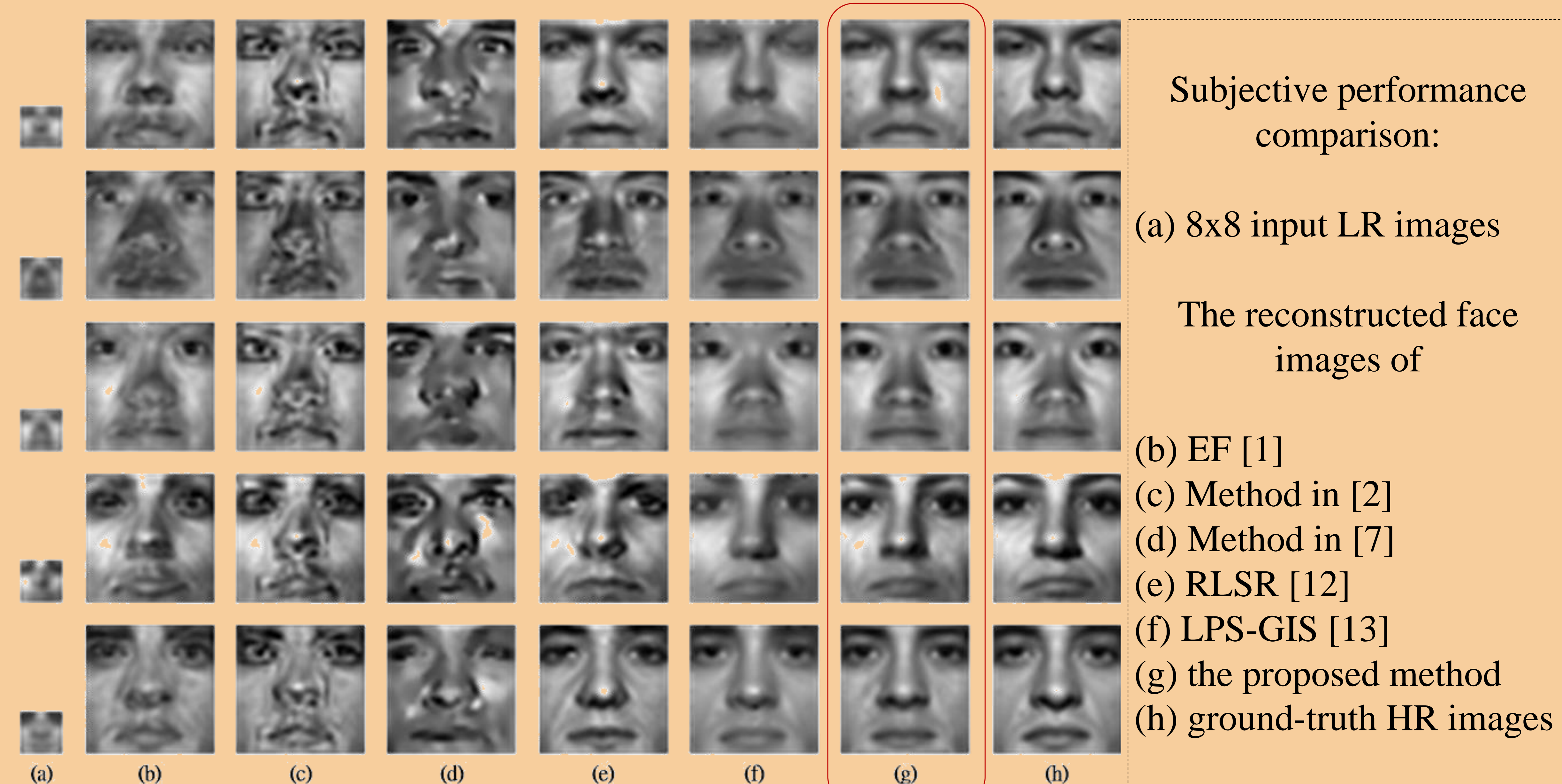
$$I'_c = \{I_{T_c}^1, I_{T_c}^2, \dots, I_{T_c}^{m_c}\}; \text{ s. t. } r_{1,c} \geq r_{2,c} \geq \dots \geq r_{m_c,c}.$$

The final class-specific dictionary is: class-specific dictionary set:

$$P_T = \{P^1, P^2, \dots, P^k\}$$

III. Results and Conclusion

Settings: we select 910 face images with the frontal view for the 38 identities from Yale B in which aligned by RASL method [5]. Training set and test set contain 607 and 303 face images respectively. The size of HR and LR face image are 32x32 and 8x8.



Method\ Recognition rate	SRC	MFL	CR
EF [1]	60%	61%	62%
PCA-based [2]	50%	49%	59%
Two-Step [7]	3%	4%	5%
RLSR [12]	62%	63%	66%
LPS-GIS [13]	63%	66%	69%
Proposed	73%	74%	78%
Ground-truth	77%	78%	80%

Comparison of face recognition rates using the HR faces reconstructed by the proposed method and the others using three SRC-based face recognition engines: SRC [16], MFL [19], CR [20]. The average recognition rates with our method are significantly higher than that with the others.

In this paper, we proposed a supervised learning-based face hallucination scheme which learns class-specific dictionaries based on label information to well fit the characteristics of input LR faces.