Partial Face Recognition: An Alignment Free Approach

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Introduction

❖ Can we recognize a person from his partial face image? State-of-the-art FR systems have difficulties in recognizing partial face images that cannot be aligned

❖ Partial face recognition (PFR) is important in video surveillance and images captured by mobile devices

❖ A new method is proposed, which is able to recognize an arbitrary patch of a face without alignment
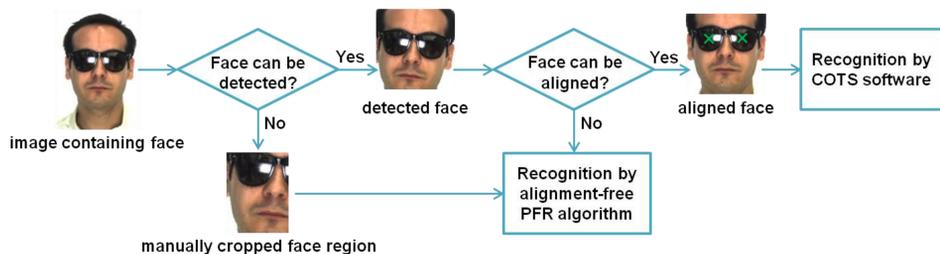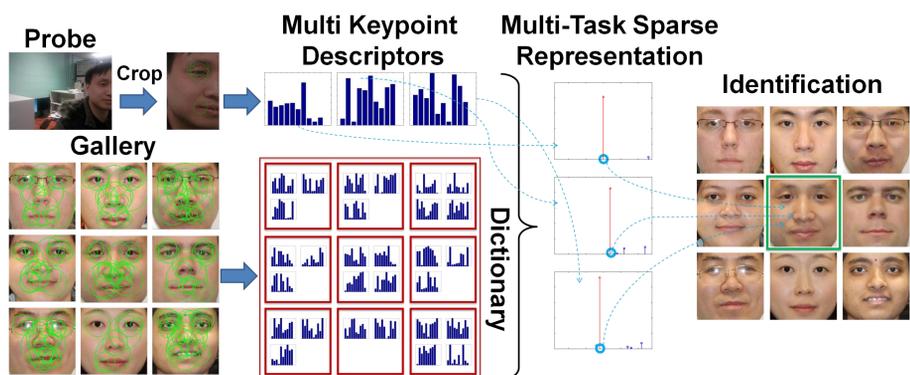

Proposed Method

❖ Multi keypoint descriptors (MKD) based sparse representation classification (SRC)

▪ Each subject c is described by a pool of keypoints and descriptors (SIFT): $\mathbf{D}_c = (\mathbf{d}_{c_1}, \mathbf{d}_{c_2}, \cdots, \mathbf{d}_{c_{k_c}})$

▪ A gallery dictionary is built: $\mathbf{D} = (\mathbf{D}_1, \mathbf{D}_2, \cdots, \mathbf{D}_C)$

▪ For a test sample $\mathbf{Y} = (\mathbf{y}_1, \mathbf{y}_2, \cdots, \mathbf{y}_k)$, solve
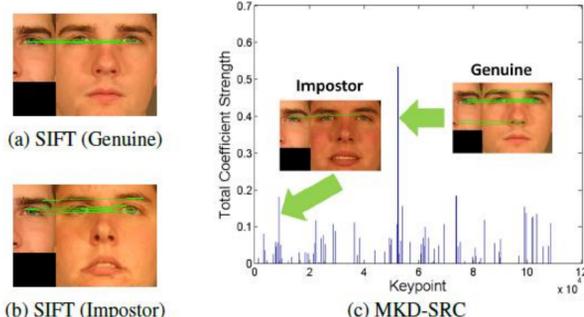
$$\hat{\mathbf{X}} = arg \min_{\mathbf{X}} \sum_{i=1}^{k} \|\mathbf{x}_i\|_1, \ s.t. \ \mathbf{Y} = \mathbf{DX}$$

▪ Determine the identity of the test sample by

$$\min_c r_c(\mathbf{Y}) = \frac{1}{k} \sum_{i=1}^{k} \|\mathbf{y}_i - \mathbf{D}_c \delta_c(\hat{\mathbf{x}}_i)\|_2^2$$

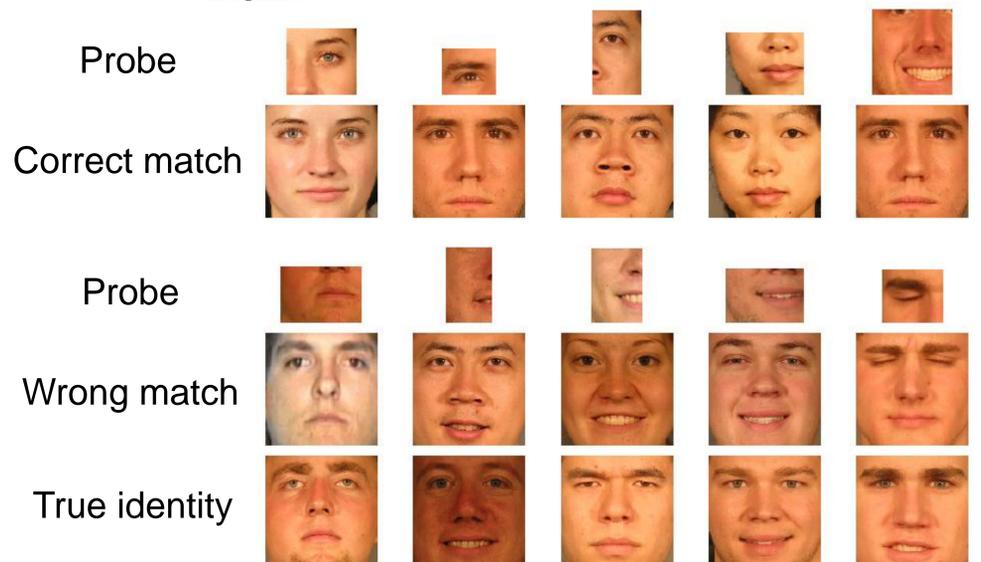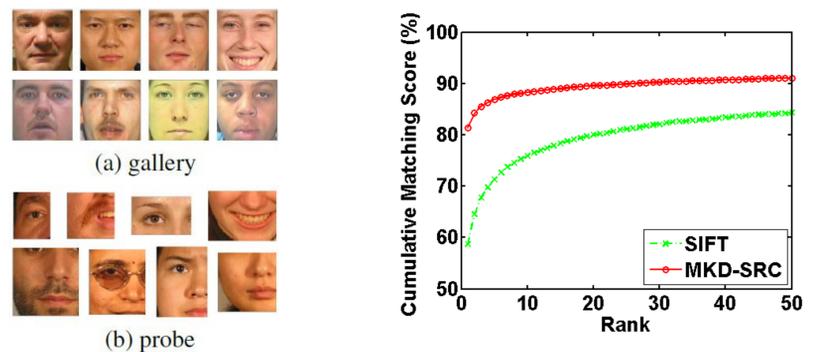MKD-SRC is more discriminative than SIFT matching for partial face recognition

(a) SIFT (Genuine)
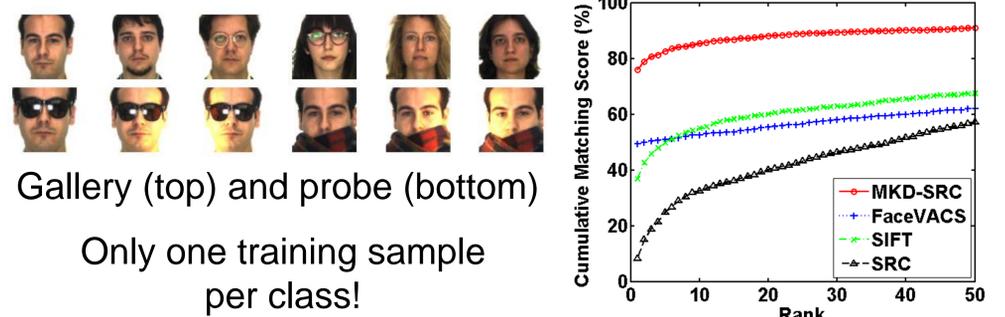
(b) SIFT (Impostor)

(c) MKD-SRC

Experimental Results

Table 1. Databases used in our experiments

Database	FRGCv2.0	AR	LFW
Scenario	partial patch	occlusion	pose & occlusion
#Gallery	11,398	1,331	20,489
#Probe	14,630	1,530	2,744
#Subjects	10,466	1,331	15,749

❖ FRGC v2.0 database

(a) gallery

(b) probe

Probe

Correct match

Probe

Wrong match

True identity

❖ AR database

Gallery (top) and probe (bottom)

Only one training sample per class!

❖ LFW database

Correctly Identified

Mis-classified