Face Recognition for Mobile Phones

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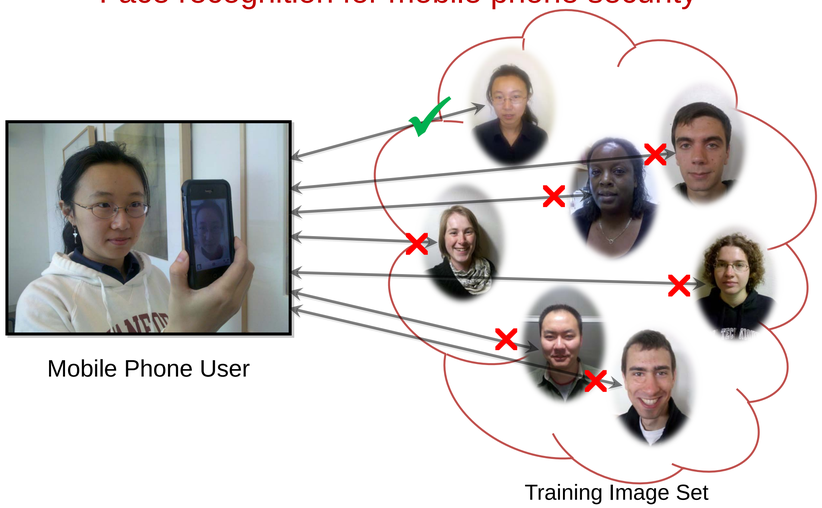
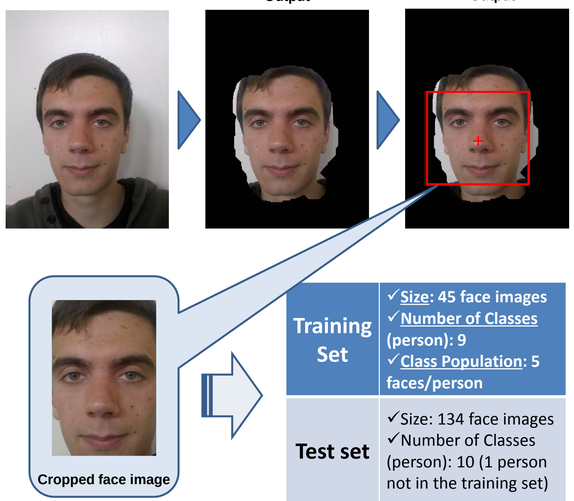
Face Recognition Application

Face recognition for mobile phone security



Face Detection

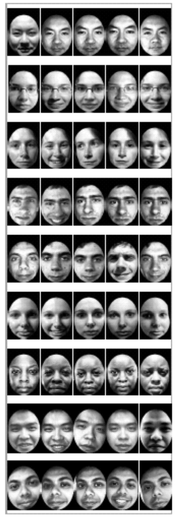


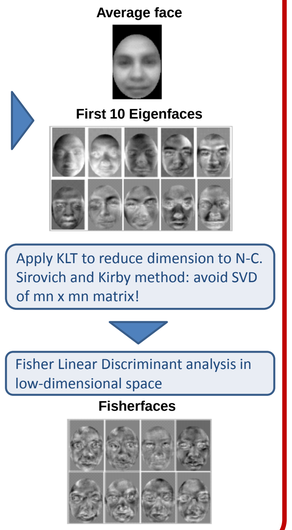
Training Set	✓Size: 45 face images ✓Number of Classes (person): 9 ✓Class Population: 5 faces/person
Test set	✓Size: 134 face images ✓Number of Classes (person): 10 (1 person not in the training set)

Face Recognition

Pre-processing	
Color to gray and Histogram equalization	✓Reduce variation in lighting
Elliptical mask	✓Eliminate noise from hair / background, retain only face part

Number of images: N
Number of classes: C
Image size: m x n



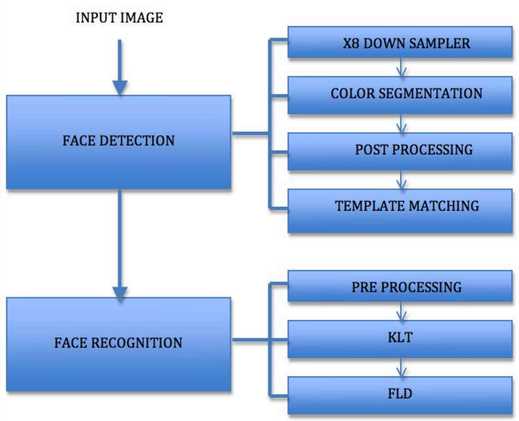


Apply KLT to reduce dimension to N-C. Sirovich and Kirby method: avoid SVD of mn x mn matrix!

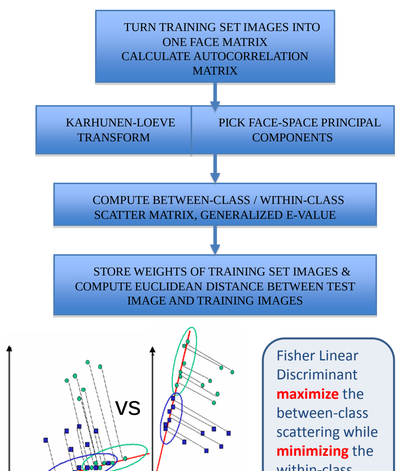
Fisher Linear Discriminant analysis in low-dimensional space

Algorithm

Block Diagram



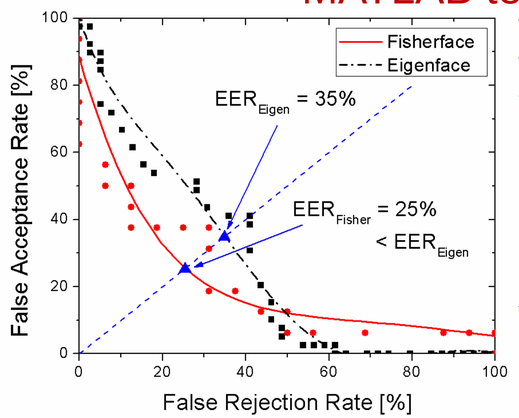
Fisherface algorithm



Fisher Linear Discriminant **maximize** the between-class scattering while **minimizing** the within-class scattering.

Experimental Results

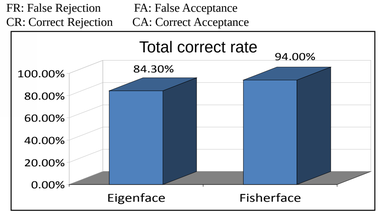
MATLAB test



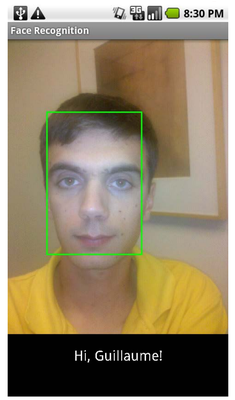
EER = Equal Error Rate.
where False Acceptance Rate = False Rejection Rate
The smaller EER, the better a recognition system works!

Eigenface Max Correct Rate (84.3%)					Fisherface Max Correct Rate (94.0%)				
FR	FA	CR	CA	Total correct	FR	FA	CR	CA	Total correct
28	0	39	67	106	23	0	16	95	111
21	1	38	74	112	11	1	15	107	122
17	8	31	78	109	5	3	13	113	126
6	22	17	89	106	3	6	10	115	125
2	35	4	93	97	2	7	9	116	125
1	38	1	94	95	0	10	6	118	124
0	38	1	95	96	0	12	4	118	122
0	38	1	95	96	0	14	2	118	120
0	39	0	95	95	0	15	1	118	119
					0	15	1	118	119
					0	16	0	118	118

FR: False Rejection FA: False Acceptance
CR: Correct Rejection CA: Correct Acceptance



Droid Implementation



Device	Motorola DROID, ARM A8 550MHz
Size of the Training Set	45 face images (98x147)
Computation time	1.5 s