FACE RECOGNITION FROM SINGLE SAMPLE

Omelina L. - Slovak University of Technology
lubos.omelina@stuba.sk

S T U
F E I
SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA
Faculty of Electrical Engineering and Information Technology

Abstract

An accurate face recognition from a single sample is a challenging task and number of issues, like changing expression, remain to be addressed. Facial expression, changing face geometry, has a strong influence on the face recognition accuracy. This negative influence is even higher when only a single training sample is available. We extend the idea of a rule based approach to generate a synthetic facial expression for the recognition purpose.

Preprocessing

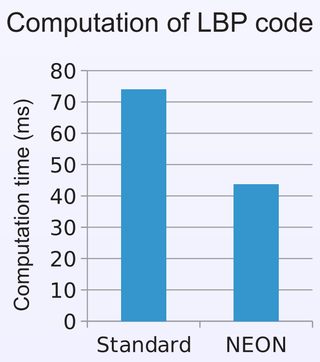
The FERET database is used in our experiments. The images are preprocessed by *(i)* geometric normalization (aligning according to eye coordinates) *(ii)* histogram equalization *(iii)* resizing to 120x180 pixels.

Work in progress

We are currently working on an expression-invariant features extraction algorithm which uses knowledge from optimized rules. We are analyzing opportunities to reduce intra-class variabilities not only for different expressions but also for changes in poses and illumination as well. We also try to find ideal parameters of evolutionary algorithms and other approaches to divide a face mask into triangles.

Embedded devices are becoming more and more suitable for the real-time implementation of biometric methods even though they have limited computational resources and memory space.
We are also focused on usability of biometric methods on embedded devices:

- biometrics on Android platform
- NEON optimizations on ARM processors
- OpenCV optimizations for Android and NEON extension



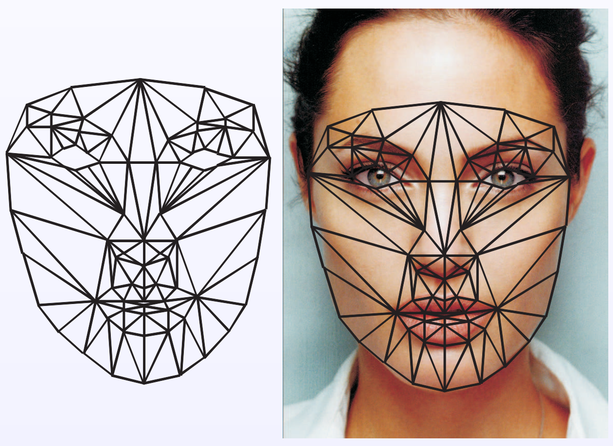
References

[1] M., Oravec, J., Pavlovicova, Jan., Mazanec, L., Omelina, M., Feder, J., Ban, Efficiency of recognition methods for single sample per person based face recognition, in *Face Recognition*, INTECH, 2011

[2] L., Omelina, M., Oravec, Universal biometric evaluation system: Framework for testing evaluation and comparison of biometric methods, in IEEE International Conference on Systems, Signals and Image Processing 2011

Facial features detection

The first step is to create a face mask matching facial features. We make use of active shape models (ASM) to accomplish this task. After the facial markers are automatically located, a face mask is created by triangulation. Because the face mask will be used to model facial expressions, we take the distribution and orientation of muscles and possible muscle contractions into consideration.



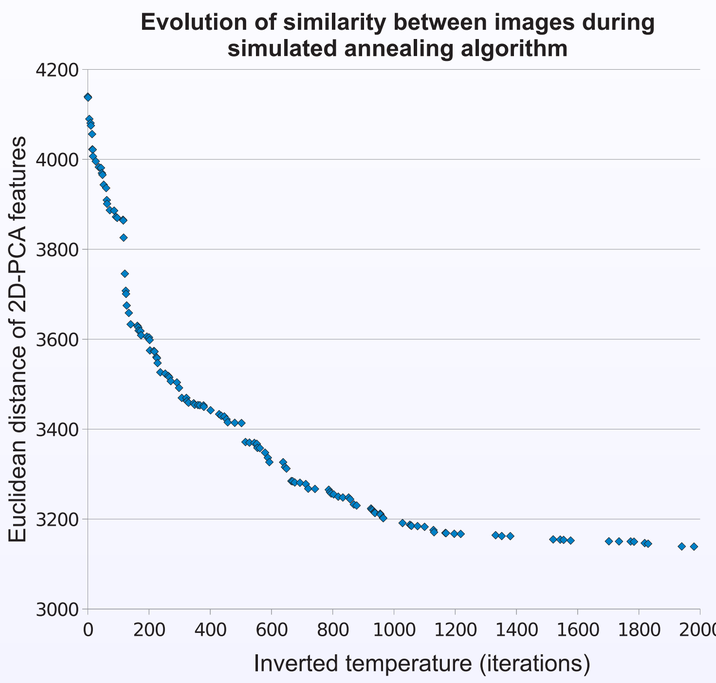
Expression modeling

After the face mask is created, a rule based approach is used to move points in the mask to simulate movements during an expression. We adopt an evolutionary algorithm (simulated annealing) to find best rules generating expression and increasing recognition rates. The temperature decreases linearly to converge faster than the usual logarithmic approach.

Results

Expression invariant recognition

1652 selected images of 695 subjects. For each neutral facial expression the smile or semi-smile expression was available. All neutral images and images with an expression were associated together to form 862 image pairs.



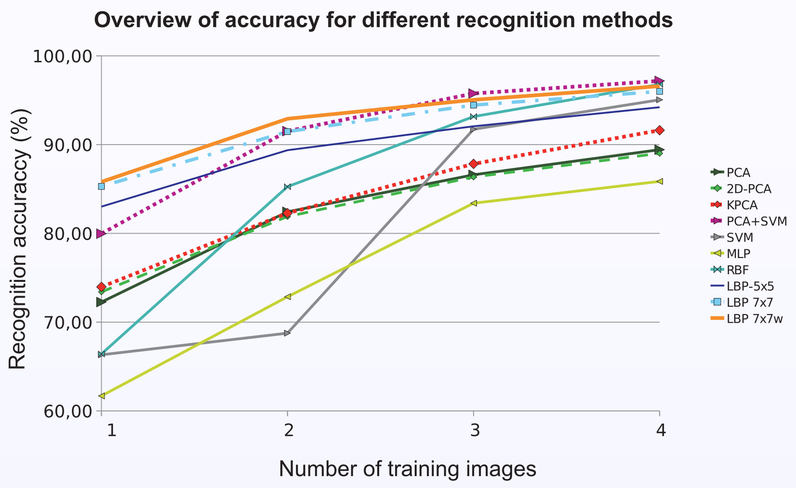
Tested feature extraction methods:

- $LBP_{7\times7}$ + chi-square distance
- $2D-PCA$ + Euclidean distance

Approach	$2D-PCA$ (%)	$LBP_{7\times7}$ (%)
Neutral expression	90,79	97,34
Generated expression	98,04	99,97
Fitting to reference face	95,15	99,03
Fitting to test face	92,62	97,82

Recognition accuracy of different methods

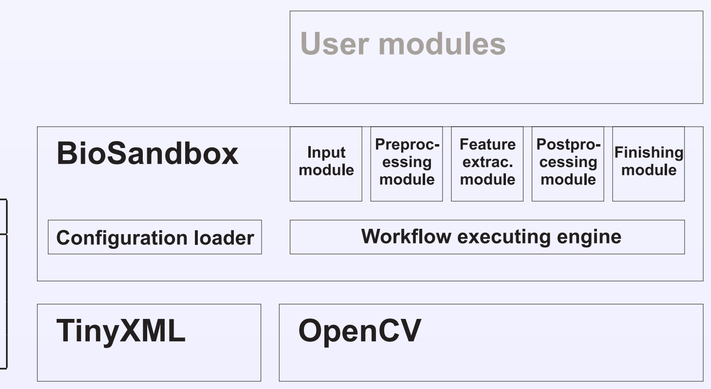
665 selected images of 82 subjects (all subjects from FERET that have more than 4 frontal images). The efficiency comparison of several algorithms with 1 (single-sample problem), 2, 3 and 4 images/subject [1].



BioSandbox

`http://biosandbox.fei.stuba.sk/`

Framework for testing evaluation and comparison of biometric methods [2]



Acknowledgements

Research described in this poster was done within the grants No. 1/0214/10 and 1/0961/11 of the Slovak Grant Agency VEGA. Portions of the research in this paper use the FERET database of facial images collected under the FERET program, sponsored by the DOD Counterdrug Technology Development Program Office.