

Kernel ELM based Age Estimator

September 21, 2015

1 Team details

- Team name : Boğaziçi
- Team leader name : Albert Ali Salah
- Team leader address, phone number and email : Boğaziçi University, Department of Computer Engineering, +90 212 359 7774, salah@boun.edu.tr
- Rest of the team members : Furkan Gürpınar, Heysem Kaya, Hamdi Dibeklioglu, Sadaf Afshar
- Boğaziçi University, Department of Computer Engineering

2 Contribution details

- Title of the contribution: Kernel ELM based Age Estimator
- Final score : 0.524055
- General method description : Kernel ELM regression with feature-level fusion of 4 appearance features after dimensionality reduction with PCA
- Representative image / diagram of the method: See Figure.

3 Face Detection Stage

Viola & Jones face detector is used for face detection. Since some of the faces are initially rotated upto 90 degrees, we tried rotating the original images to increase the chance of detecting faces.

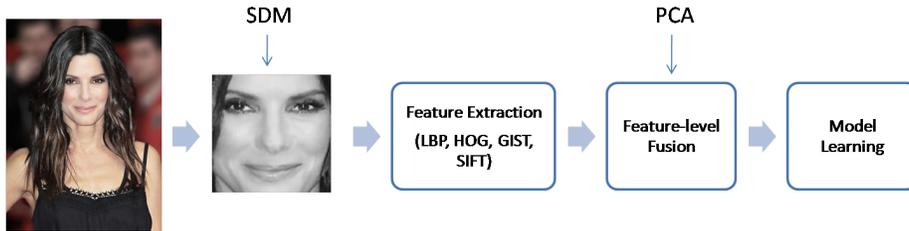


Figure 1: Flow Diagram of the proposed system

4 Face Landmarks Detection and Alignment

Supervised Descent Method implementation of Xiong and De La Torre (IntraFace) is used for landmark localization.

After facial landmarks have been detected, faces are rotated in order to eliminate in-plane rotation, and aligned by cropping with a bounding box around the outer landmarks.

5 Apparent Age Estimation Stage

5.1 Features / Data representation

Histogram of Oriented Gradients (HoG), Local Binary Patterns (LBP), Scale-invariant feature transform (SIFT) and gist features are extracted from regular, non-overlapping grids over aligned faces.

5.2 Dimensionality reduction

Features have been transformed with Principal Component Analysis (PCA) to preserve 90% of the variance, and the resulting scores are concatenated to obtain the combined feature vector.

5.3 Learning strategy

Combined features are represented with RBF kernels, where the kernel parameter is optimized by a grid search. Then regression is performed with Extreme Learning Machines (ELM) by tuning the regularization parameter again with a grid search.

5.4 Other techniques

For the non-aligned faces, average age for misdetections (31) is used as an estimation.

6 Global Method Description

- Viola & Jones face detector and Supervised Descent Method for face landmark detection was pre-trained. The rest of the system is implemented by us.
- Faces from the training set are mirrored horizontally to double the number of samples. This usually decreases the MAE around 4%.
- Thanks to ELM, the parameter tuning and model learning stages of the system is very fast. More details are given in the following section.

7 Other details

- *Language and implementation details (including platform, memory, parallelization requirements)* : The whole system is implemented in MATLAB, on a 64-bit Windows-7 with 12GB RAM and 2.67GHz Intel i7 processor.
- *Human effort required for implementation, training and validation?* : No manual effort required for any part of the system.
- *Training/testing expended time?* After the face alignment is performed, feature extraction for the whole dataset takes no more than 1 hour, and the testing (including grid search for kernel and regularization parameters), thanks to ELM, is completed in less than 2 minutes.
- *General comments and impressions of the challenge? what do you expect from a new challenge in face and looking at people analysis?* Age estimation seems to have a lot of room for improvement. Interaction, interpersonal synchrony, and mimicry in two-party communications have a lot of implications. This kind of data, particularly from sessions in psychotherapy or consulting (with either symmetrical or asymmetrical relationships) could be very interesting to analyze.