

Claims

1. A method for facial recognition comprises the steps of
- a) reading an image which can show one or more persons,
- 5 b) detecting whether said image shows at least one human face of a person, wherein the method is only continued if the image shows at least one face,
- c) analyzing the image for non-facial attributes of the person of this face,
- d) extracting facial attributes of this face from the image,
- e) sorting and/or filtering face templates stored in a database by said non-facial-attributes,
- 10 f) searching the sorted and/or filtered database for a face-template matching this face of the image;
- wherein the non-facial attributes comprise one or more of the following attributes:
- shape of hair
 - color of hair

15 - texture of hair

 - color of clothing
 - texture of clothing
 - shape of neck
 - color of neck

20 - shape of shoulder

 - presence of eyewear
 - presence of collar.
2. Method according to claim 1,
- 25 characterized in that
- a face thumbnail having a size of the face dimensions is picked out from the image before carrying out step d) and said facial attributes are extracted from the face thumbnail, wherein searching for a face-template according to step f) is carried out by matching the facial attributes of the extracted thumbnail.
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3. Method according to claim 1 or 2,
- characterized in that

the detecting of a human face according to step b) is carried out by performing a classification method on the image by means of a wavelet transformation.

- 5 4. Method according to claim 3,
characterized in that
the wavelet transformation uses 2-dimensional Haar-like wavelets for the detection of Haar-like features.

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5. Method according to claim 1,
- 5 characterized in that
- non-facial attributes relating shapes are determined by an edge detection method (histograms of gradients) and/or
- non-facial attributes relating colors are determined by a color detection method (color histograms) and/or
- 10 non-facial attributes relating textures are determined by a texture classification method (local binary patterns).
6. Method according to one of the claims 1 to 5,
- characterized in that
- 15 extracting face features from the image is carried out by a texture classification method (local binary patterns).

7. Method according to one of the claims 1 to 6,
characterized in that

5 the non-facial attributes of said image taken form a non-facial vector and each template of the database comprises a corresponding non-facial vector of non-facial attributes, wherein the filtering according to step e) is carried out by selecting all face templates of said database having a non-facial vector of non-facial attributes being less distant from the non-facial vector of the image taken than a predetermined threshold distance.

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8. Method according to one of the claims 1 to 7,
characterized in that

the non-facial attributes of said taken image forms a non-facial-vector and each face-template of the database comprises a corresponding non-facial vector of non-facial attributes, wherein
15 the sorting according to step e) is carried out by sorting the face-templates of said database according to the distance of their non-facial vectors from the non-facial vector of the image taken.

9. Method according to claim 7 or 8,

20 characterized in that

distance of the non-facial vectors of the templates from the non-facial vector of the image taken is determined by weighting the individual non-facial attributes.

10. Method according to one of the claims 1 to 9,

25 characterized in that

in step b) a face thumbnail is determined showing the face, wherein this face thumbnail is used for extracting face features, and an attribute thumbnail which contains the face thumbnail and which is larger than the face thumbnail is used for analyzing the non-facial attributes.

11. Method according to one of the claims 1 to 10,
characterized in that
the searching according to step f) is carried out by sorting the selected face templates or by
sorting a limited number of sorted face templates having a distance between their non-facial
5 vectors and the non-facial vector of the image taken that lies below a certain threshold,
wherein the sorting is carried out on the basis of face features.
12. Method according to claim 11,
characterized in that
10 the sorting is carried out by multi-dimensional indexing.
13. Method according to one of the claims 1 to 11,
characterized in that
multiple cameras are used for taking a plurality of images, wherein for each image the facial
15 recognition is carried out.
14. System for facial recognition comprising
- at least one camera for taking images,
- a control unit connected to the at least one camera, wherein a server is embodied for carry-
20 ing out the method according to one of the claims 1 to 13.