Gender Recognition from a Partial View of the Face Using Local Feature Vectors

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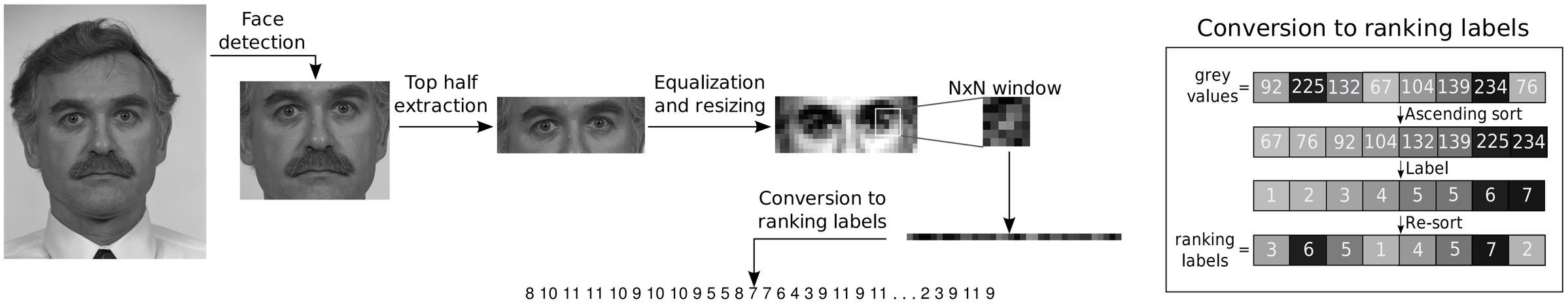
Abstract

This paper proposes a gender recognition scheme focused on local appearance-based features to describe a partial view of the face.
Due to the fact that only the top half of the face is used, this is a feasible approach in those situations where the bottom half is hidden.
In the experiments, several face detection methods with different precision levels are used in order to prove the robustness of the scheme with respect to variations in the accuracy level of the face detection process.

Methodology

Feature Extraction



Classification

1. Compute the nearest neighbour of each vector extracted from the test images.
2. Assign to each test image the class obtained by majority voting of its vectors.

Metric: $\sum_{i=1}^{n} |v_i - w_i|$, where v and w are vectors extracted from a training image and a test image respectively.

Experiments

Description

In order to prove that the gender recognition method presented is robust to inaccuracies in the detection of the face, the combination of different methods to detect the face were used.

- **Exp. 1**: Training set: DB coordinates; test set: DB coordinates.
- **Exp. 2**: Training set: DB coordinates; test set: automatic method.
- **Exp. 3**: Training set: automatic method; test set: automatic method.
- **Exp. 4**: The area that contains the face was randomly shifted in all directions between 0 and 15 pixels and it was performed after detecting the face using the DB coordinates.

The **1st series** of these experiments used all the feature vectors extracted from the images while in the **2nd series** the number of feature vectors was reduced before the classification process.

Details

- FERET image database was used. The training and test sets contain the 60% and 40% of the total amount of images, respectively.
- Each of the top half faces was resized to obtain images of 30 pixels in width (maintaining the aspect ratio).
- Window size used was 9×9, so vectors of 81 components were obtained. The number of vectors extracted from each face was usually 110.
- $T = 16$ was used as a threshold to reduce the complexity of the data. The vectors where the number of different numeric labels is lower than T are ruled out.

Results

Recognition rates for both series of experiments

	Tra and Tst coordinates **Exp. 1**	Tra coordinates Tst auto detection **Exp. 2**	Tra and Tst auto detection **Exp. 3**	Shifting the area of the face **Exp. 4**
1st series	79.55%	83.16%	82.57%	79.21%
2nd series	81.07%	82.30%	88.51%	83.06%

- All the results obtained are very close to or higher than 80% despite the fact that the system does not have any restriction on how accurate the detection of the face should be.
- In the 1^{st} series, the best recognition rates were achieved when the face was automatically detected. The automatic method provides a wider area that contains more of the face than the other method.
- In the 2^{nd} series the recognition rates are higher since the vectors used were the most discriminant and it is possible that those vectors that were ruled out were the ones that provided information that confused the classifier.

Conclusions

This paper has proposed a gender recognition scheme based on local feature descriptions from the top half of the face, which makes it suitable for use in real situations where the bottom half is hidden.
As the experiments demonstrate our method is robust to variations in the accuracy of face detection, since the classification results obtained from the intentional shift of the face regions produced similar results to those achieved under normal conditions.