GENDER RECOGNITION FROM FACE IMAGES

Marian Kałuża
Bachelor Degree Programme (1), FIT BUT
E-mail: xkaluz07@stud.fit.vutbr.cz

Supervised by: Adam Herout
E-mail: herout@fit.vutbr.cz

ABSTRACT

This paper tests the idea that gender recognition accuracy can be improved not only by aquiring different features on the same image but even by gathering just a single feature at different image scales. The experiment showed that information relevance from different scales can be comparable to different features at a single scale.

1. INTRODUCTION

The aim of this paper is to test the idea, proposed by [1], to extract features at different image resolutions rather than different features and fuse the obtained decisions. Feature fusion is done here in two strategies: serial and parallel. Results from both methods are compared in the results section.

The experiments were performed on FERET - a public available set defined in Mäkinnen and Raisamo [4]. This dataset receives constant attention from researchers, so results can be easily comparable with other works.

2. METHOD

This paper uses shape and texture features applied on image windows sliding over grayscale images.

2.1. IMAGE WINDOWS

The original image is scanned by sliding windows. Features extraction is done on these windows instead of a full-size image. Final feature vector is obtained by concatenating feature vectors from all windows in the image.

2.2. SHAPE FEATURES

Histograms of edge directions similar to histograms of oriented gradients like in [2] are used as a shape feature. Histograms used in this paper are quite simplified because no normalization is performed and pictures are grayscale.

Two shape representations are obtained from the original picture: vertical and horizontal edge maps. For each pixel, edge direction and magnitude are found from vertical and horizontal edge values of the given pixel.

The directions obtained are discretized to 18-degrees intervals, so histogram representing full 360 degrees contains 20 bins. Each pixel adds its edge magnitude to the corresponding bin of the histogram.

An image is represented by a vector of 20n real values by concatenating the n individual histograms, where n means number of windows used on the whole image.

2.3. TEXTURE FEATURES

Texture features have to deal with real world textures which have often variations in orientation, uneven illumination or great within-class variability. Good example of a texture feature which is not much affected by these complications can be Local Binary Patterns as proposed by Ojala et al. [3].

The method is based on recognizing certain local binary patterns termed „uniform“, which, as Ojala claim, are important properties of local image texture. The term „uniform“ refers to a uniform property appereance in local binary pattern, i.e., there is a limited number of transitions or discontinuities in the circular representation of the pattern.

2.4. CLASSIFIER

Support vector machine was used as only one classifier in this paper. There were used a linear kelner with fixed parameter C = 100 (the tradeoff between the training error and the margin). Fixed C parameter was chosen because the aim of that paper is to focus attention on the features rather than on the classifier.

3. RESULTS

3.1. SHAPE AND TEXTURE FEATURES

Results show a recognition accuracy in percentage by applying 4 different window size on 3 image resolutions:

Feature	Image size	Window size			
		4x4	8x8	16x16	32x32
Shape feature	64x96	94.94	95.5	88.2	73.59
	128x192	92.69	93.82	87.64	85.95
	256x384	89.88	92.69	93.25	92.69
Texture feature	64x96	76.4	91.57	94.38	87.08
	128x192	89.32	94.94	94.94	92.69
	256x384	-	92.13	95.5	93.82

Table 1: Shape feature accuracy. Numbers show an accuracy achieved by applying different image window on different image resolution.

3.2. FEATURE FUSION

The method for fusing the partial results is presented here. It is done in three steps, one for each image resolution, so different scales can be observed independently. Partial result is obtained from each combinations of scale and image windows. Final decision is then used as majority of votes from all partial results. Results of feature fusion are presented in the table 2:

Fusion	Shape	Texture	Shape + Texture
64x96	93.82	89.33	95.5
128x192	94.38	91.57	94.38
256x384	94.94	90.45	94.38
Feature	95.5	92.13	-
All	**96.06**		

Table 2: Fusion accuracy on different image resolutions and the final accuracy

Comparing results obtained from single feature applied on different image resolutions (columns 2, 3) with the results obtained from 2 types of features applied on single image resolution (column 4) it can be seen that former approach have at least or better result improvement then the latter aproach. Finally, the best obtained result was 96.06%.

4. CONCLUSION

This paper presented the way of gender recognition from face images that shows how fusion aproach based on features from different scales can improve accuracy. Based on performed experiment conclusion is that fusing information from different scales, even if just from a single feature, can have comparable result improvement as fusing from more features on a single scale.

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