



GENDER RECOGNITION FROM FACIAL IMAGES USING LOCAL GRADIENT FEATURE DESCRIPTORS

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OUTLINE

- Contributions
- •Gender Recognition Methods
 - Face Detection
 - Local Gradient Feature Descriptors
 - Classifier Method
- Experimental Settings and Results
- Conclusion





Contributions

- We proposed two well-known local gradient feature descriptors
 - Histogram of Oriented Gradients (HOG)
 - Scale-Invariant Feature Transform (SIFT)
- The gradient feature descriptor combined with the *Support Vector Machine (SVM) with the Radial Basis Function (RBF)*

Gender Recognition Methods

- Face Detection: Haar-Cascade Classifier
- Local Gradient Feature Descriptors: HOG and SIFT
- Classifier Method: SVM with RBF Kernel



Local Gradient Feature Descriptors



Experimental Settings and Results

- We will describe;
 - The *face image dataset* used in the experiments
 - The experimental results consisting of
 - The face detection results
 - Parameter settings
 - Grid search parameter

MAH estimation

• Gender recognition results

Face image dataset

- We used a benchmark face image dataset, called *the color face recognition technology (ColorFERET) dataset*.
 - Firstly, we used ColorFERET for *face detection* purpose.
 - Secondly, we divided the ColorFERET dataset using 2-fold (50:50) and 10-fold (90:10).

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Face image dataset

- The ColorFERET dataset consists of 14,126 face images from 1,199 subjects.
- The resolution of images in the dataset is 384x256 pixels.



Face image dataset

 In the ColorFERET dataset, there are 13 different poses of each person, such as regular frontal image, profile left, half left, quarter left and also head turned





Experimental results

• Face Detection Result:

$$Acc_{fd} = Ac_{fd} - Er_{fd}$$

when

$$Ac_{fd} = \frac{c*100}{N}$$

where

C The number of face images, after using a face detection technique

e The number of the error face images N The total number of the face images in the dataset

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Experimental results

- Face Detection Result: The Haar-Cascade classifier obtained an accuracy of **39.25%**.
- The accuracy of the male and female faces was 36.87% and 41.63%, respectively.

TABLE I. PERFORMANCE OF THE FACE DETECTION USING HAAR-CASCADE CLASSIFIER ON THE COLORFERET DATASET

Gender	Number of male images	Number of face detected	Number of error detected
Male	7,139	2,854	222
Female	3,980	1,770	113

Experimental results

• Face Detection Result:





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Parameter settings

TABLE II

 The best parameters of HOG descriptor used 9 orientations, 8 pixels per cell, and 3 cells per block

PARAMETERS						
	HOG Descriptor Parameters					
Orientations	Pixels per cell	Cells per block	Accuracy (%)			
4	8	1	94.6			
8	16	1	92.2			
8	16	2	92.8			
9	8	1	94.8			
9	8	3	95.8			
9	16	1	93.3			
24	16	1	92.0			

THE PERFORMANCE OF DIFFERENT HOG DESCRIPTOR



Parameter settings

 The best parameters of SIFT descriptor used patch size = 25 pixels

TABLE III. THE PERFORMAN DIFFERENCE	TABLE III. THE PERFORMANCE OF THE SIFT DESCRIPTOR USING DIFFERENCE PATCH SIZES				
SIFT Descriptor Parameters					
Patch sizes	Accuracy (%)				
10	97.8				
20	98.2				
25	98.4				
30	97.1				
40	97.1				
45	97.8				
50	96.9				

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Grid search parameter estimation

- We have optimized the hyper-parameters of the SVM classifier with the RBF Kernel using grid-search method.
- We searched the hyper-parameter C and gamma between the number of 2⁻⁷ and 2⁷.

TABLE IV.THE BEST HYPER-PARAMETER VALUES FOR THE SVM
CLASSIFIER WITH THE RBF KERNEL

Methods	С	γ
HOG	2 ³	2 ⁰
SIFT	2 ³	2 ⁻⁵

Gender recognition results

 From the face detection result, we divided 4,624 face images into train and test sets with the ratio of 50:50 (2-cv) and 90:10 (10-cv).

TABLE V. THE ACCURACY (%) OF THE SVM CLASSIFIER OBTAINED WITH 2-FOLD AND 10-FOLD CROSS-VALIDATIONS				
Methods	Accuracy (%)			
	2-cv	10-cv		
HOG	96.50 ± 1.8	98.75 ± 2.5		
SIFT	95.98 ± 0.4	99.20 ± 0.8		

Conclusion

- The main objective of this paper is to recognize gender (male and female) from facial images.
- *First*, the Haar-cascade classifier was used to find the face from the whole image.
- Second, the face images were then assigned to the local gradient feature descriptors (HOG and SIFT) to compute the feature vector.

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Conclusion

- **Finally**, for gender recognition, the invariant feature vector was classified using SVM with the RBF kernel.
- The SIFT descriptor outperformed the HOG descriptor when combined with SVM with the RBF kernel.
- This method obtained very high recognition accuracy.

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