Project Title	**Face emotion recognition in the wild based on histogram of oriented gradients**			Date	2019. 5. 27
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1. Project Overview

Facial emotion recognition plays the important role in human-computer interaction with wider applications in health-care, customer marketing, and emotionally intelligent robotic interfaces. The problem requires to detect seven facial expressions with universal meaning: anger, disgust, fear, happiness, sadness, surprise and neutral suggested by Ekman et al. [1]. There has been significant research interest in computer vision field to recognize face emotion recognition. But it also a challenging problem due to complex and dynamic properties in emotion.

In this project, we apply the HOG (histogram of oriented gradients) [2] to classify facial emotion expressions. We evaluate our method on RAF-DB dataset [3].

2. Key technology

The basic purpose of feature extraction is to find out a combination of most efficient features for classification. The performance of problem depends on the quality and the consistency of the selected features. In this work, we use HOG for classification of face emotion expressions.

HOG features were first introduced by Dalal et al. [3], which are descriptors mainly used in computer vision and machine learning for not only detecting object but also quantifying and representing both shape and texture.

A feature descriptor is a representation of an image or an image patch that simplifies the image by extracting useful information and throwing away extraneous information. Typically, a feature descriptor converts an image of size width x height x 3 (channels) to a feature vector / array of length n. In the HOG feature descriptor, the histograms of directions of gradients-oriented gradients are used as features. Gradients of an image are useful because the magnitude of gradients is large around edges and corners, where packing in a lot more information about object shape than flat regions.

There are five stage to create HOG descriptors: (1) normalizing the image prior to description, (2) computing gradients in both the x and y directions (3) obtaining weighted votes in spatial and orientation cells (4) contrast normalizing overlapping spatial cells (5) collecting all histograms of

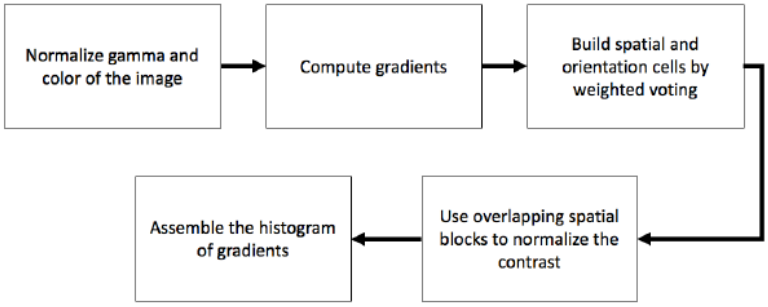
oriented gradients to form the final feature vector.

Finally, the descriptors are used by SVM (support-vector machine) to classify emotion recognition. It constructs a hyperplane or set of hyperplanes in a high-dimensional space, which can be used for classification. Intuitively, a good separation is achieved by the hyperplane that has the largest distance to the nearest training-data point of any class.

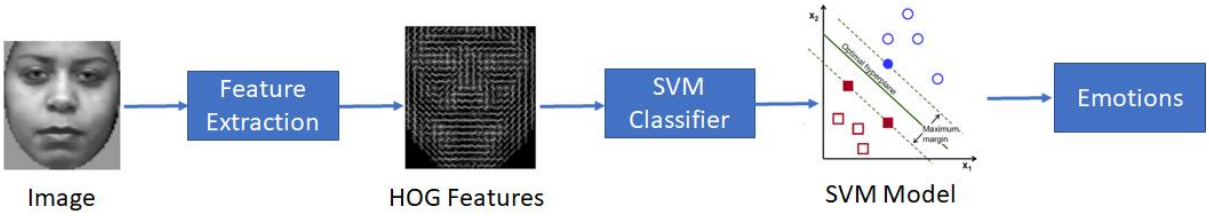
3. Project contents

- Dataset RAF-DB: 12271 training images / 3068 testing images

- HOG calculating flowchart



- Overall system



4. Schedule

Work Contents	Schedule							Remarks
	May 20th	May 27th	May 30th	June 03rd	June 06th	June 10th	June 13th	
Internet search and paper collection	<----	---->						

Paper reading		<----	---->					
Data Analysis			<----	---->				
Report Writing			<----			---->		
Programming and Test				<----			---->	

5. Others

6. References

[1] P. Ekman and W. V. Friesen. "***Emotional facial action coding system"***. Unpublished manuscript, University of California at San Francisco, 1983.

[2] Dalal, Navneet, and Bill Triggs. "***Histograms of oriented gradients for human detection***." international Conference on computer vision & Pattern Recognition (CVPR'05). Vol. 1. IEEE Computer Society, 2005.

[3] Li, Shan, and Weihong Deng. "***Reliable crowdsourcing and deep locality-preserving learning for unconstrained facial expression recognition***." IEEE Transactions on Image Processing 28.1 (2019): 356-370.