

<Homework 2 _ Artificial Intelligence>

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1. Results

From the left, 4 HOG results, and Face detection (before NMS, after NMS)



2. Description

2.1 HOG

```
[[-1  0  1]
 [-1  0  1]
 [-1  0  1]] filter_x
-----
[[ 1  1  1]
 [ 0  0  0]
 [-1 -1 -1]] filter_y
```

In get_differential_filter(), I used filter consists of [-1,0,1]

And I added 0s on the edge for the filter_image, and used the formulas to get gradients which are (1) $\text{grad}_{\text{mag}} = \sqrt{dx^2 + dy^2}$ (2) $\text{grad}_{\text{angle}} = \tan^{-1} dy/dx$. To make the angle range $[0, \pi]$, divided angles by π

Build histogram through 6 types of angles, and got HOG Descriptor through my own function normalizer. All the processes in extract_hog to get HOG of given image.

2.2 Face detection

First, I made IOU function to eliminate those who has IOU value over 0.5 compared to box that has higher confidence level. I set threshold for the first bounding_boxes 0.485 so that I can get 5 people's face in rough. And then through NMS algorithm, which eliminates all the boxes that has low confidence except the one box that has highest confidence. I finally got 5 points that respectively matched to each person, and revisualized through embeded function visualize_face_detection. Though it took a lot of time to get HOG in every pixel, I could get right answer. It seems necessary to make it faster through code optimization.