People Counter using Face/Human Detection

Group #: 15

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Introduction

1. **Face / Human body detection** – A computer technology that identifies the locations and sizes of human faces or bodies without any other things in visual media scene automatically.

2. **Counting Algorithm** – Return the total number of humans in an image by the combination of face and human detections

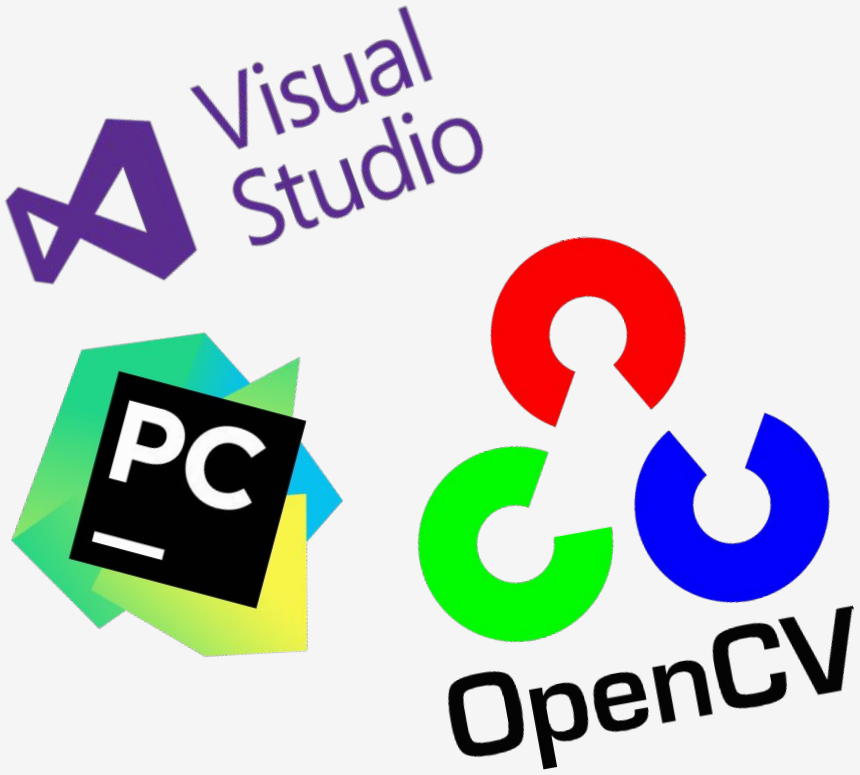
3. **Real-time Video Face Counting** – Use webcam to capture video in real time, then count the number of faces in the video

IDE & Language & Library

1. Visual Studios 2017 (C++)

   PyCharm (Python)

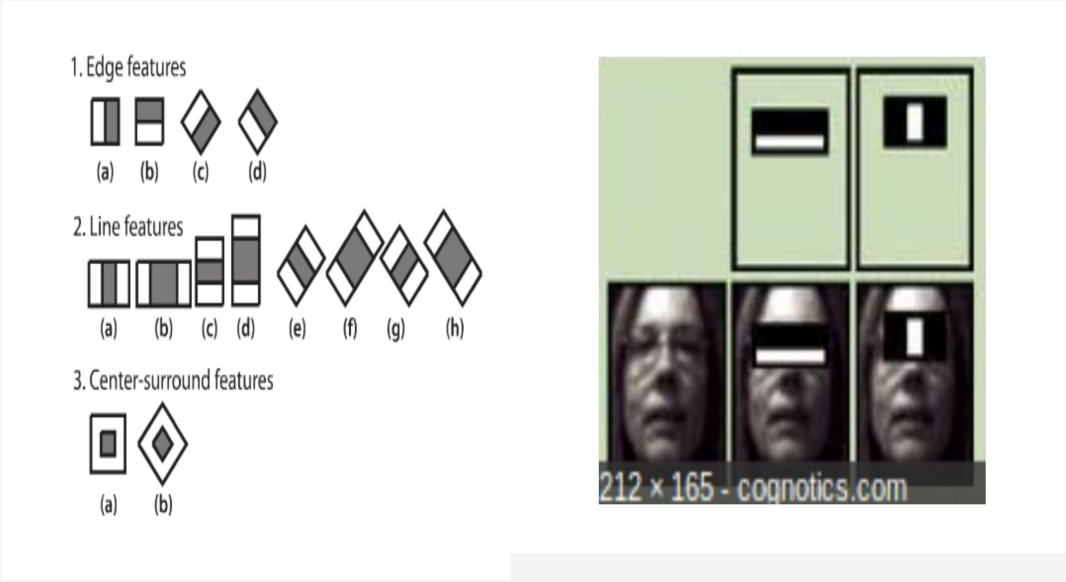
2. OpenCV – A library aimed at real-time computer vision.



Face Detection

1. Haar Feature-based Cascade Classifier(used for object detection)
   - Trained the classifier with both positive(image with faces)and negative (image without faces)examples

2. Applied the trained classifier to the small size of input image,
   - Search for the face in the whole image and check every location using classifier.
   - Classifier can be resized in order to find the objects for different sizes



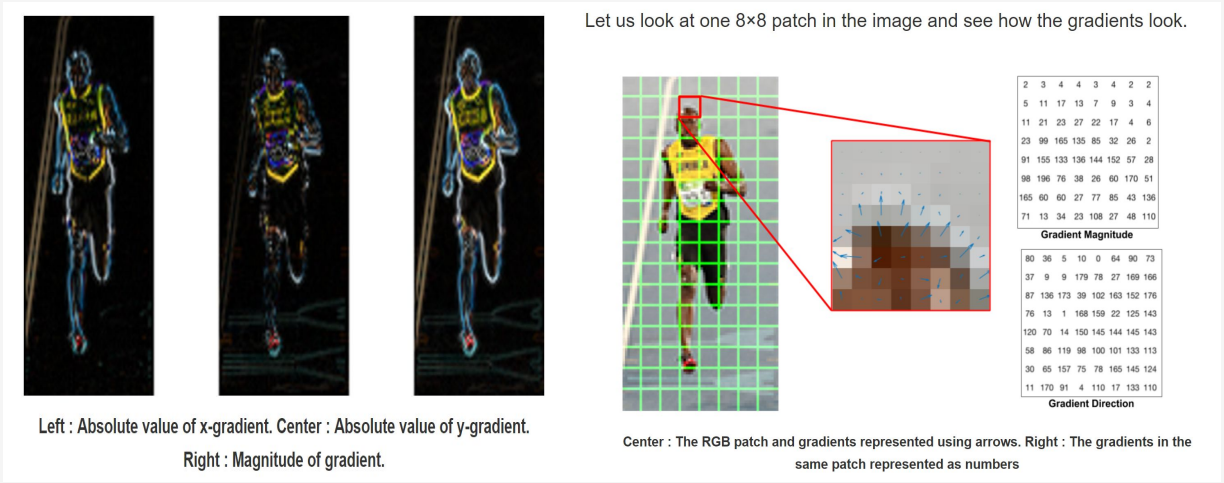
Haar-like features(Picture source: How Face Detection Works)

3. Haar-like features as the input to the classifiers
   - group the features into different stage of classifiers
   - window which passes all stages of features is face region

Human Body Detection

1 Histogram of Oriented Gradients(HOG)

- Resizing the selected image to a small size
- Calculating the horizontal and vertical gradients(x and y derivatives), and histogram(distribution) of gradients
- The gradient image removed non-essential information (background color)
- Calculating histogram of gradients in 8x8 cells
- Normalizing Gradient Vector



Source:(https://www.learnopencv.com/histogram-of-oriented-gradients/)

2 Non-Maximum Suppression (NMS) Algorithm

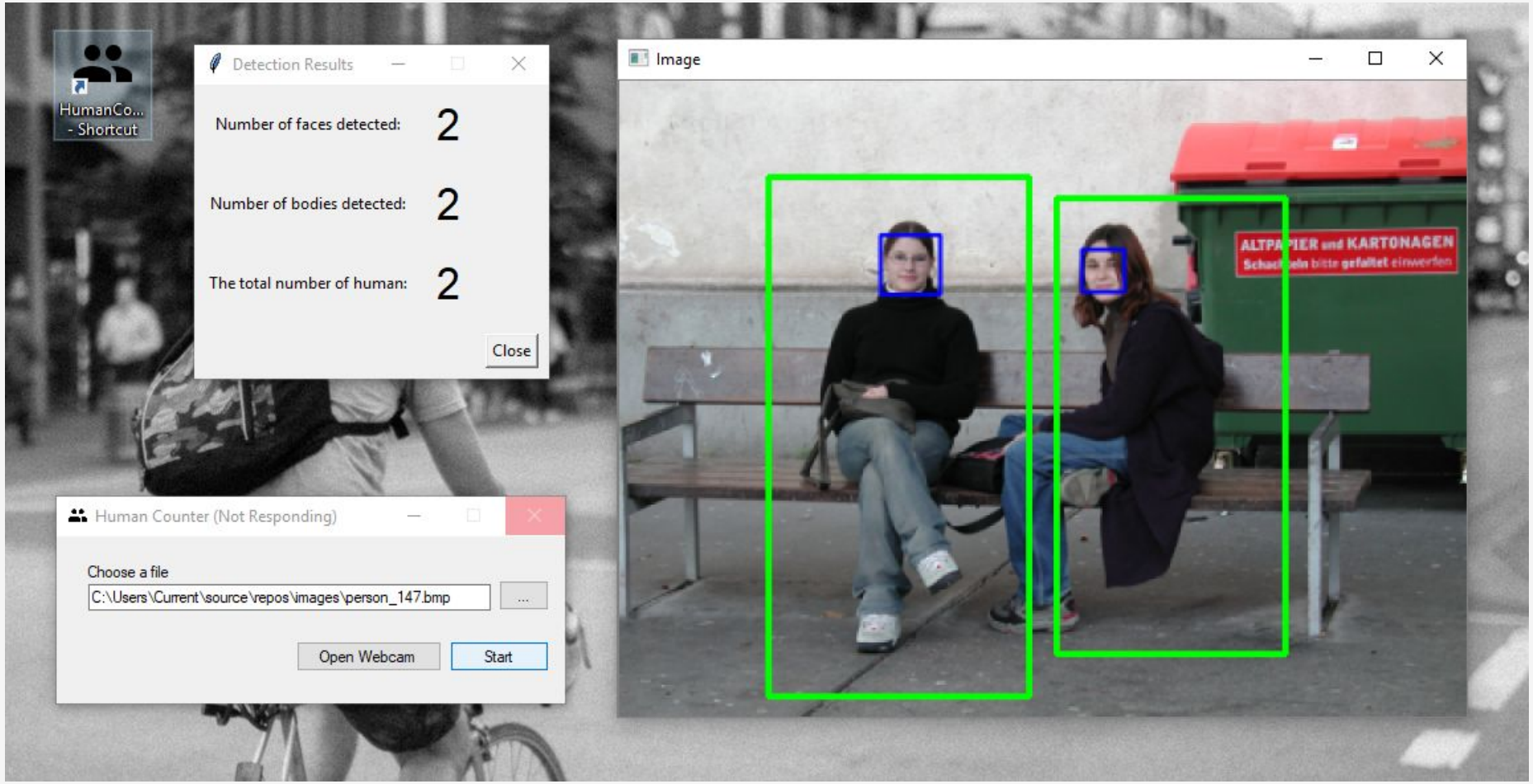
- Taking multiple overlapping bounding boxes to single bounding box
- help get one clearly human body and make the result accurate

Detection & Counting Algorithm

List of detected face / body coordinates

Size of this list

Number of detection



Real-time Video & Webcam Detection

1. Play whatever the Video / Webcam is recording and detect the faces / bodies in the video stream.
   - Haar Feature-based Cascade Classifier -> Face detection
   - Histogram of Oriented Gradients(HOG) -> People detection
   - Capture the video frame-by-frame
   - Detect faces and bodies in each frame <- detectMultiScale()

2. Meanwhile, displaying the number of faces / bodies appear the video stream and show the number at the corner of the video playing window.
   - If the center point of a face detection is in the body detection, the system would count this as only one person.

Problems & Future Improvement

1. The face detection works better with higher resolution image while the body detection works better with lower resolution image. Current solution is to resize the image after face detections so that the image will have relative lower resolution for the body detections.

2. It is laggy to play the video while running the detection because the calculation of body/face detection is not fast enough.

3. The overall accuracy of the detection and human counting is not very high because there are noises in the picture. In the future, we will have our own models and train them so they can perform better when distinguishing human from other object.

Thank you…