Image Background Blurring Using Image Segmentation Techniques

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***Abstract*—Background blurring of images consists of segmentation of the image into separate background and foreground, and then applying a low pass filter on the background pixels. We extract HoG (Histogram of Gradient) features of the images. We train a Random Forest algorithm model using HoG features as data and pixel wise presence of humans as labels. This model classifies the image into background and foreground and a blurring kernel is applied to the background pixels.**

I. Introduction

In digital image processing and computer vision, image segmentation refers to the process of partitioning or separating a digital image into multiple groups or segments of pixels. The goal is to simplify the task of analyzing an image by creating a meaningful and interpretable version of it. With multiple applications pertaining to medical imaging, object detection, facial recognition, video surveillance, multiple works keep coming up exploiting the practical and approachable aspect of it.

In the context of digital image processing, several methods have been proposed. Thresholding techniques like Otsu have been found effective on images which follow a bimodal distribution. Edge detection techniques like Canny edge detection have been around for a while, which coupled with techniques like Hough transform help in effectively detecting the 'strong' and 'weak' edges in a given image. Clustering techniques like K-Means are also used in images which have a sparse color distribution. But all of these mentioned techniques fall short when it comes to the task of object detection in practical real-life images.

With the rising growth in the fields of Deep Learning, and Machine Learning models, new research keeps on pushing the boundaries of image segmentation by coupling the power of these predictive techniques with the existing image-processing techniques. For the purposes of our task which involves detecting the pixels corresponding to humans in a given image, we explore a histogram based technique known as Histogram of Oriented Gradients or HoG. For the human-detection part, we train a Random Forests classifier on the HoG features of an open source dataset[3]. Then once we have separated the image into separate foreground and background, we use a Gaussian filter to blur the background.

II. Implementation

HoG or Histogram of Gradient is a feature extraction technique used to extract features from image data. It consists of information regarding both, the edge magnitude and direction and is obtained over a localised region.

To maintain uniformity, all our input images are resized to the dimension 128x64 pixels. Then, the gradient at each pixel is calculated in both, horizontal(Gx) and vertical(Gy) directions. The magnitude is calculated as the square root of the sum of squares of Gx and Gy. The orientation(direction) is computed as the inverse tan of the ratio of Gy and Gx.

The image is divided into blocks consisting of 8x8 pixels. For each of these blocks, a histogram is generated consisting of the 180 degrees orientation obtained being divided into 9 bins covering 20 degrees each. The magnitude of gradient is then added to the respective bin based on the interpolation over nearest neighbours of the corresponding orientation information of each pixel.

A histogram of these bins is the Histogram of Gradients which is a 9x1 sized vector representing a 8x8 block of pixels. To account for the different intensity in different parts of the image, each of these blocks is normalized over 3 neighbouring blocks to form a cell of 4 blocks, represented as a 36x1 vector, formed by concatenating the HoG vectors of the different blocks. This vector is normalized by dividing each of the elements by the Root Mean Squared sum of its constituent elements.

This gives us 105(7x15) cells representing 16x16 pixels. Each cell is represented by a 36x1 vector, thus giving 105x36 = 3780 features.

These features are then fed to a Random Forest Classifier model with the labels vector consisting of 'background' or 'foreground' class for each pixel. The model then predicts the mask identifying the foreground pixels. The background pixels are blurred using the blurring kernel :

[1 1 1 1 1

1 2 2 2 1

1 2 3 2 1

1 2 2 2 1

1 1 1 1 1]

While the foreground pixels are unaffected.

III. Results

The results shown in Fig. 1, were obtained by executing our Python implementation. The resized_mask denotes the output of our Random Forests classifier for the original image. The final obtained image was obtained after an element-wise multiplication of the foreground image with the resized_mask followed by filtering with a Gaussian kernel of size 5.

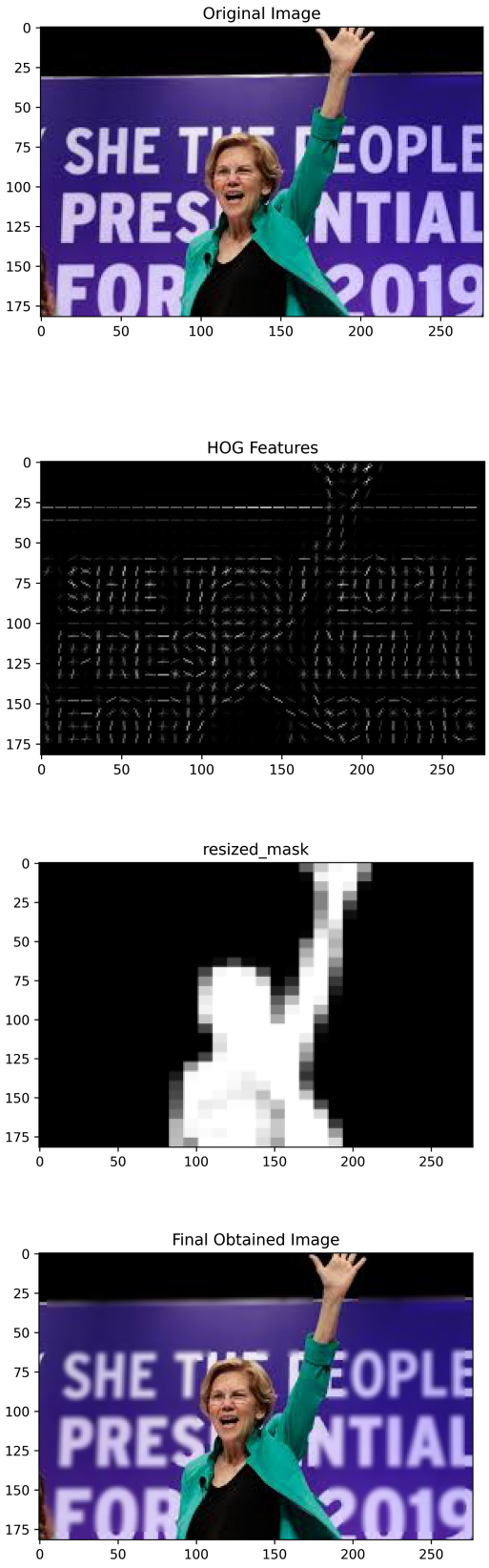

Figure. 1: Results for a sample image

IV. Conclusion

In this project, we used the predictive proficiency of a Random Forests Classifier and the segmentation capabilities of the HoG technique(Histogram of Oriented Gradients) to separate out humans from a given image. We then used a blurring process for blurring out the background. Given the current scope of the course, and our limited proficiency in Machine Learning and Deep Learning techniques.

References

[1]N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'05), San Diego, CA, USA, 2005, pp. 886-893 vol. 1, doi: 10.1109/CVPR.2005.177.

[2] M. Svanera, U. R. Muhammad, R. Leonardi and S. Benini, "Figaro, hair detection and segmentation in the wild," 2016 IEEE International Conference on Image Processing (ICIP), Phoenix, AZ, 2016, pp. 933-937, doi:10.1109/ICIP.2016.7532494.10.1109/ISCA.2014.6853196.

[3] Shenoy V, 'Human Segmentation Dataset' [Online] Available: https://github.com/VikramShenoy97/Human-Segmentation-Dataset