Evaluating Different Blurring Techniques on Faces to Protect Privacy Through OpenCV and Python

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Introduction

Beacon: An app that allows people to video record their environment in a situation where they may feel vulnerable.

- Some people in it may not be related to the incident, so their privacy should be protected
- One way of protecting privacy is by blurring the person's face so that they are not recognizable

Purpose: Evaluating the performance of various face blurring techniques on an image dataset

Figure 1: Example of face blurring for anonymity

Methodology

To help the app Beacon blur faces in videos, we will first explore this problem through images.

First step: detect the faces and identify which ones to blur

Second step: add blurring

In this project, we focus on the blurring aspect with a dataset that has pre-identified faces with coordinates.

Dataset called **WIDER**:

- Contains images of people and a text file for coordinates location of the faces

Blurring techniques:

- Box blurring: The blurring value is uniform throughout the blurred box
- Gaussian blurring: The blurring value is typically higher at the centre of a blurred box and less at the corners

Implementation

- Parse (organize) data with regular expressions, which are commands to find patterns in text
- Use Google Colab (coding in browser) to import OpenCV (cv2 - a library of programming functions)

```
0--Parade/0_Parade_marchingband_1_849.jpg
1
449 330 122 149 0 0 0 0 0 0
0--Parade/0_Parade_Parade_0_904.jpg
1
361 98 263 339 0 0 0 0 0 0
0--Parade/0_Parade_marchingband_1_799.jpg
21
78 221 7 8 2 0 0 0 0 0
78 238 14 17 2 0 0 0 0 0
113 212 11 15 2 0 0 0 0 0
134 260 15 15 2 0 0 0 0 0
163 250 14 17 2 0 0 0 0 0
201 218 10 12 2 0 0 0 0 0
182 266 15 17 2 0 0 0 0 0
245 279 18 15 2 0 0 0 0 0
304 265 16 17 2 0 0 0 2 1
```

Figure 2: Face coordinates for the WIDER dataset

```
import pandas as pd
import os # use for WIDER dataset
import json
import zipfile # used for WIDER dataset

from google.colab import files

import cv2 #for blur

import numpy as np # package that provides
import matplotlib.pyplot as plt #for blur.

from google.colab.patches import cv2_imshow
```

Figure 3: Coding environment in Google Colab

```
blur = cv2.boxFilter(ROI, -1, (27, 27))
blur = cv2.GaussianBlur(ROI, (47, 47), 0)

image[y:y+h, x:x+w] = blur
cv2_imshow(image)
cv2.waitKey()
```

Figure 4: Code lines of box blurring and gaussian blurring respectively

Results

Here we present results demonstrating the performance of the two blurring techniques under different parameter settings, particularly **kernel sizes**

- The larger the kernel sizes the more blurred the images come out, and vice versa
- For certain kernel sizes across both blurring techniques, the image turns out blue.

kernel size: (25, 25)

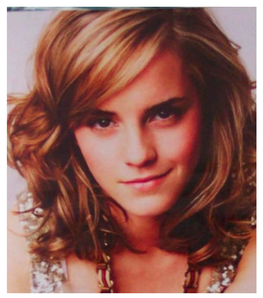

Figure 5: Original image

Figure 6: Gaussian blurring

Figure 7: Box blurring

kernel size: (35, 35)

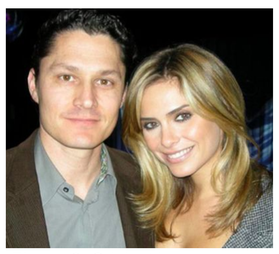

Figure 8: Original image

Figure 9: Gaussian blurring

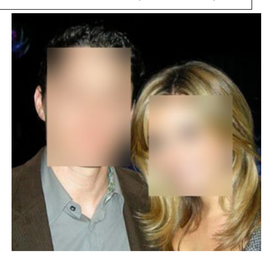

Figure 10: Box blurring

kernel size: (45, 45)

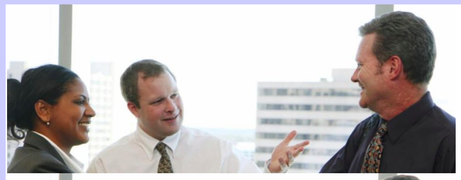

Figure 11: Original image

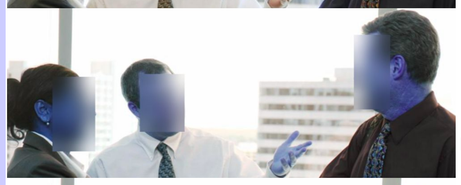

Figure 12: Gaussian blurring

Figure 13: Box blurring

Conclusions

- Successfully applied two types of face blurring
- Evaluation by visual inspection is shown
- Application: Process here can be used to protect the identity of others.
- Future developments: Can be implemented in videos after developing a face detection model

Literature Cited

Pulfer, E. (2019). Different Approaches to Blurring Digital Images and Their Effect on Facial Detection. Computer Science and Computer Engineering Undergraduate Honors Theses Retrieved from https://scholarworks.uark.edu/csceuht/66

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