FinalProject

July 21, 2019

1 Final Project

This program reads images from a zip file, scans them for text and faces. It searches for a certain word and displays the faces found in the article where the word was found.

How does it work? Per image: * The result of the OCR is stored in a list, per word. * The reslut of the face recognition is also stored in a list, per face. * Then both are stored in a dictionary per image: key = name of the image as it was read from the zip. 'words' = the distinct words found in the text. 'faces' = the faces found in the image. The advantage of this system is that you can perform different searches without the need of doing the OCR and face recognition again.

```
In [1]: #########################
        # Imports
        #########################
        import os
        import zipfile
        import io
        import pytesseract
        from PIL import Image, ImageDraw
        import cv2 as cv
        import numpy as np
        import math
```

```
In [2]: ###############################################################################
        # Contstants
        ###############################################################################

        # Scale factor & neighbour setting for the classifier.
        SCALE_FACTOR = 1.3
        NEIGHBOURS = 5

        # Path to tessearct engine. Only if you run this locally.
        TESSERACT_PATH  = r'C:/Program Files/Tesseract-OCR/tesseract.exe'

        # Path to classifier config.
        FACE_CLASSIFIER = 'readonly/haarcascade_frontalface_default.xml'

        # the zip file
        ZIPFILE = "/readonly/images.zip"
```

```
In [3]: ################################################################################
        # Functions
        ################################################################################

        #
        # Helper function to determine if a word was found in a list of words.
        # If fullmatch = 1 then only full matches are checked.
        # Return 0: not found.
        # Return 1: Exact match is found.
        # Return 2: Partial match is found, e.g. problem in 'problems'
        #
        def FindInWwords(wordToSearch,words,fullmatch=0):
            if (wordToSearch in words) :
                # Exact match.
                return (1)
            elif any(wordToSearch in s for s in words) and (fullmatch==0):
                # Partial match.
                return(2)
            else:
                # No match.
                return(0)

        #
        # Takes an image as input and returns a list of distinct words found in the OCRed text
        #
        def OCRImage(originalImage):

            # Convert to gray scale
            img = originalImage.convert('L')

            # run OCR on the greyscale image
            # On some systems you need to change the path to the Tesseract OCR Engine
            # pytesseract.pytesseract.tesseract_cmd=TESSERACT_PATH
            text = pytesseract.image_to_string(img)

            # Store words in a list.
            # Reconstruct to full words:
            #  -> for example 'instru-ction' on 2 lines is reset to 'instruction'
            # Remove blanks and periods and commas.
            words = text.replace('-\n','').replace('\n',' ').replace('.','').replace(',','')

            # All to lower, split in a list.
            words = words.lower().split(' ')
            if len(words) > 0:
                if ('' in words):
                    words.remove('')

            # only keep unique values
```

```
    words = list(dict.fromkeys(words))
    return(words)

#
# Search for a word in a dictionary and returns a dictonary where
# it appeared in the 'words'.
#
def SearchNewsPaperData(wordToFind,NPData):
    newspapers={}
    for item in NPData:
        # Get the words from the newspaper
        words = NPData[item]['words']
        # Get the faces.
        faces = NPData[item]['faces']
        f = FindInWwords(wordToFind,words,0)
        if f > 0:
            # Found a match, store in a dictionary.
            newspapers.update({item:{'faces':faces}})
    return (newspapers)

#
# Takes a PIL image and returns a list of images with the faces found.
#
def GetFaces(pil_img):
    face_images=[]
    # Convert to OpenCV format
    open_cv_image = np.array(pil_img)
    open_cv_image = open_cv_image[:, :, ::-1].copy()

    # loading the face detection classifier
    face_cascade = cv.CascadeClassifier(FACE_CLASSIFIER)
    faces = face_cascade.detectMultiScale(open_cv_image,SCALE_FACTOR,NEIGHBOURS)

    # Crop image to only the faces
    for x,y,w,h in faces:
        im = pil_img.crop((x,y,x+w,y+h))
        face_images.append(im)
    return (face_images)

#
# Resize an image to a square, respecting the ratio.
#
def ResizeImage(pil_img,basewidth):
    wpercent = (basewidth / float(pil_img.size[0]))
    hsize = int((float(pil_img.size[1]) * float(wpercent)))
    return(pil_img.resize((basewidth, hsize), Image.ANTIALIAS))

#
```

```
        # Compile a list of images into a single image in a matrix lay-out
        # max_per_row = number of pictures in the row.
        # picture szie = the size of the images (square).
        #
        def MakeSingleImage(images,max_per_row,picture_size):
            # Determine the size of the final image,
            # taking into account the number of images in the list
            max_per_row = min(max_per_row,len(images))
            total_width = picture_size * max_per_row
            max_height = picture_size * math.ceil(len(images)/max_per_row)
            new_im = Image.new('RGB', (total_width, max_height))
            x_offset = 0
            y_offset = 0
            c = 0
            for im in images:
                # Resize the image as a square to the desired size.
                im_sized = ResizeImage(im,picture_size)
                # paste into the master image.
                new_im.paste(im_sized, (x_offset,y_offset))
                x_offset += picture_size
                c+=1
                if (c % max_per_row) == 0:
                    # We are on another row, reset offsets.
                    y_offset+=picture_size
                    x_offset = 0
            return(new_im)

        #
        # Search for a certain word and display an image if faces are found
        #
        def ShowResults(wordToFind):

            faces_found = SearchNewsPaperData(wordToFind,NewspaperData)
            display("Searching for "+wordToFind)
            for item in faces_found:
                display("Results found in file {}".format(item))
                if len(faces_found[item]['faces']) > 0:
                    display(MakeSingleImage(faces_found[item]['faces'],5,120))
                else:
                    display("No faces found.")
            return()

In [4]: ###############################################################################
        # Generate a dictionary with words and faces per picture
        ###############################################################################

        # Zip file info
        zipfilename    = os.getcwd() + ZIPFILE
```

```
zipfilecontent = zipfile.ZipFile(zipfilename,mode="r")

# Initialize the newspaper dictionary
NewspaperData = {}

for filename in zipfilecontent.namelist():

    display(filename)
    # Read image and convert to something PIL understands
    newspaperImage = Image.open(io.BytesIO(zipfilecontent.read(filename)))

    # OCR
    words = OCRImage(newspaperImage)

    # Compile the faces
    faces = GetFaces(newspaperImage)

    # Store in Newspaper dictionary
    NewspaperData.update({filename:{'words':words,'faces':faces}})
```

```
'a-0.png'

'a-1.png'

'a-10.png'

'a-11.png'

'a-12.png'

'a-13.png'

'a-2.png'

'a-3.png'

'a-4.png'

'a-5.png'
```

```
'a-6.png'
```

```
'a-7.png'
```

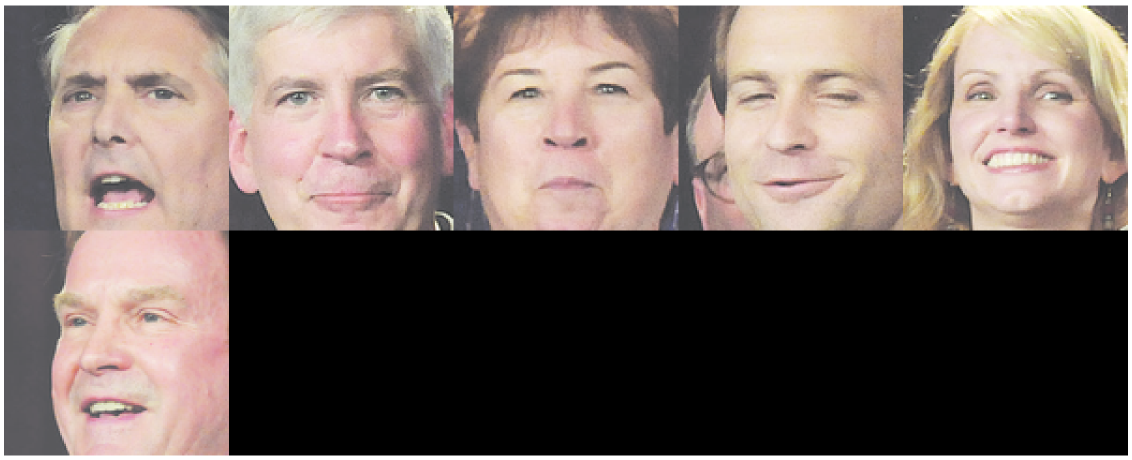
```
'a-8.png'
```

```
'a-9.png'
```

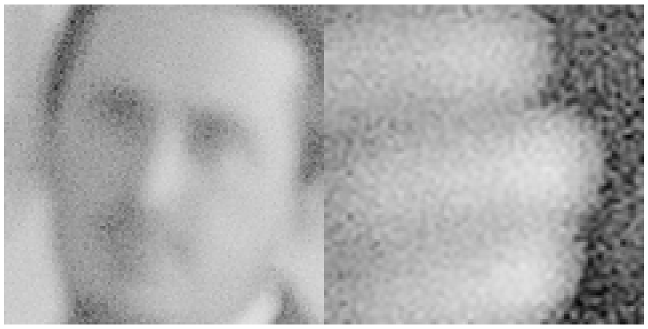
```
In [6]: ###############################################################################
        # Main
        ###############################################################################

        ShowResults("christopher")

        ShowResults("mark")
```

```
'Searching for christopher'
```

```
'Results found in file a-0.png'
```

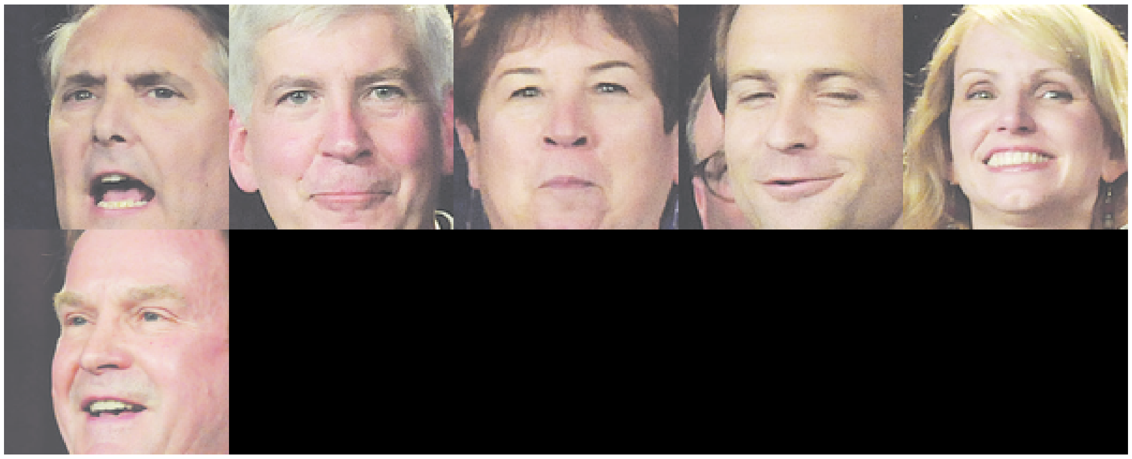


```
'Results found in file a-3.png'
```

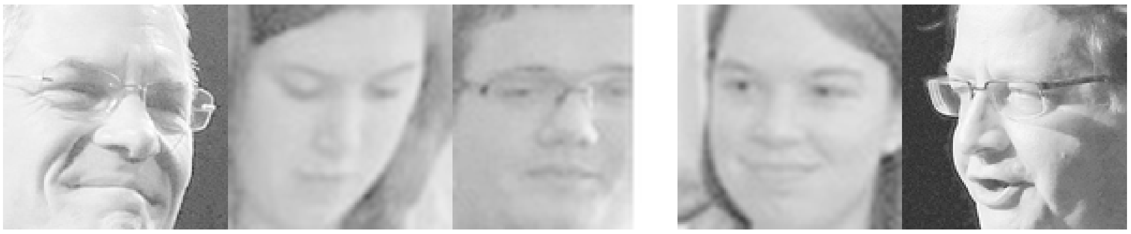


```
'Searching for mark'
```

```
'Results found in file a-0.png'
```



```
'Results found in file a-1.png'
```

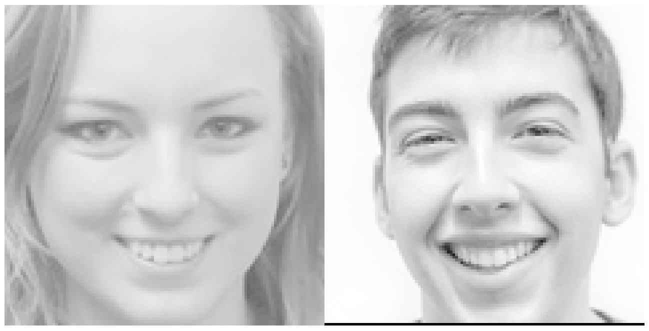


```
'Results found in file a-10.png'
```

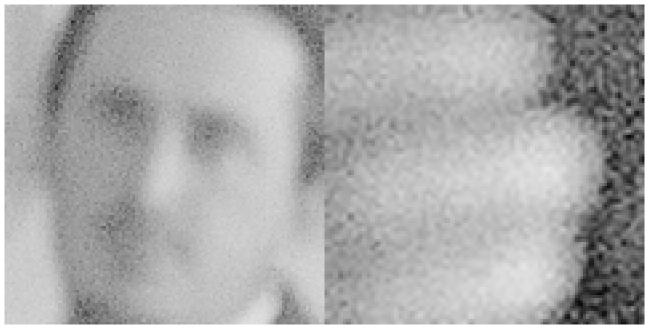
```
'No faces found.'
```

```
'Results found in file a-13.png'
```

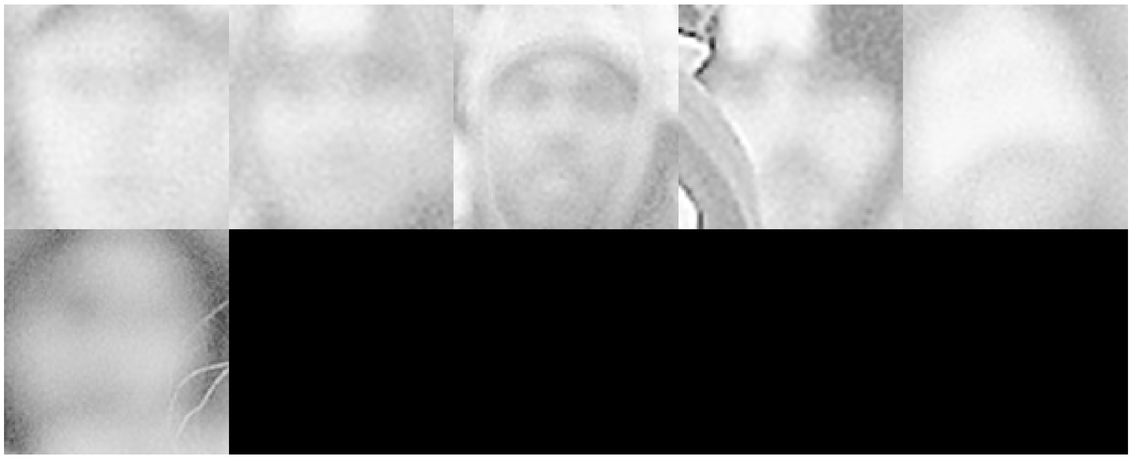
```
'Results found in file a-2.png'
```



```
'Results found in file a-3.png'
```



```
'Results found in file a-5.png'
```



```
'Results found in file a-8.png'
```

```
'No faces found.'
```

```
'Results found in file a-9.png'
```

```
Out[6]: ()
```

```
In [ ]:
```