Finding the edges with Canny

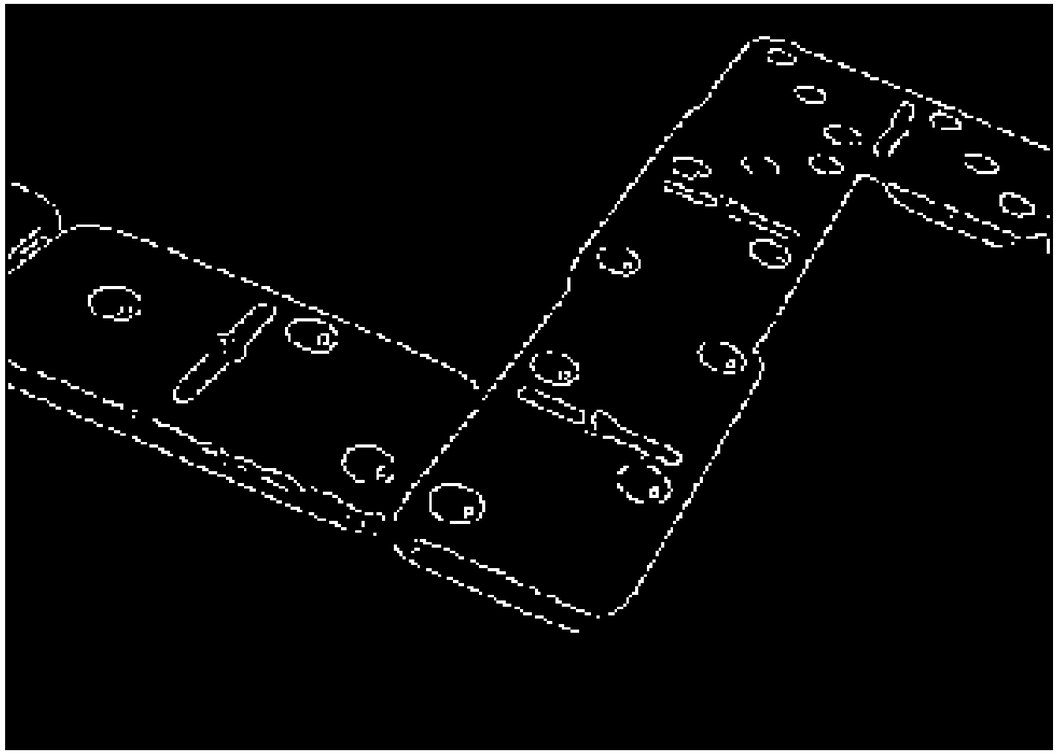
IMAGE PROCESSING IN PYTHON

Rebeca Gonzalez
Data Engineer

Detecting edges

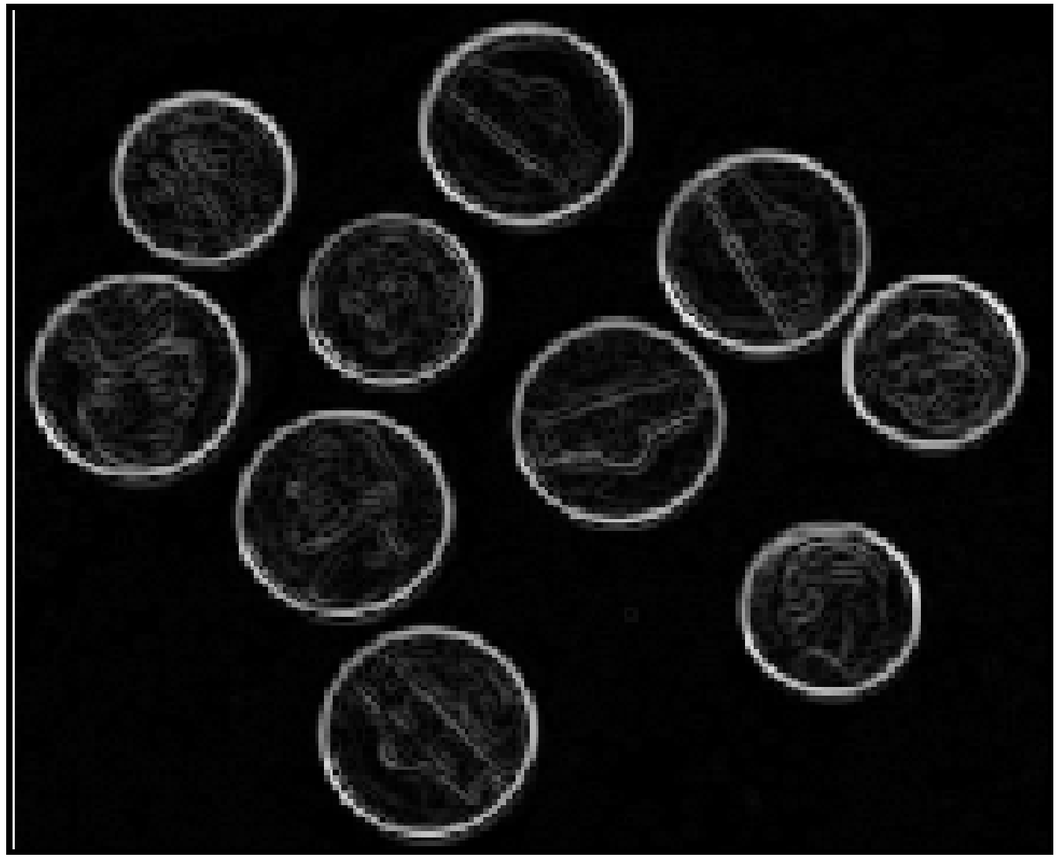
Original

Edges with Canny

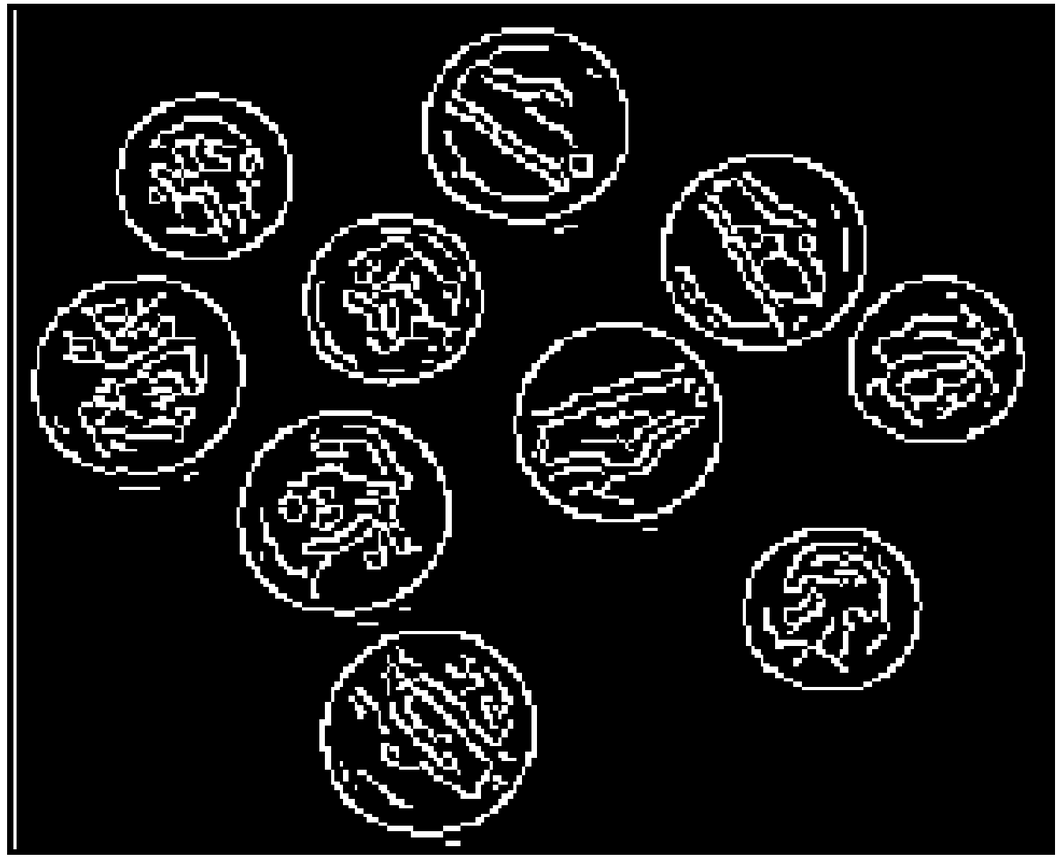


Edge detection

Edges with Sobel



Edges with Canny



Edge detection

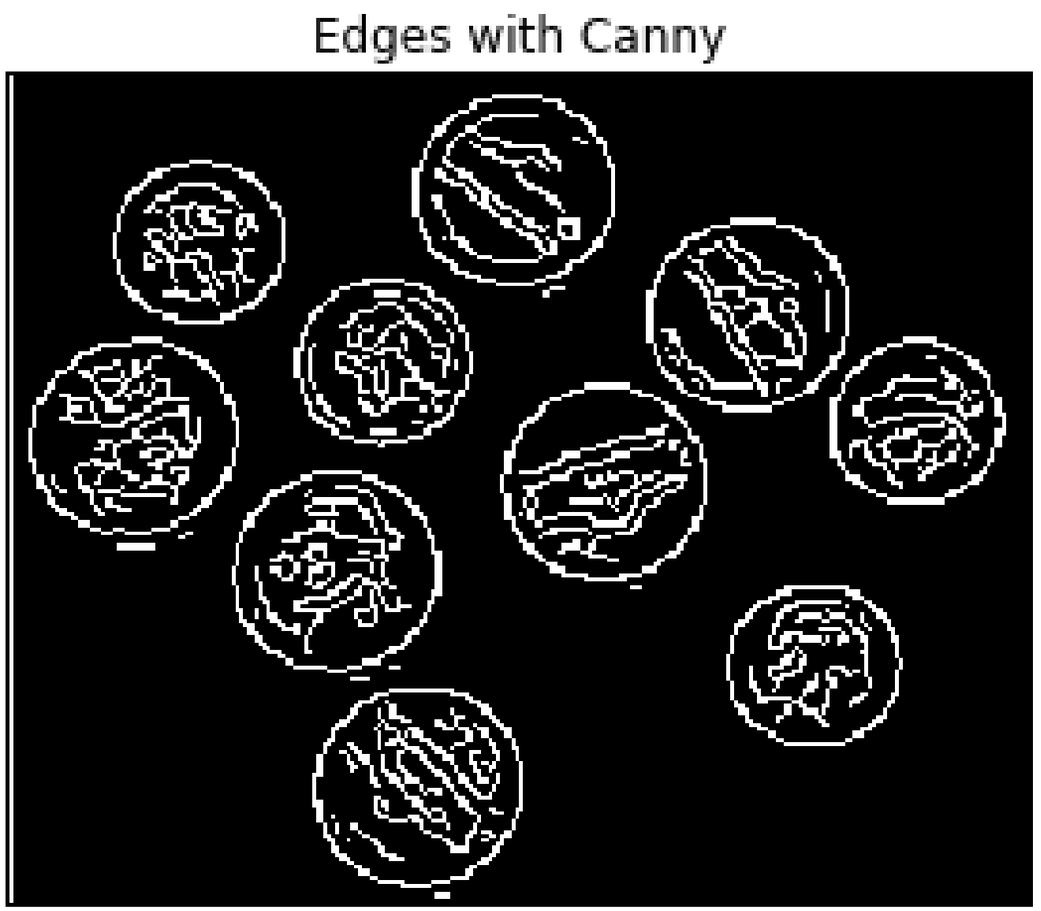
```
from skimage.feature import canny


# Convert image to grayscale
coins = color.rgb2gray(coins)


# Apply Canny detector
canny_edges = canny(coins)


# Show resulted image with edges
show_image(canny_edges, "Edges with Canny")
```

Edge detection



Canny edge detector

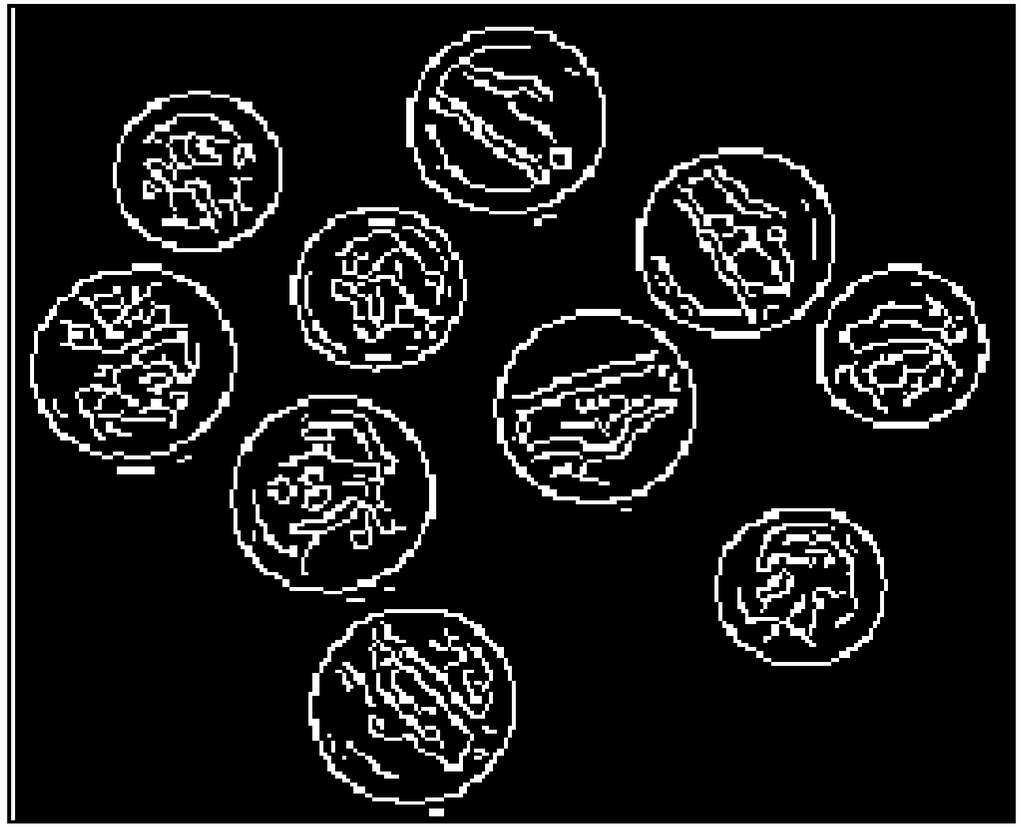
```
# Apply Canny detector with a sigma of 0.5
canny_edges_0_5 = canny(coins, sigma=0.5)


# Show resulted images with edges
show_image(canny_edges, "Sigma of 1")
show_image(canny_edges_0_5, "Sigma of 0.5")
```

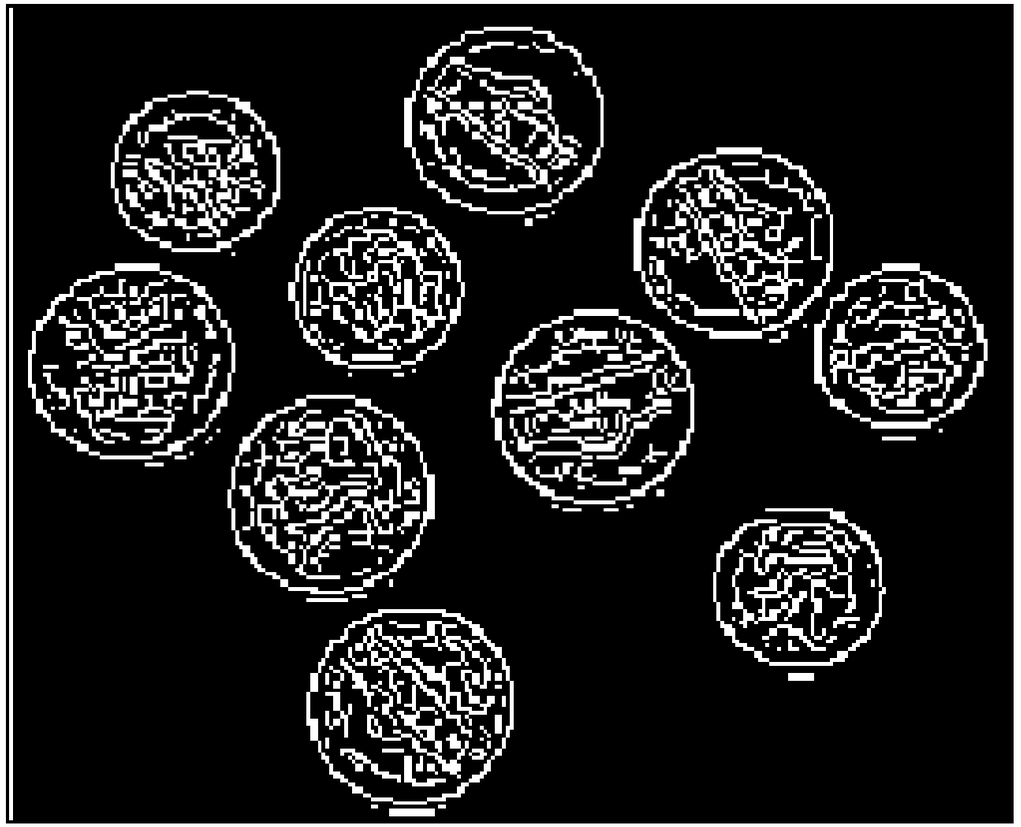
In the canny function you can optionally set the intensity of the Gaussian filter to be applied in the image, by using the sigma attribute. The lower the value of this sigma, the less of Gaussian filter effect is applied on the image, so it will spot more edges.

Canny edge detector

Sigma of 1



Sigma of 0.5



Let's practice!

IMAGE PROCESSING IN PYTHON

Right around the corner

IMAGE PROCESSING IN PYTHON

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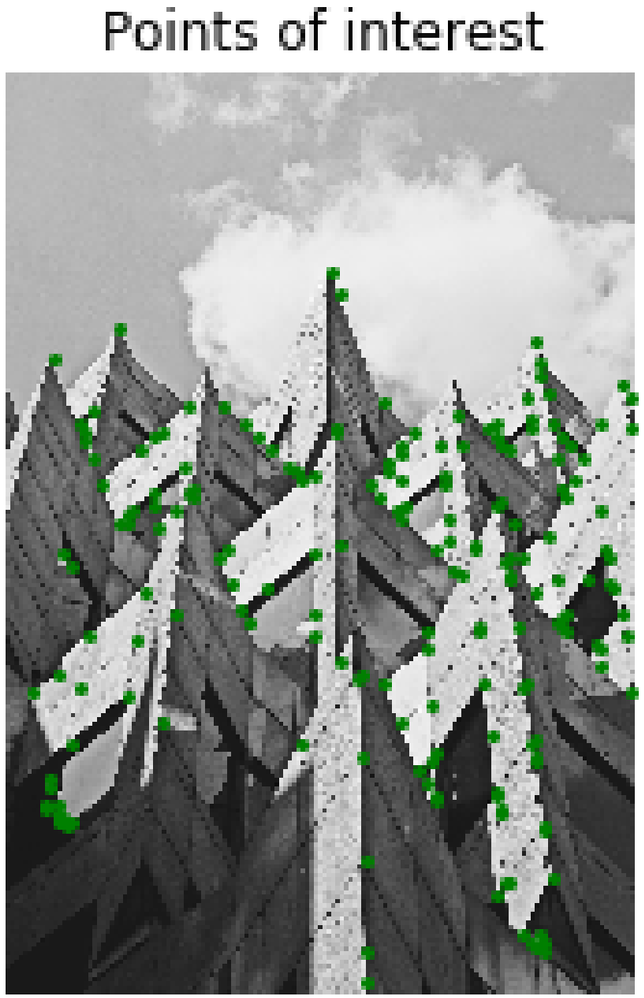
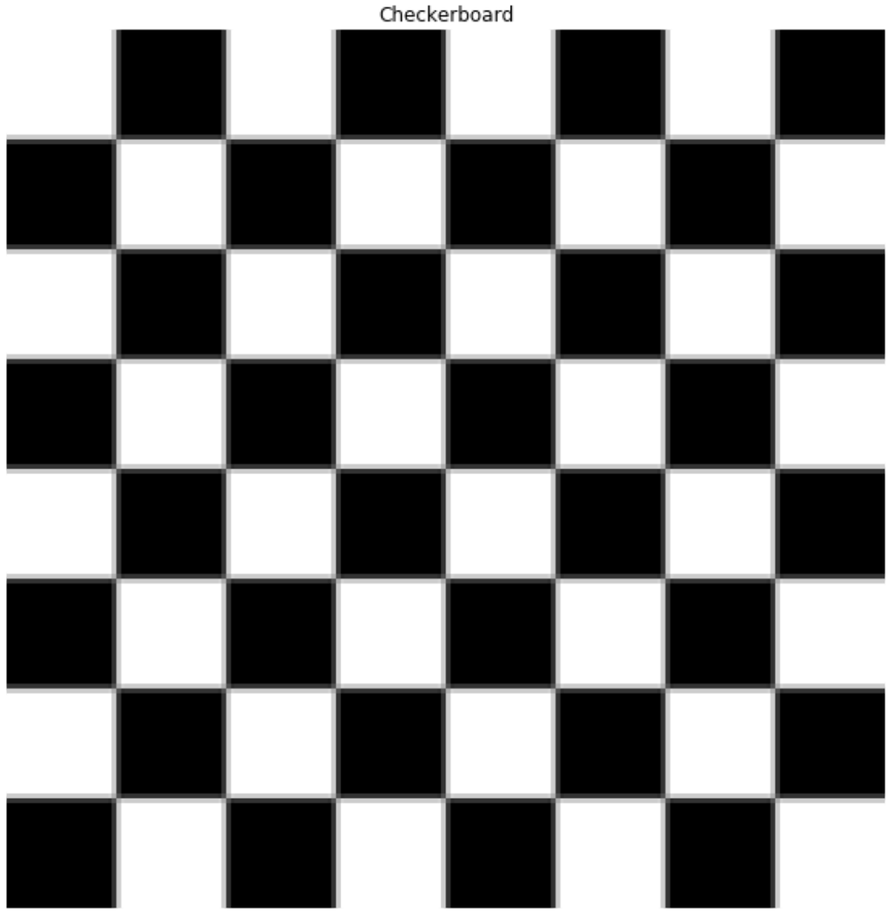
Corner detection

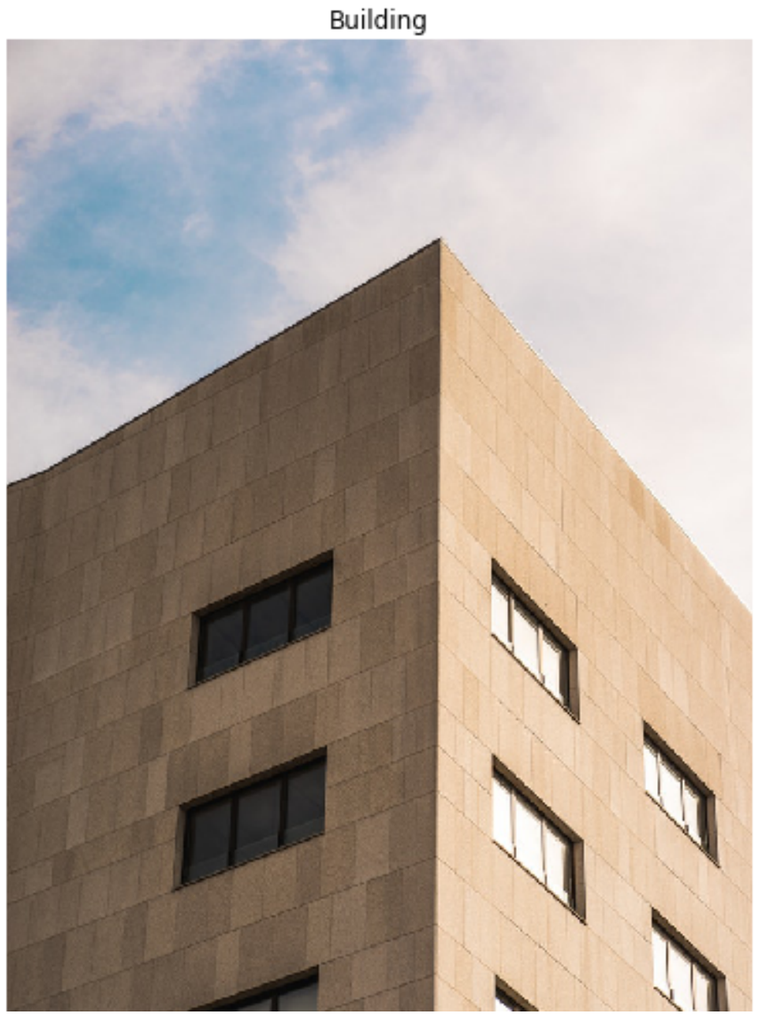
Points of interest

Features are the points of interest which provide rich image content information.
Points of interest are points in the image which are invariant to rotation, translation, intensity, and scale changes.

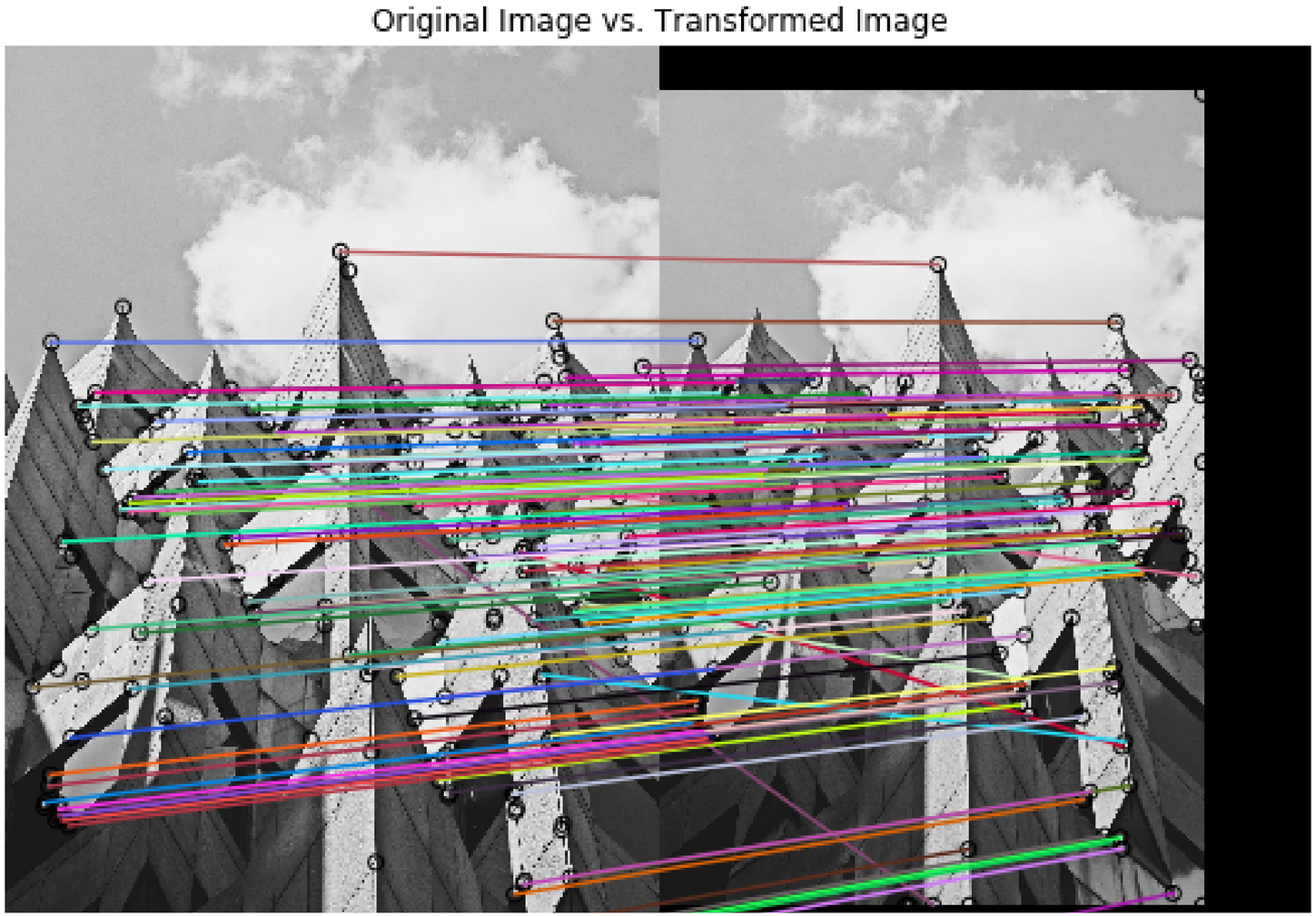


Corners

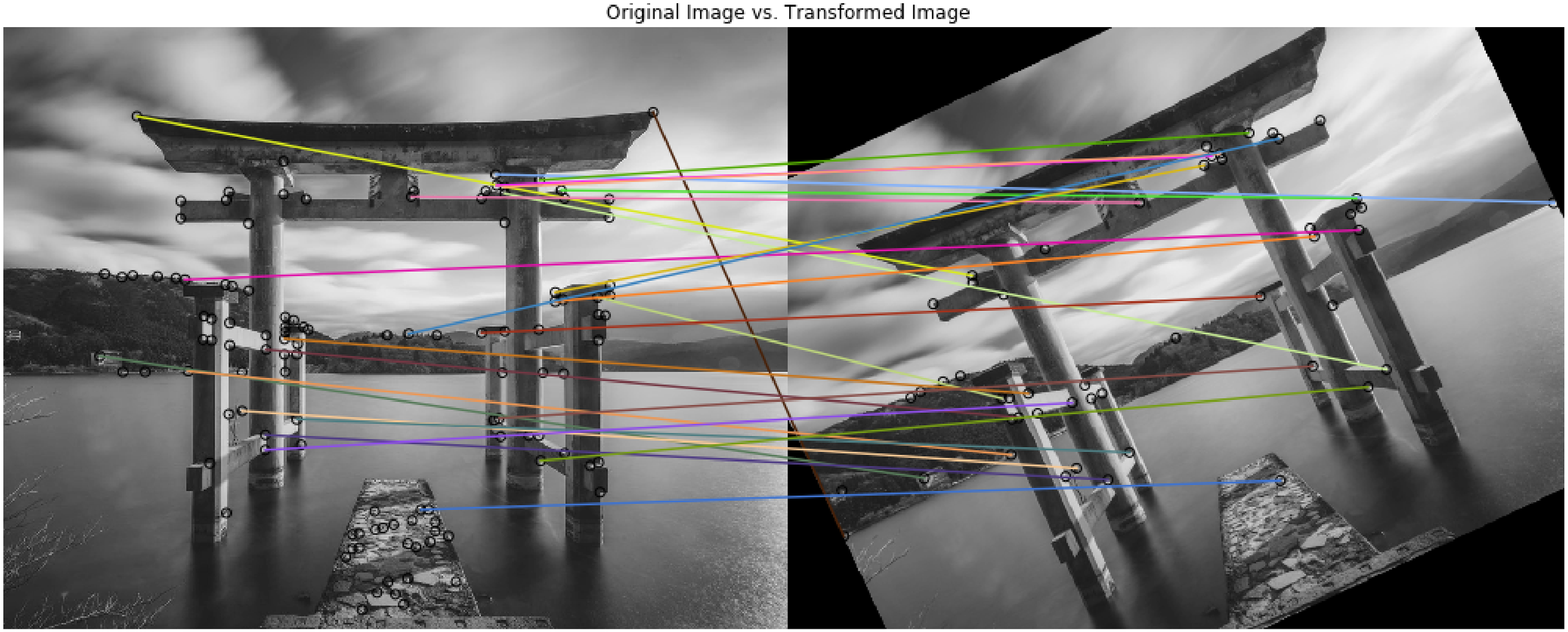




Matching corners

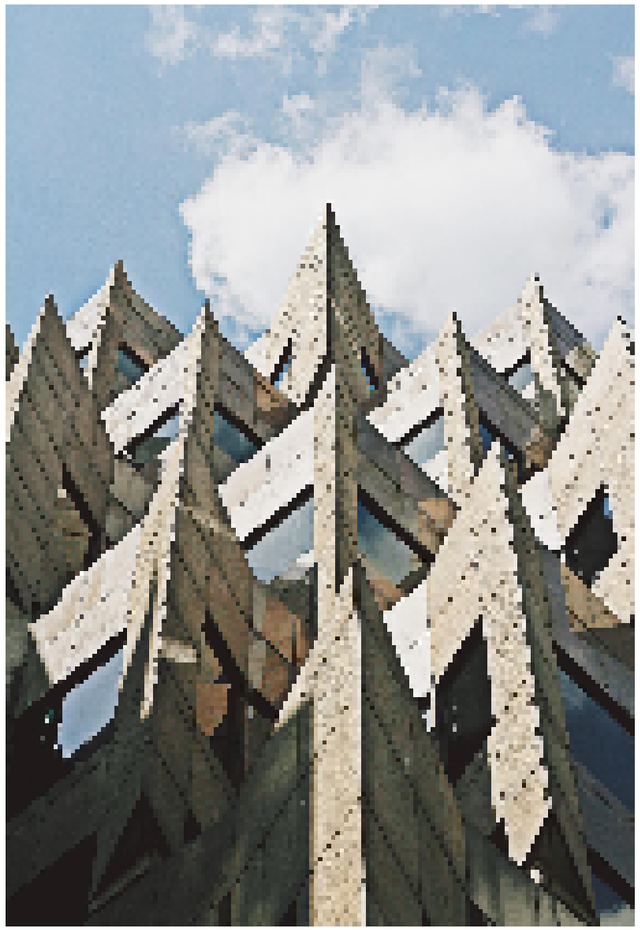


Matching corners

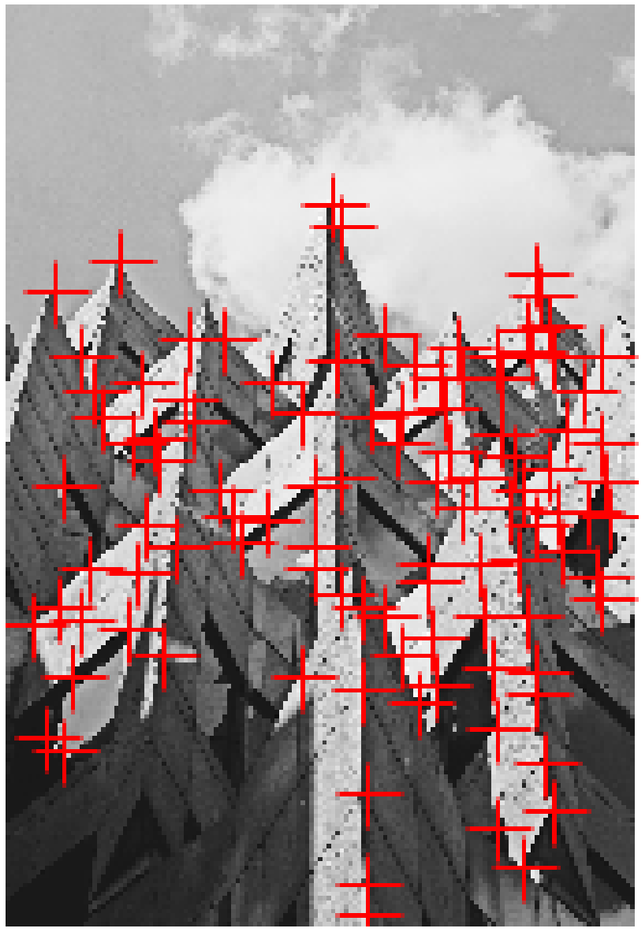


Harris corner detector

Original image



Corners detected



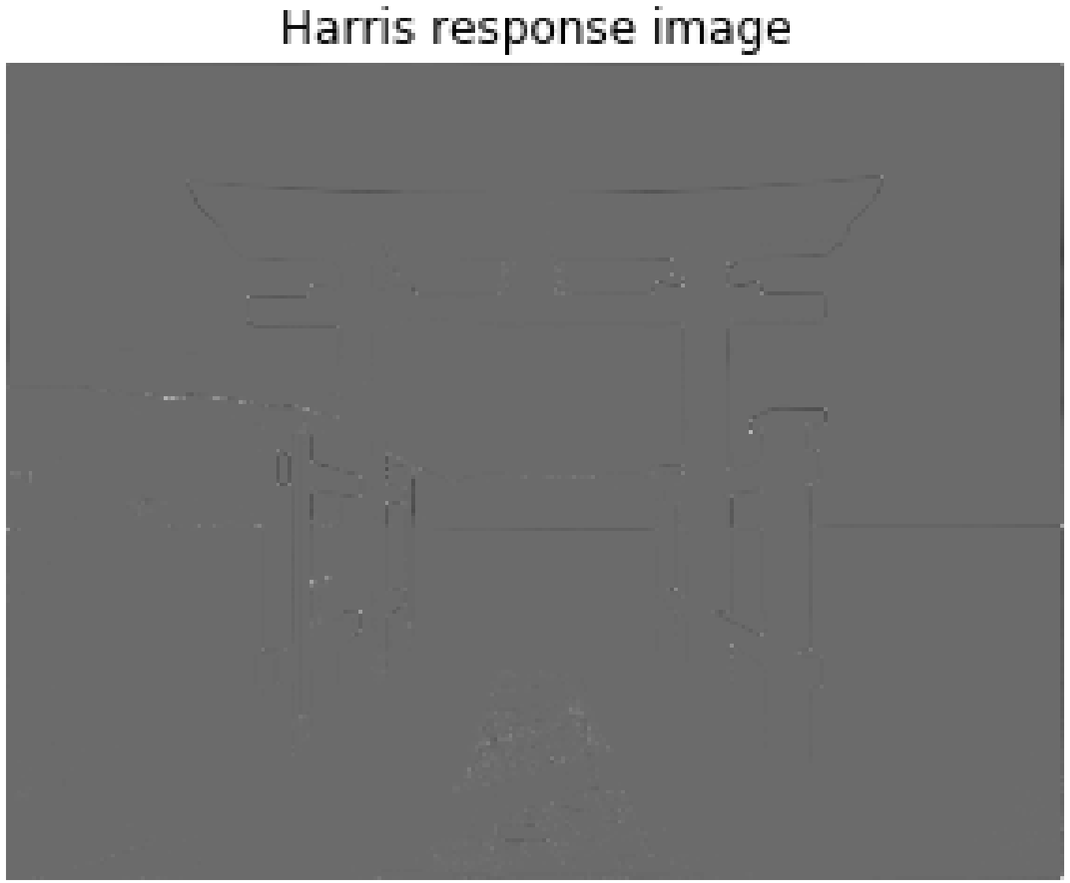
Harris corner detector

Harris corner detector

```
from skimage.feature import corner_harris

# Convert image to grayscale
image = rgb2gray(image)

# Apply the Harris corner detector on the image
measure_image = corner_harris(image)

# Show the Harris response image
show_image(measure_image)
```

Harris corner detector

We see how only some black lines are shown. These are the approximated points where the corners candidates are.



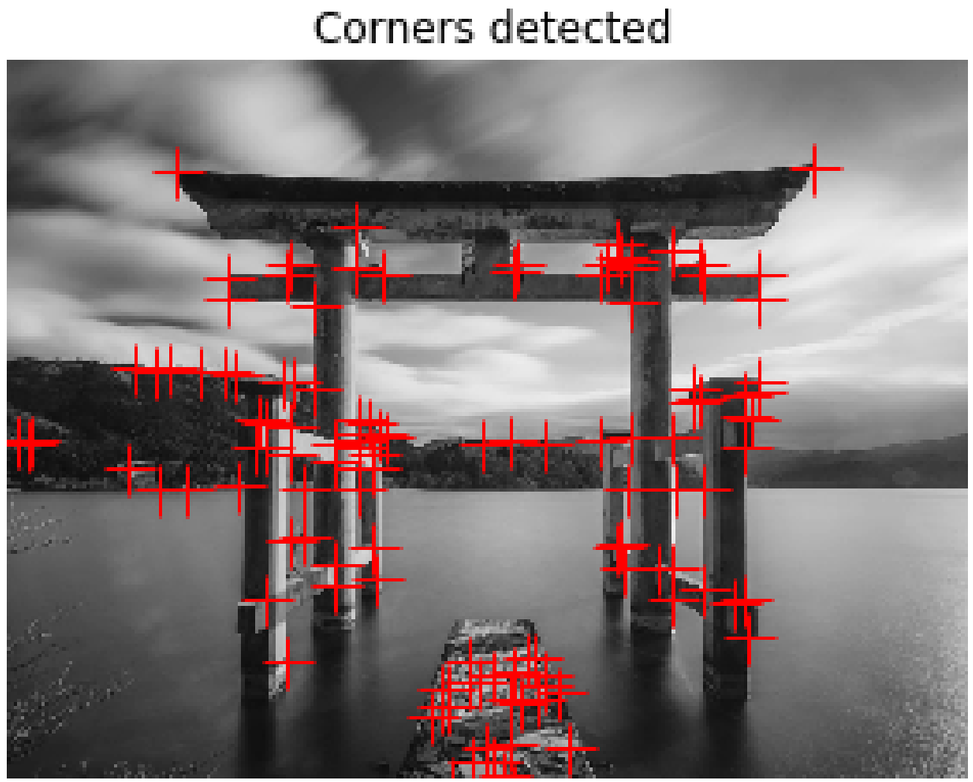
Harris corner detector

```
# Finds the coordinates of the corners
coords = corner_peaks(corner_harris(image), min_distance=5)
                                                    make sure these peak corners are separated

print("A total of", len(coords), "corners were detected.")
```

```
A total of 122 corners were found from measure response image.
```

Corners detected

```
# Show image with marks in detected corners
show_image_with_detected_corners(image, coords)
```



Show image with contours

```
def show_image_with_corners(image, coords, title="Corners detected"):
    plt.imshow(image, interpolation='nearest', cmap='gray')
    plt.title(title)
    plt.plot(coords[:, 1], coords[:, 0], '+r', markersize=15)
    plt.axis('off')
    plt.show()
```

Let's practice!

IMAGE PROCESSING IN PYTHON

Face detection

IMAGE PROCESSING IN PYTHON

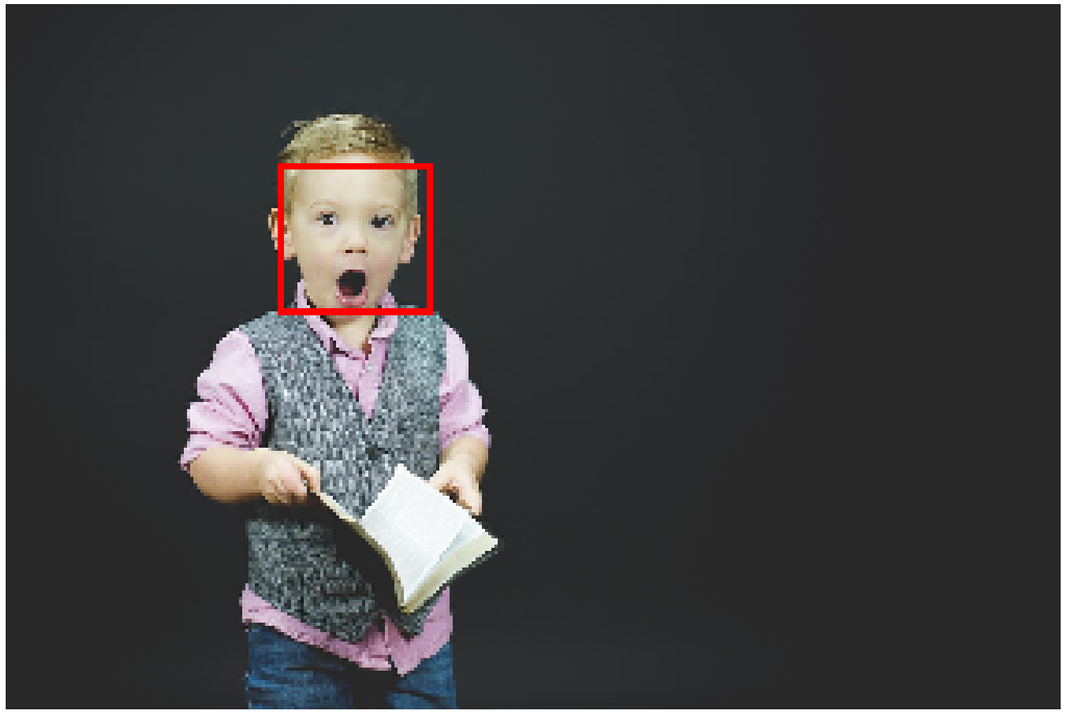
Rebeca Gonzalez
Data Engineer

Face detection use cases

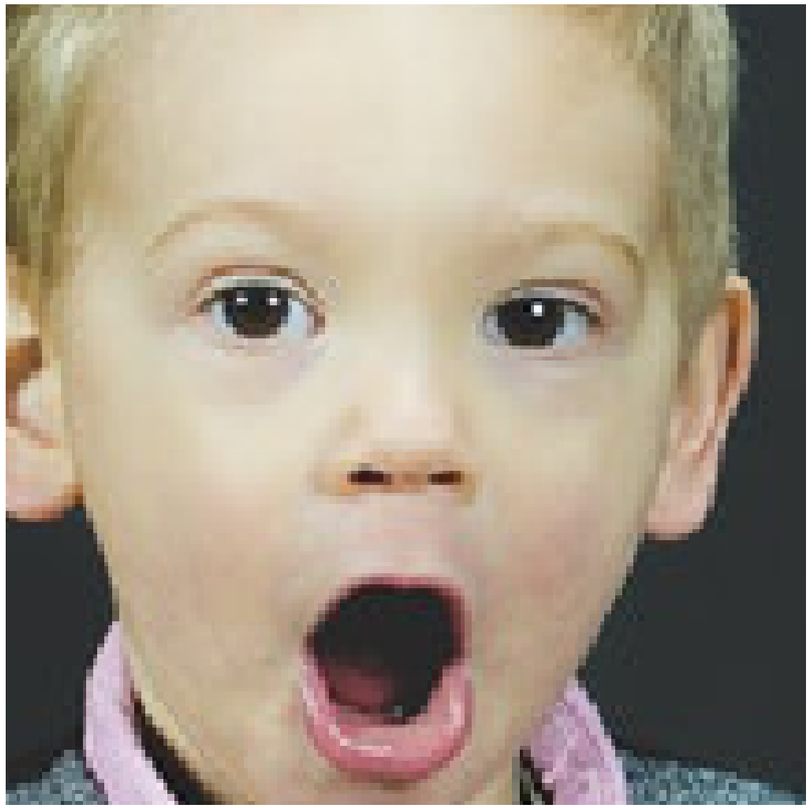
- Filters
- Auto focus
- Recommendations
- Blur for privacy protection
- To recognize emotions later on

Detecting faces with scikit-image

Face image



Face detected



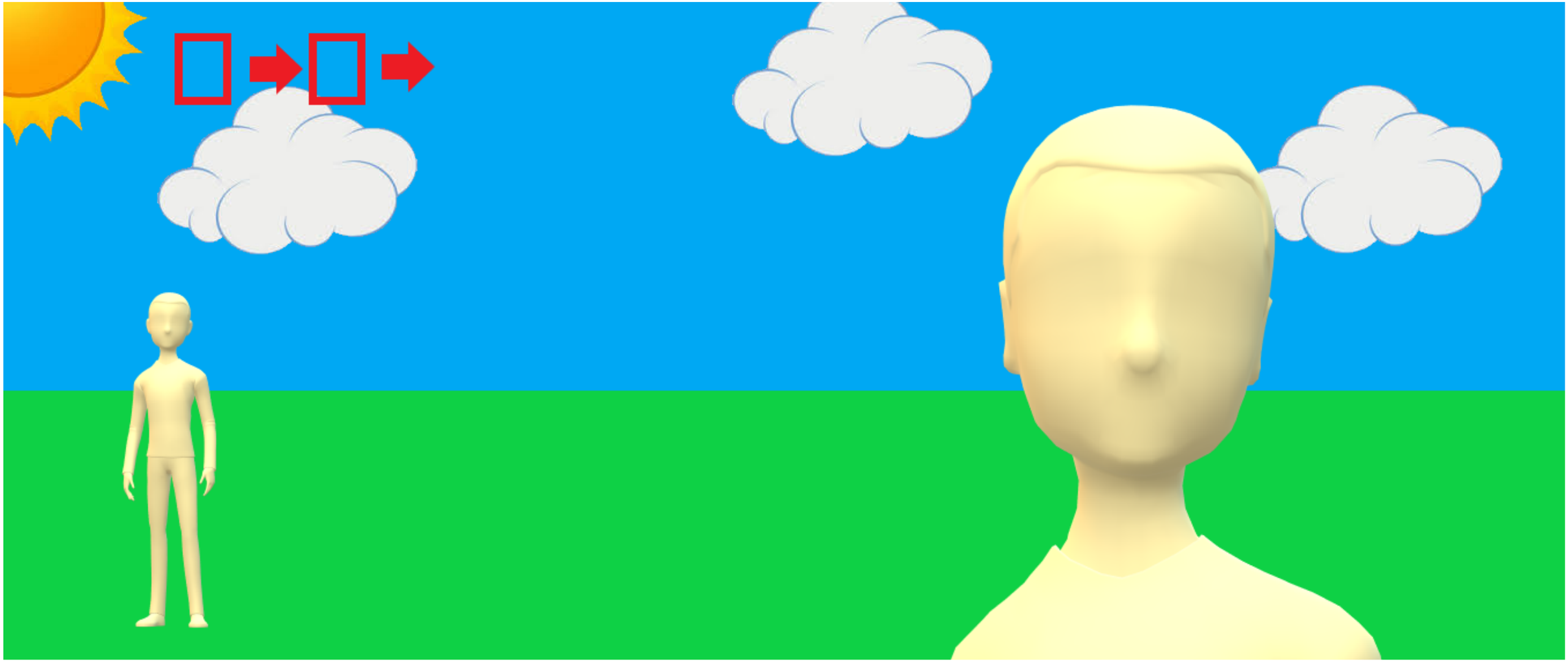
Detecting faces with scikit-image

```
# Import the classifier class
from skimage.feature import Cascade


# Load the trained file from the module root.
trained_file = data.lbp_frontal_face_cascade_filename()


# Initialize the detector cascade.
detector = Cascade(trained_file)
```

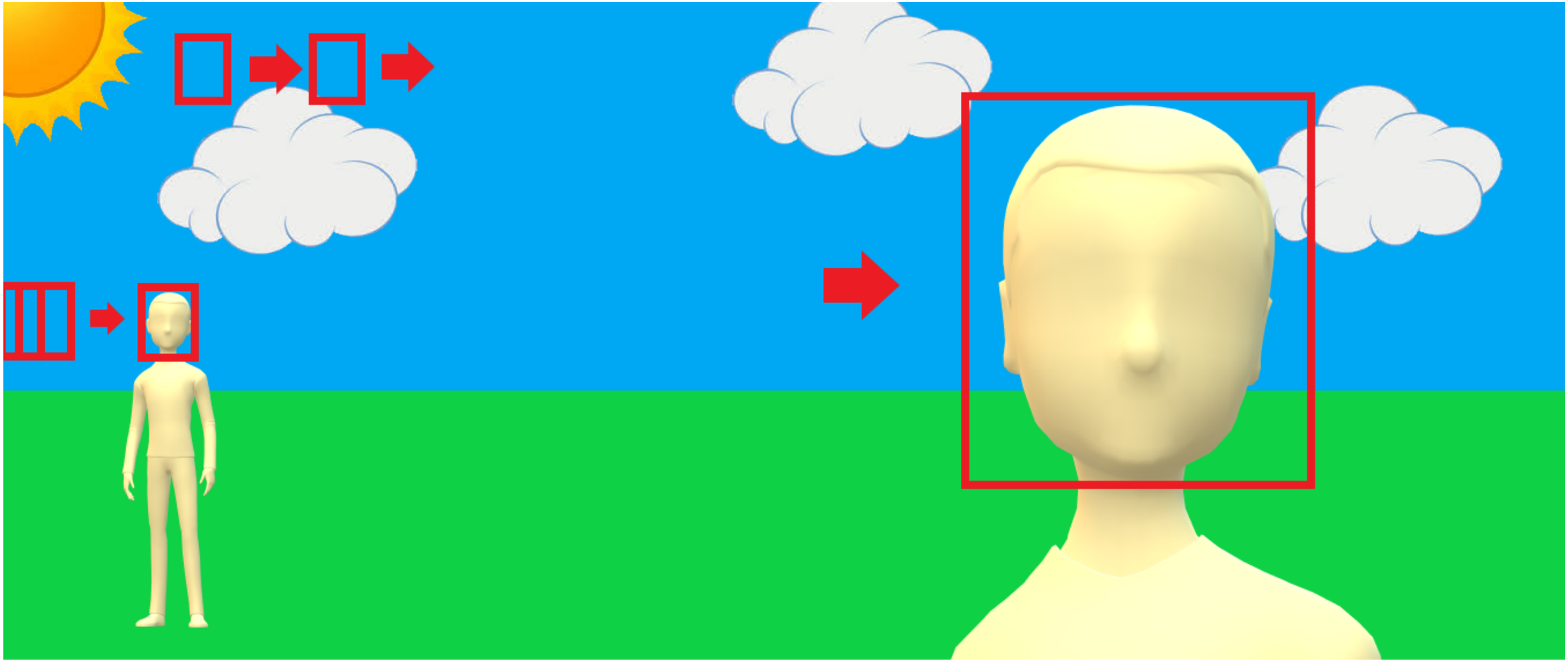
This detection framework needs an xml file, from which the trained data can be read.

Let's try it

Detecting faces



Detecting faces



Detecting faces

```
# Apply detector on the image
detected = detector.detect_multi_scale(img=image,
                                       scale_factor=1.2,
                                       step_ratio=1,
                                       min_size=(10, 10),
                                       max_size=(200, 200))
```

by which the searching window is multiplied in each step

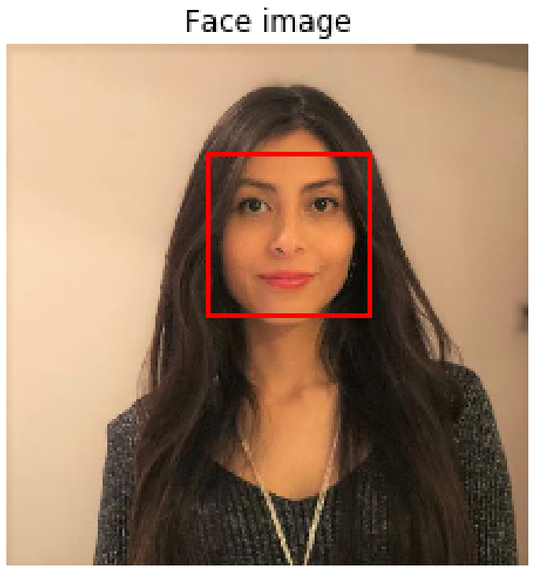
1 represents an exhaustive search and usually is slow
By setting this parameter to higher values, the results will be worse but the computation will be much faster.

This method searches for the object, in this case a face.
It creates a window that will be moving through the image until it finds something similar to a human face.
Searching happens on multiple scales.
The window will have a minimum size, to spot the small or far-away faces. And a maximum size to also find the larger faces in the image.

Detected faces

```
print(detected)

# Show image with detected face marked
show_detected_face(image, detected)
```

```
Detected face: [{'r': 115, 'c': 210, 'width': 167, 'height': 167}]
```



Show detected faces

```
def show_detected_face(result, detected, title="Face image"):
    plt.imshow(result)
    img_desc = plt.gca()
    plt.set_cmap('gray')
    plt.title(title)
    plt.axis('off')

    for patch in detected:
        img_desc.add_patch(
            patches.Rectangle(
                (patch['c'], patch['r']),
                patch['width'],
                patch['height'],
                fill=False,color='r',linewidth=2)
        )
    plt.show()
```

Let's practice!

IMAGE PROCESSING IN PYTHON

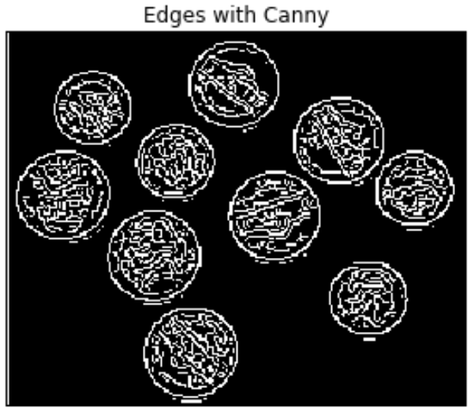
Real-world applications

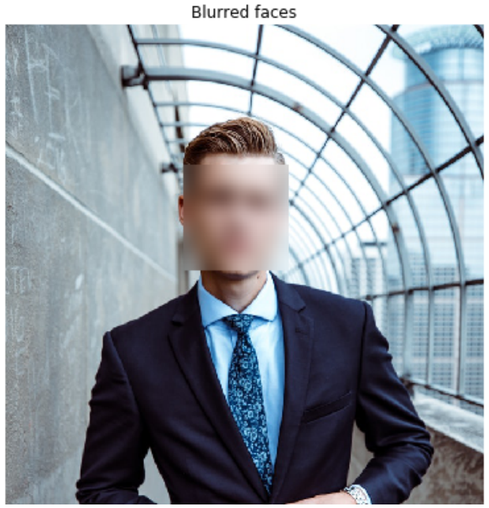
IMAGE PROCESSING IN PYTHON

Rebeca Gonzalez
Data engineer

Applications

- Turning to grayscale before detecting edges/corners
- Reducing noise and restoring images
- Blurring faces detected
- Approximation of objects' sizes





Privacy protection

Privacy protection

```
# Import Cascade of classifiers and gaussian filter
from skimage.feature import Cascade

from skimage.filters import gaussian
```

Privacy protection

```
# Detect the faces
detected = detector.detect_multi_scale(img=image,
                                       scale_factor=1.2, step_ratio=1,
                                       min_size=(50, 50), max_size=(100, 100))

# For each detected face
for d in detected:
    # Obtain the face cropped from detected coordinates
    face = getFace(d)
```

Privacy protection

```
def getFace(d):
    ''' Extracts the face rectangle from the image using the
    coordinates of the detected.'''
    # X and Y starting points of the face rectangle
    x, y  = d['r'], d['c']

    # The width and height of the face rectangle
    width, height = d['r'] + d['width'],  d['c'] + d['height']

    # Extract the detected face
    face= image[x:width, y:height]
    return face
```

Privacy protection

```
# Detect the faces
detected = detector.detect_multi_scale(img=image,
                                       scale_factor=1.2, step_ratio=1,
                                       min_size=(50, 50), max_size=(100, 100))

# For each detected face
for d in detected:
    # Obtain the face cropped from detected coordinates
    face = getFace(d)

    # Apply gaussian filter to extracted face
    gaussian_face = gaussian(face, multichannel=True, sigma = 10)

    # Merge this blurry face to our final image and show it
    resulting_image = mergeBlurryFace(image, gaussian_face)
```

Privacy protection

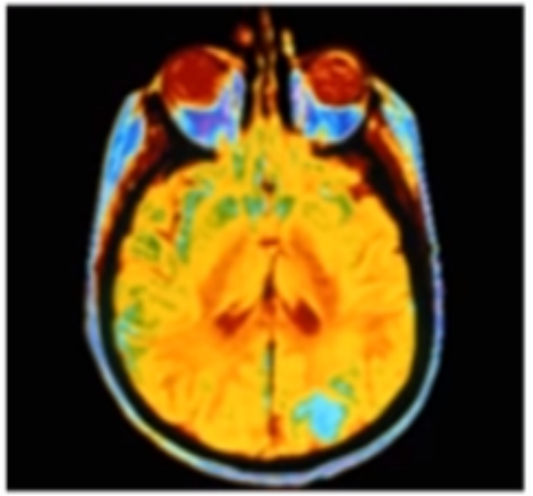
```
def mergeBlurryFace(original, gaussian_image):
    # X and Y starting points of the face rectangle
    x, y  = d['r'], d['c']
    # The width and height of the face rectangle
    width, height = d['r'] + d['width'],  d['c'] + d['height']

    original[ x:width, y:height] =  gaussian_image
    return original
```

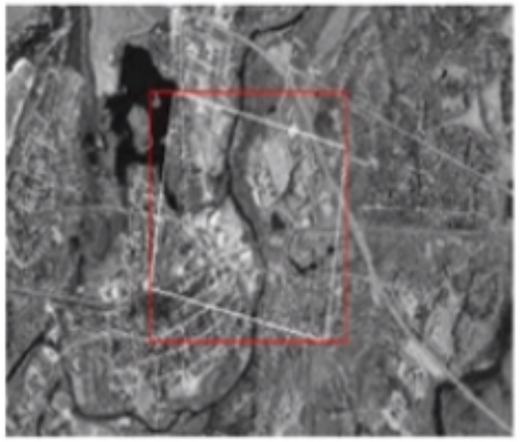
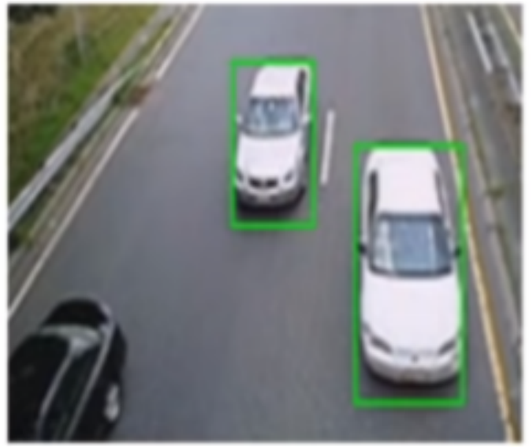
Privacy protection

Blurred faces

More cases





Let's practice!

IMAGE PROCESSING IN PYTHON

Amazing work!

IMAGE PROCESSING IN PYTHON

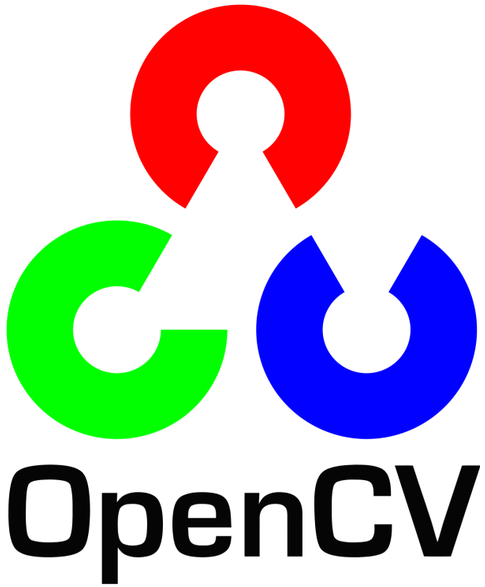
Rebeca Gonzalez
Data Engineer

Recap: What you have learned

- Improved contrast
- Restored images
- Applied filters
- Rotated, flipped and resized!
- Segmented: supervised and unsupervised
- Applied morphological operators
- Created and reduced noise
- Detected edges, corners and faces
- And mixed them up to solve problems!

What's next?

- Tinting gray scale images
- Matching
- Approximation
- Many others!



Congrats!

IMAGE PROCESSING IN PYTHON