Image restoration

IMAGE PROCESSING IN PYTHON

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datacamp

Restore an image

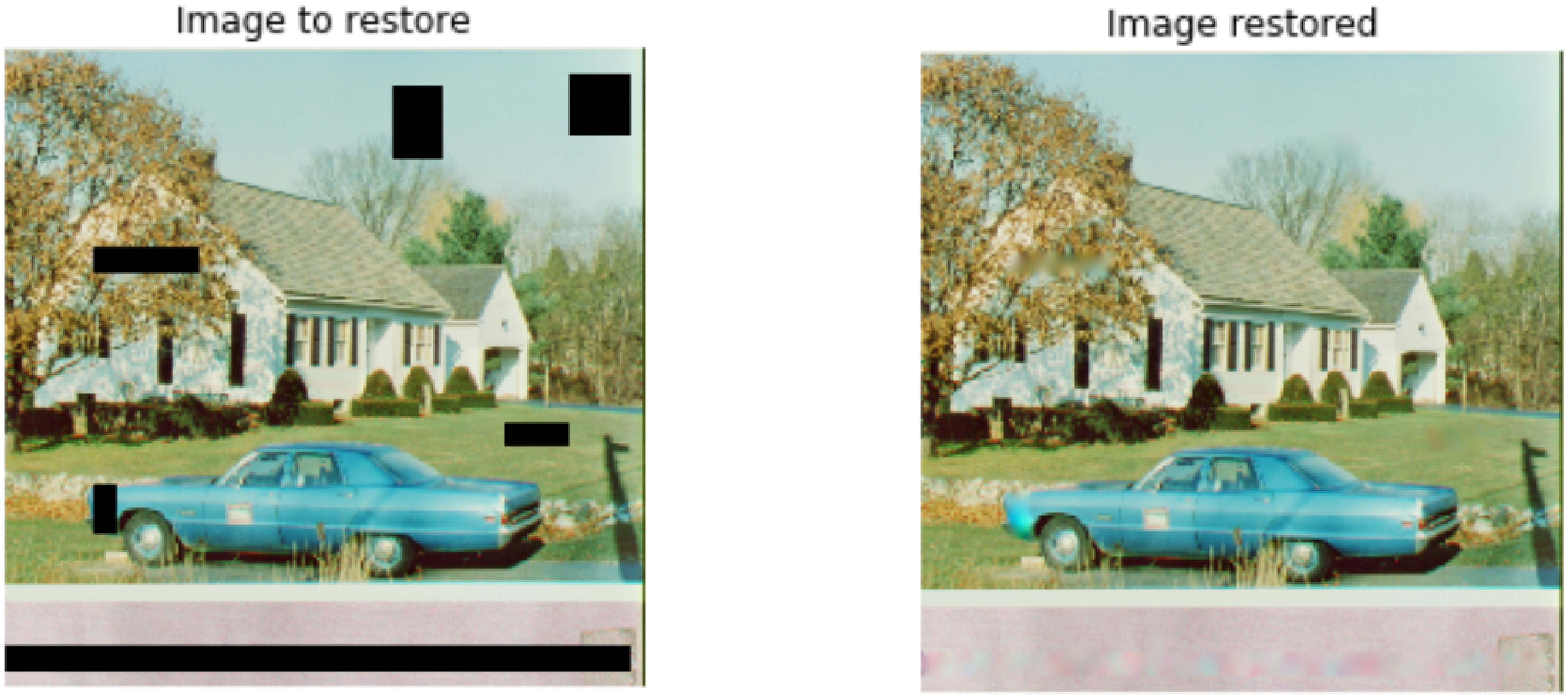


Image to restore

Image restored

Image reconstruction

- Fixing damaged images
- Text removing
- Logo removing
- Object removing

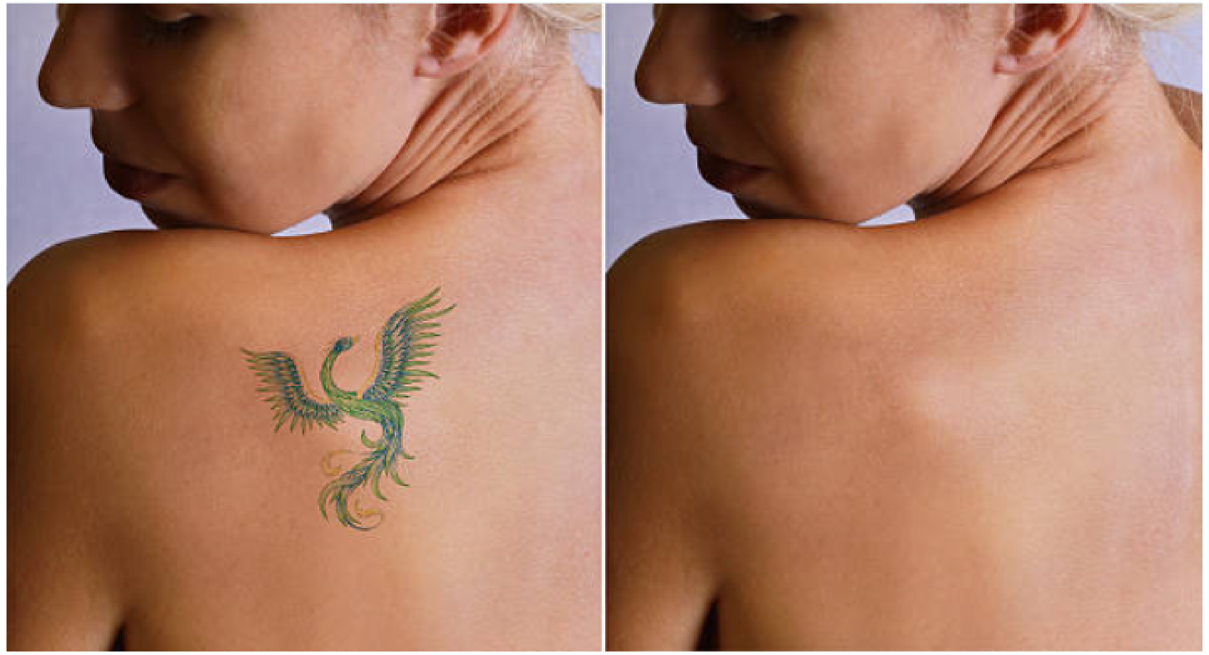


Image reconstruction

Inpainting

- Reconstructing lost parts of images
- Looking at the non-damaged regions

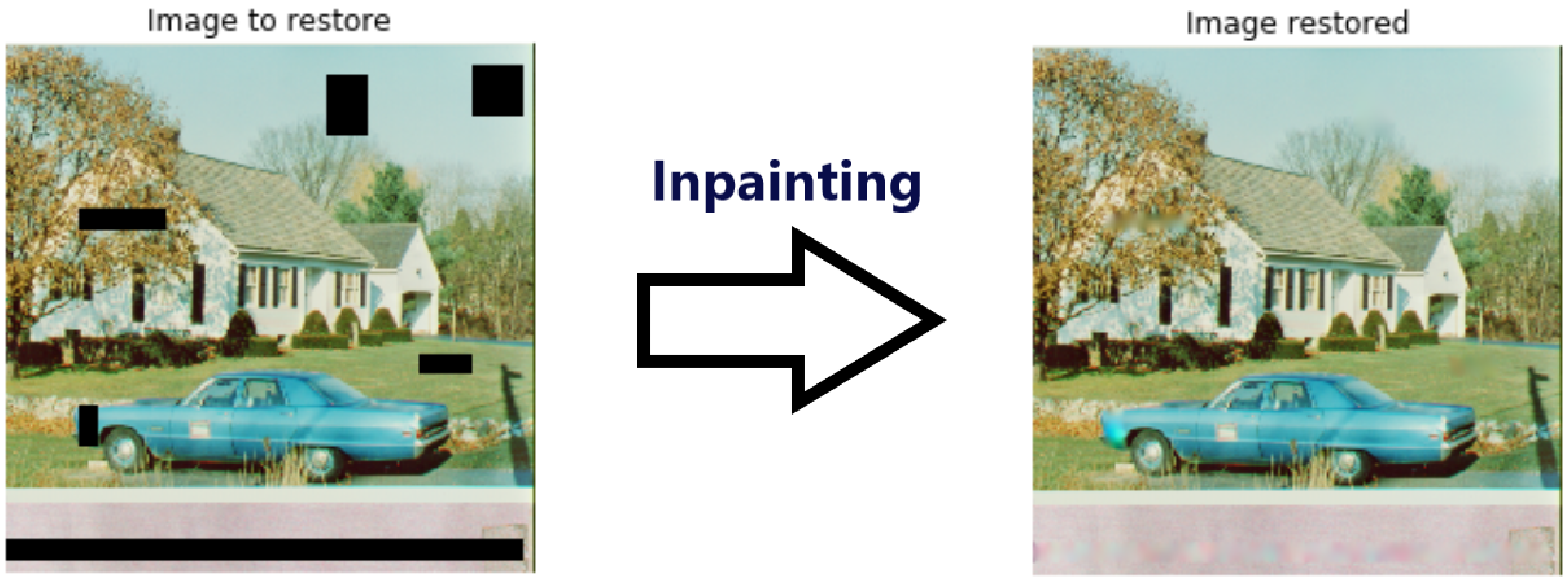
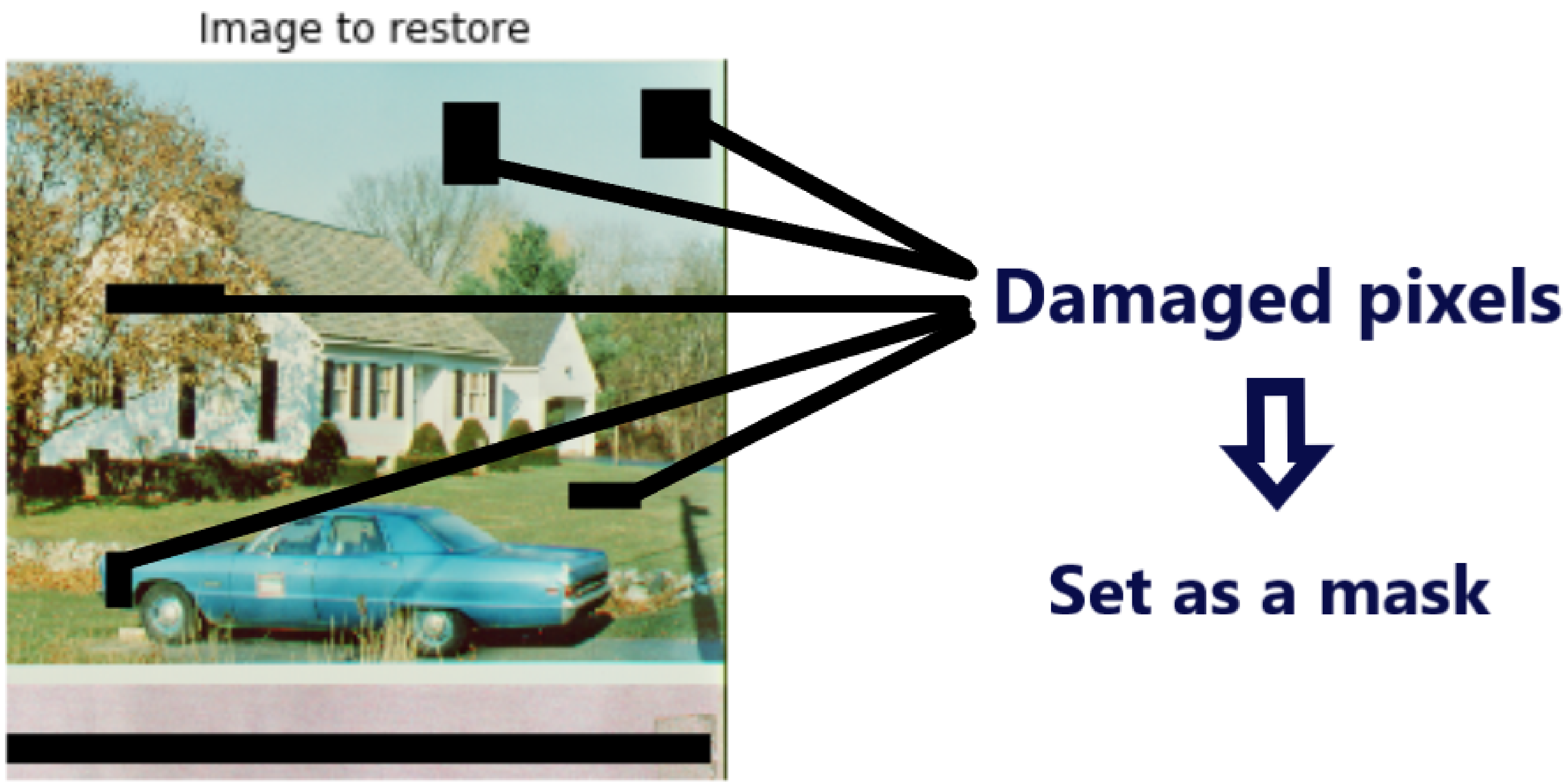


Image reconstruction



Damaged pixels

⇩

Set as a mask

Image reconstruction in scikit-image

```
from skimage.restoration import inpaint

# Obtain the mask
mask = get_mask(defect_image)

# Apply inpainting to the damaged image using the mask
restored_image = inpaint.inpaint_biharmonic(defect_image,
                                            mask,
                                            multichannel=True)


# Show the resulting image
show_image(restored_image)
```

Image reconstruction in scikit-image

```
# Show the defect and resulting images
show_image(defect_image, 'Image to restore')
show_image(restored_image, 'Image restored')
```

Image to restore

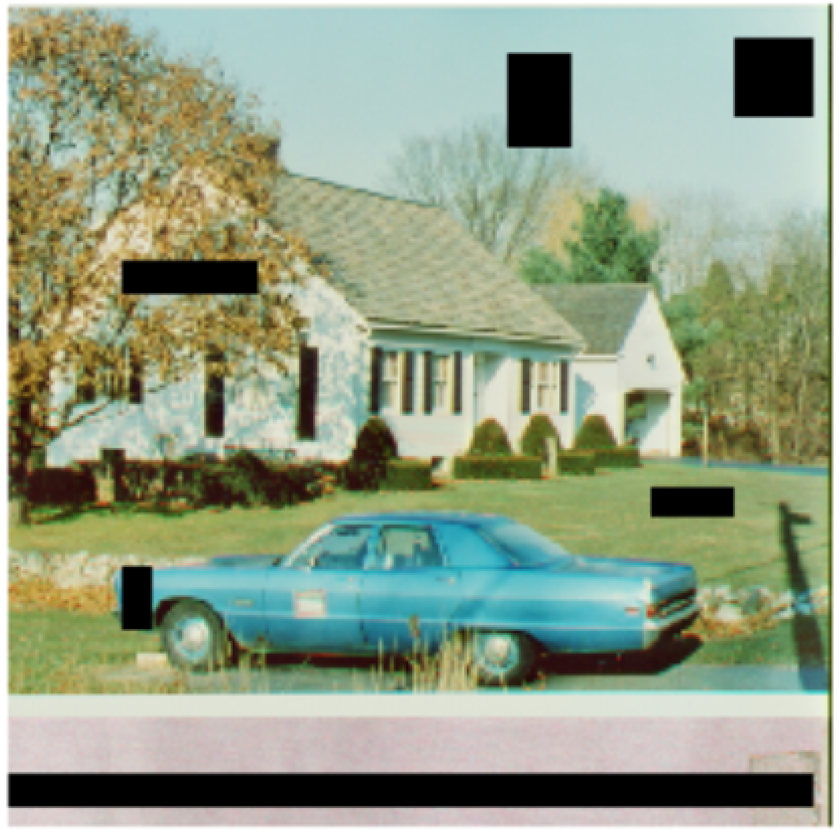
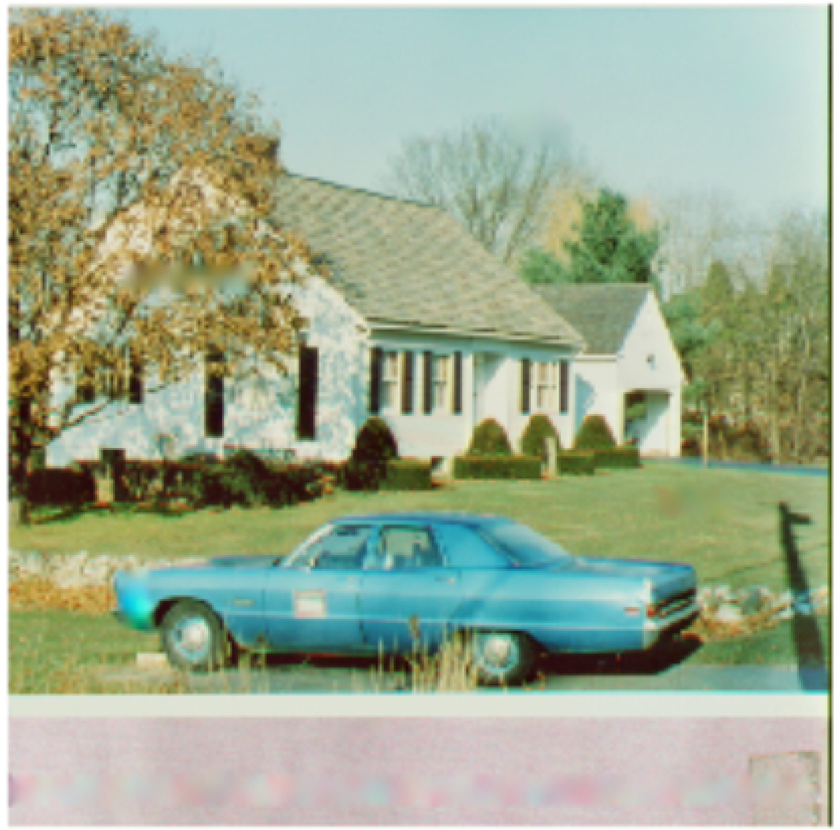


Image restored



Masks

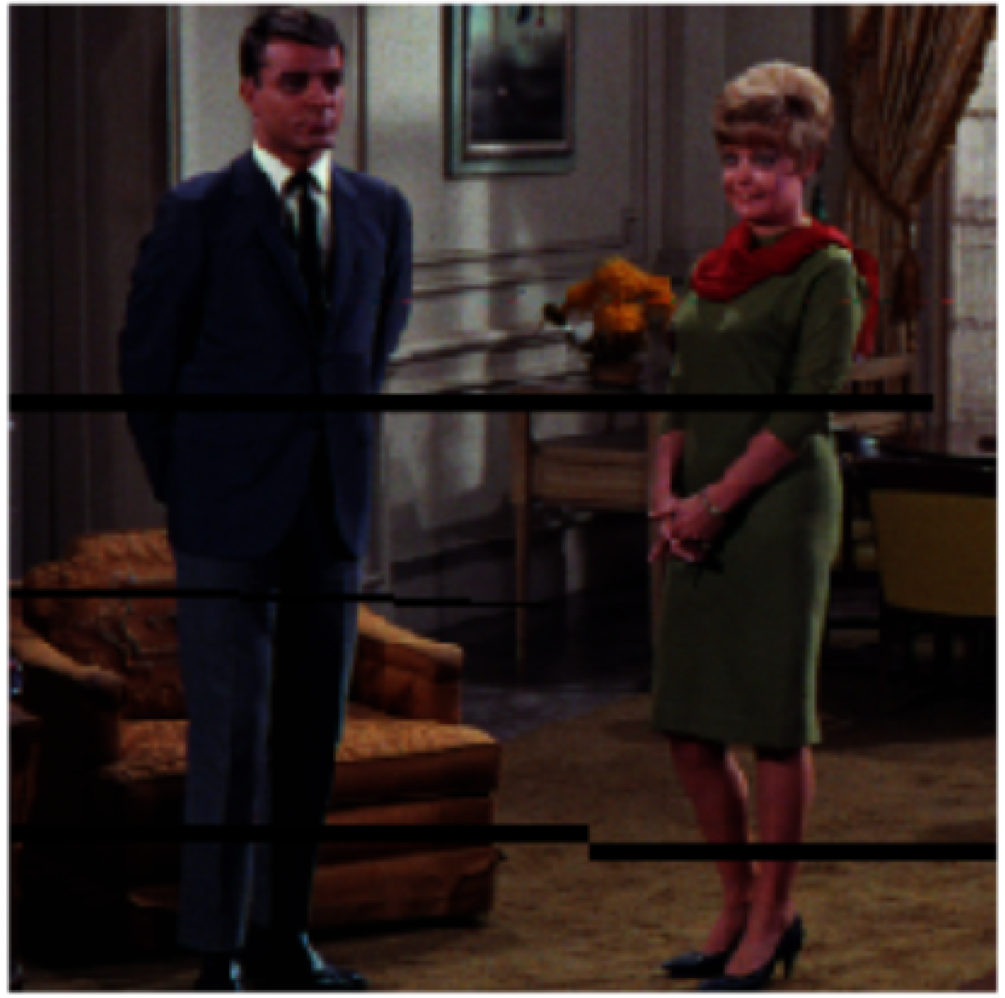
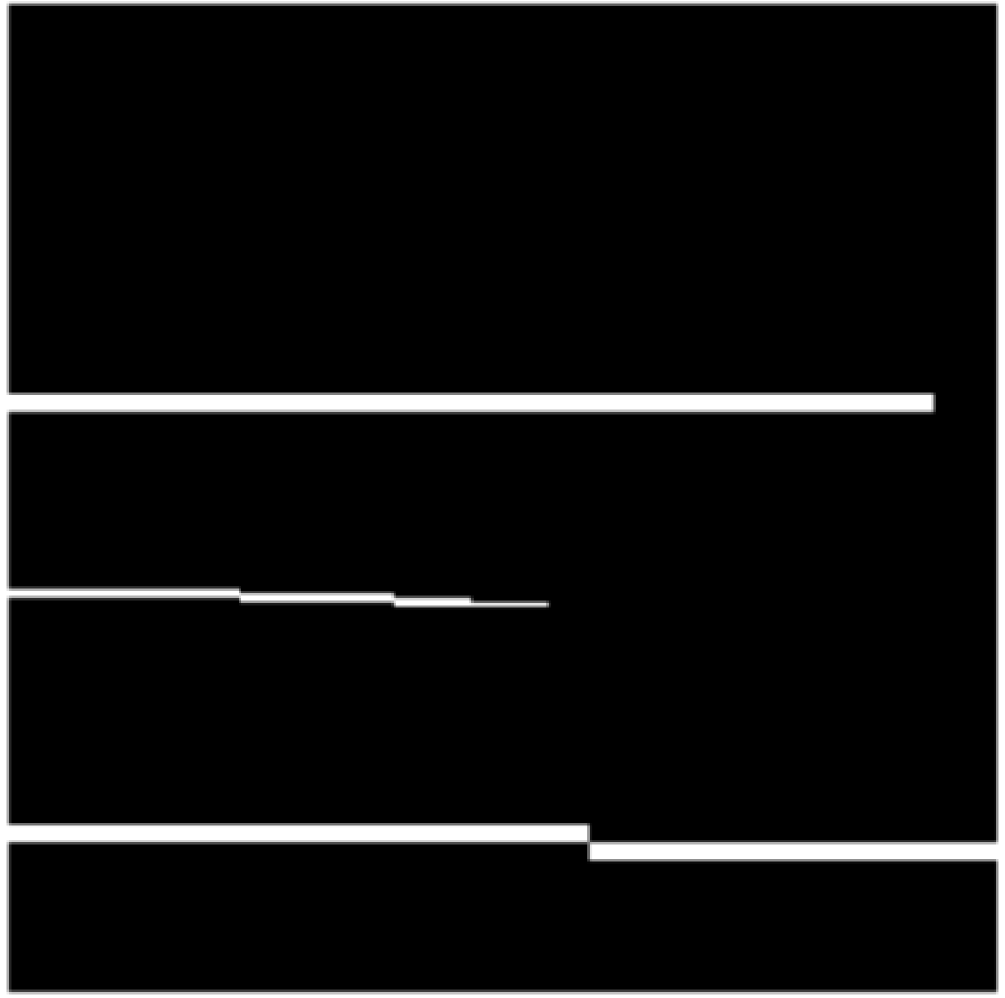


Image to restore



Mask

Masks

```python
def get_mask(image):
    ''' Creates mask with three defect regions '''
    mask = np.zeros(image.shape[:-1])

    mask[101:106, 0:240] = 1

    mask[152:154, 0:60] = 1
    mask[153:155, 60:100] = 1
    mask[154:156, 100:120] = 1
    mask[155:156, 120:140] = 1

    mask[212:217, 0:150] = 1
    mask[217:222, 150:256] = 1
    return mask
```

Let's practice!

IMAGE PROCESSING IN PYTHON

Noise

IMAGE PROCESSING IN PYTHON

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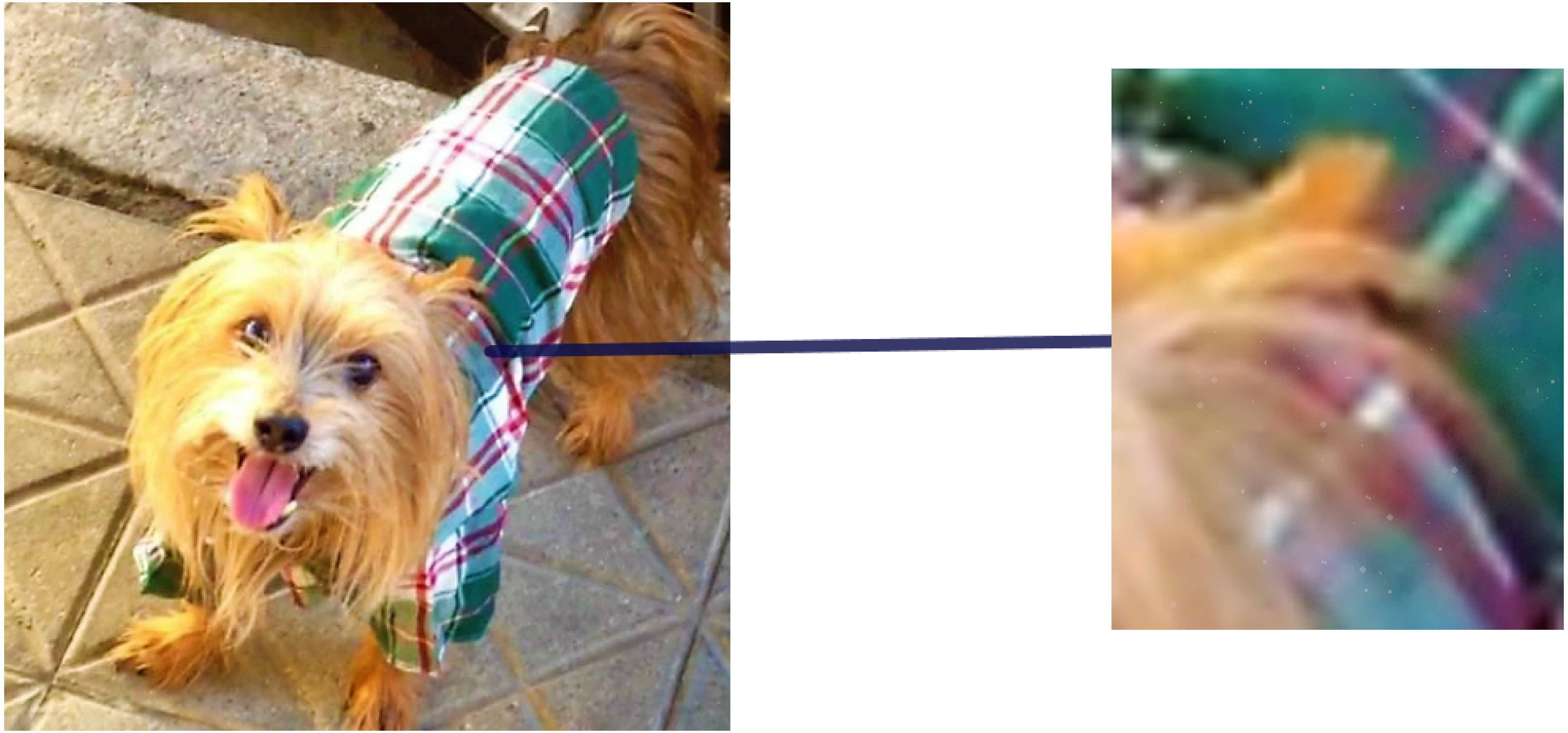
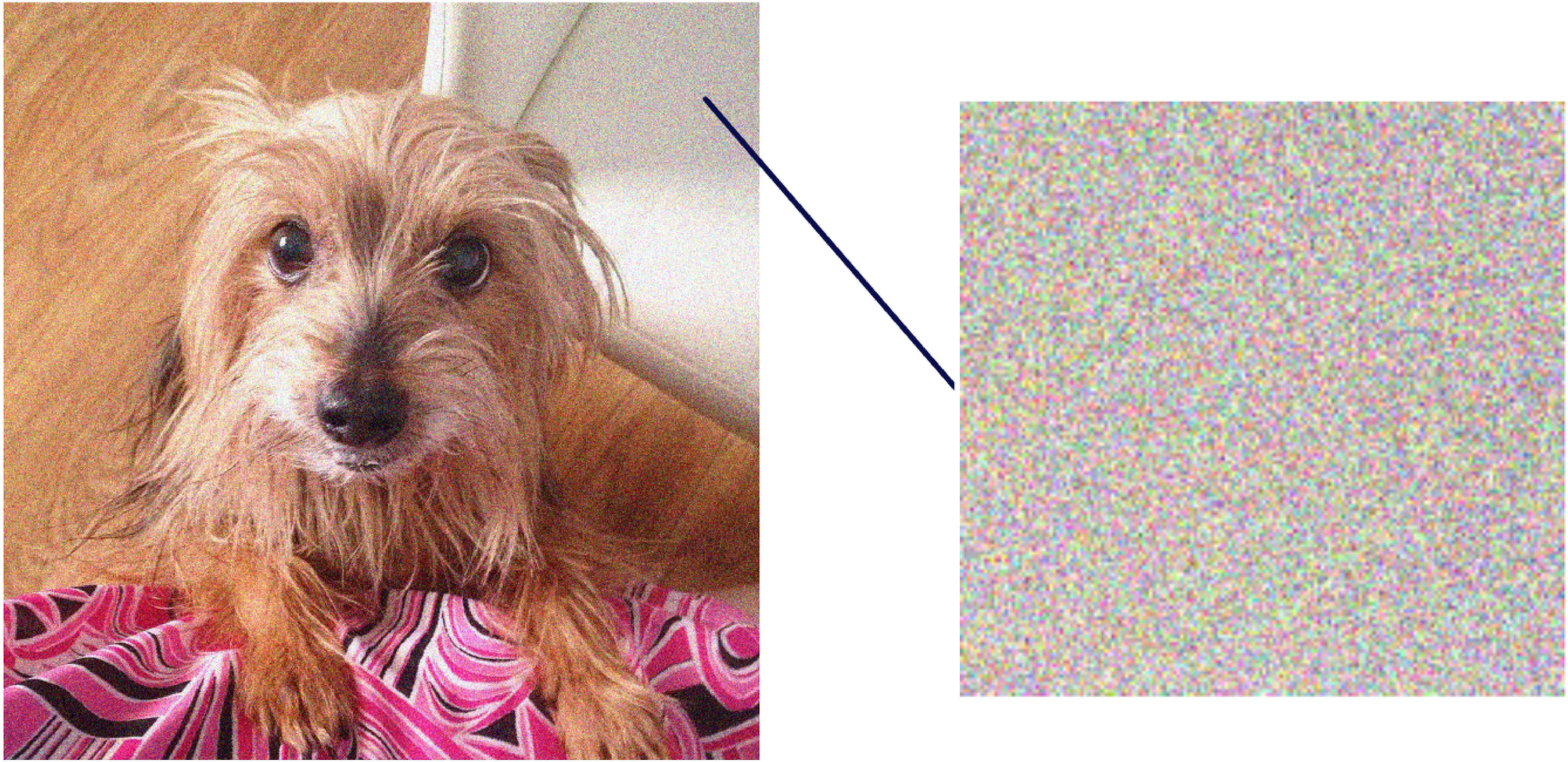
Noise



Noise

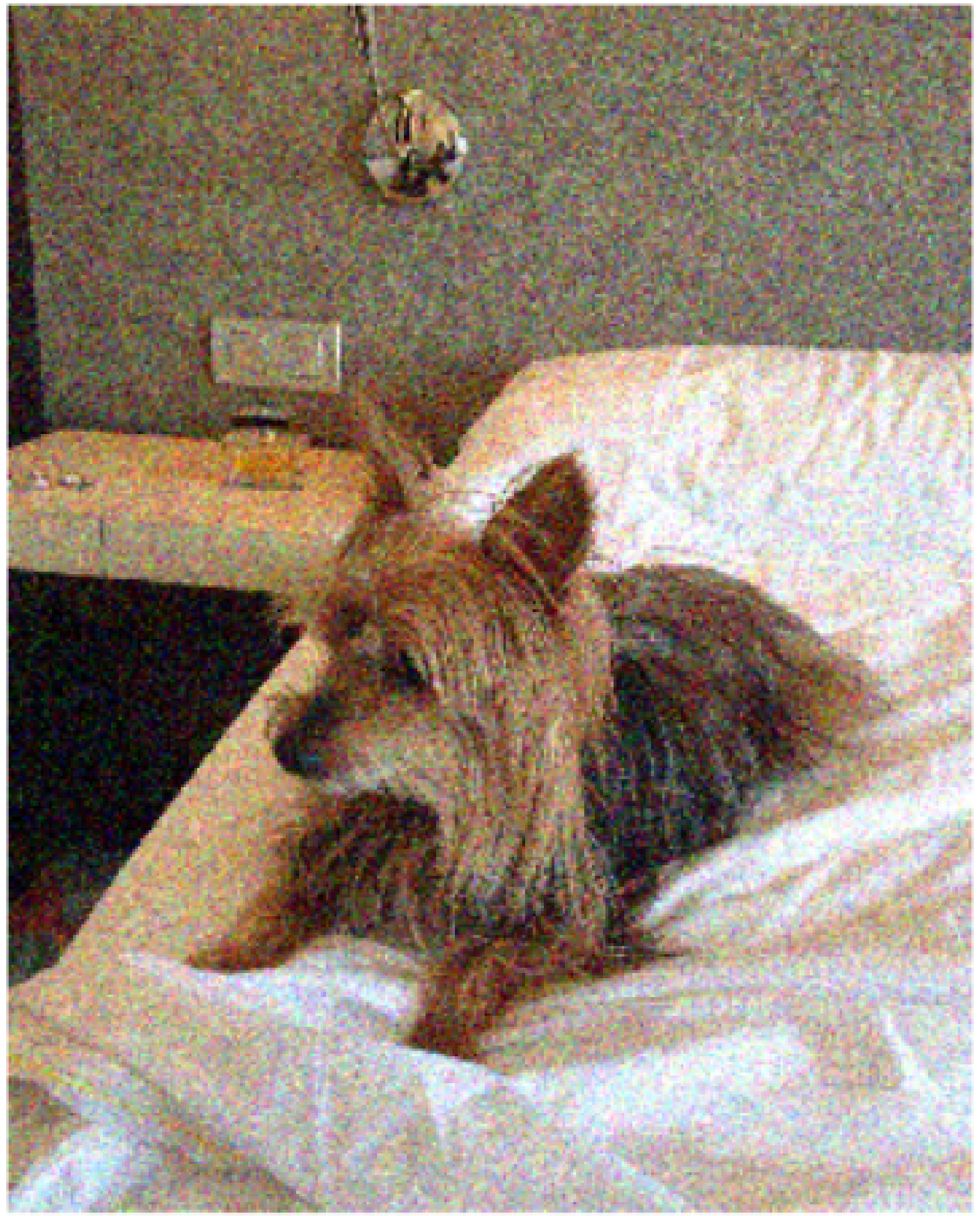


Apply noise in scikit-image

```
# Import the module and function
from skimage.util import random_noise

# Add noise to the image
noisy_image = random_noise(dog_image)

# Show original and resulting image
show_image(dog_image)
show_image(noisy_image, 'Noisy image')
```

Apply noise in scikit-image

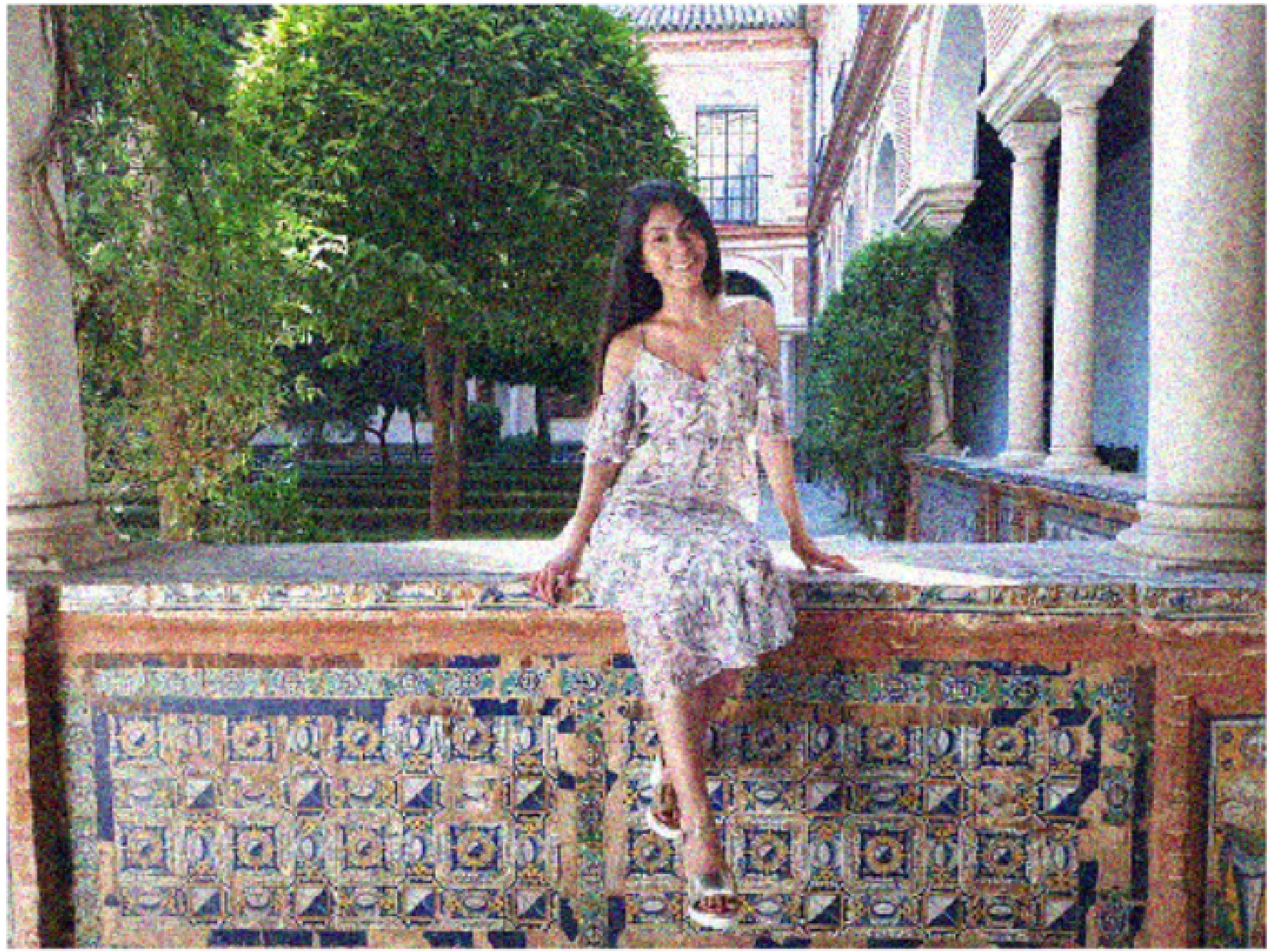
Original



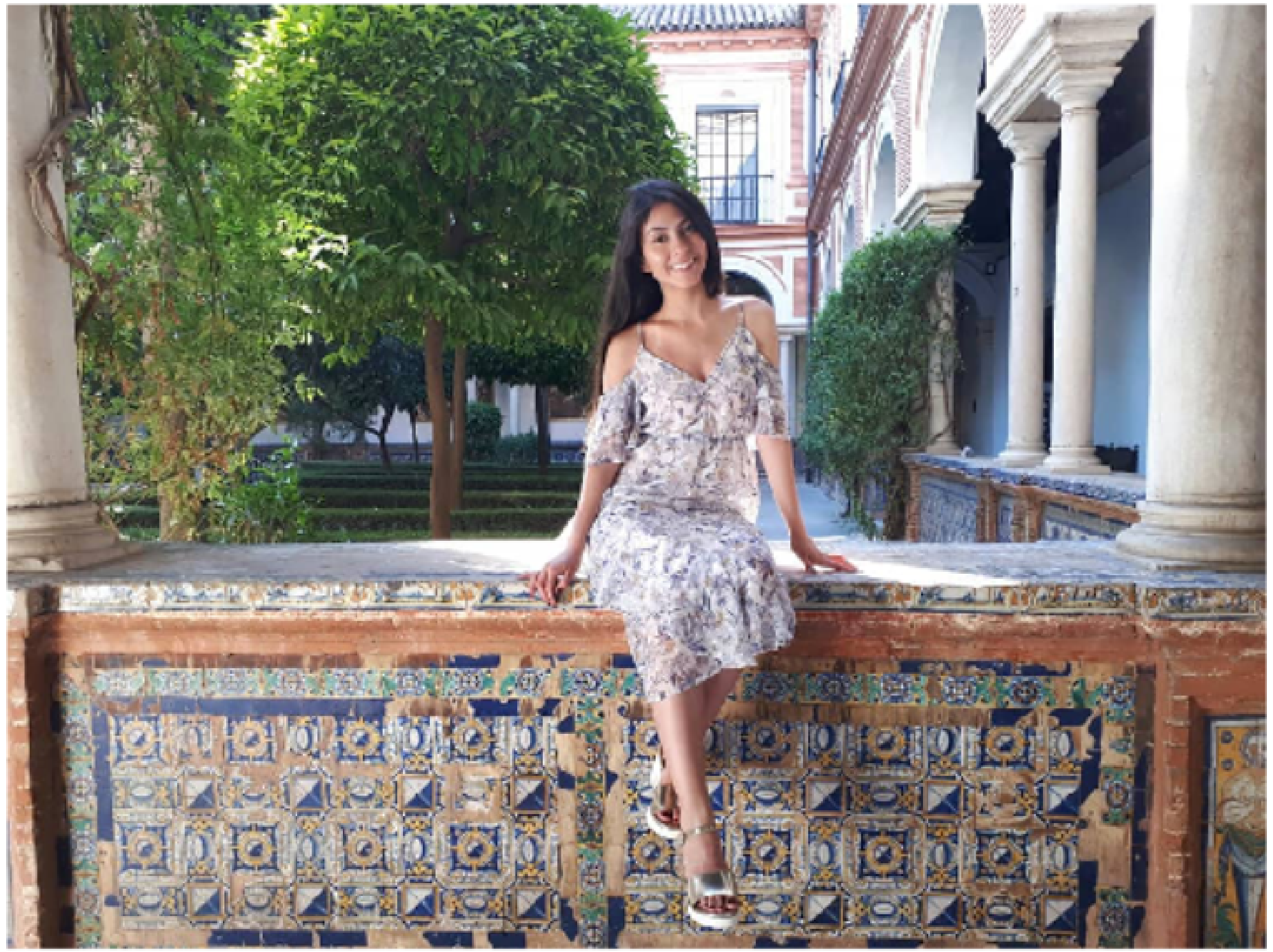
Noisy image

Reducing noise

Noisy image



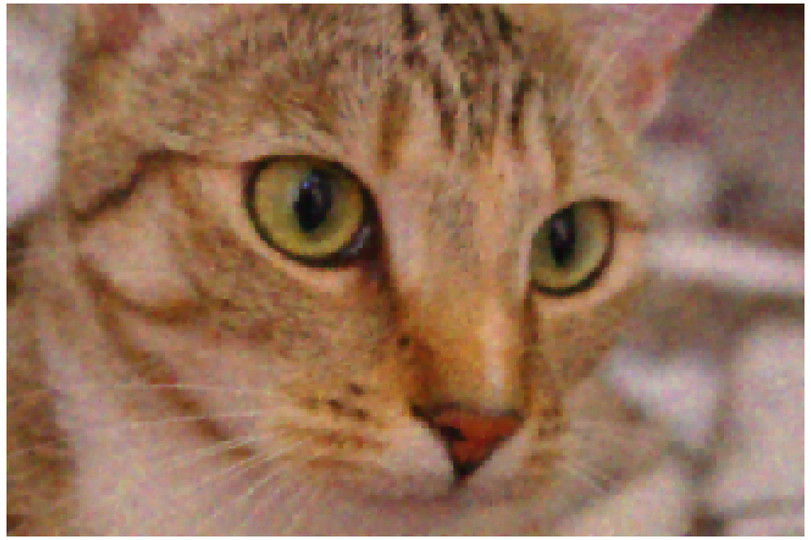
Denoised



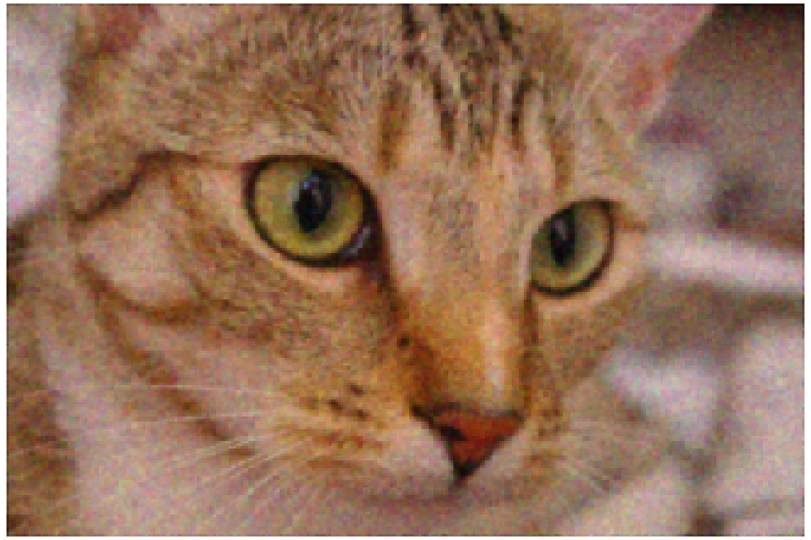
Denoising types

- Total variation (TV)
- Bilateral
- Wavelet denoising
- Non-local means denoising

TV denoising



Bilateral denoising



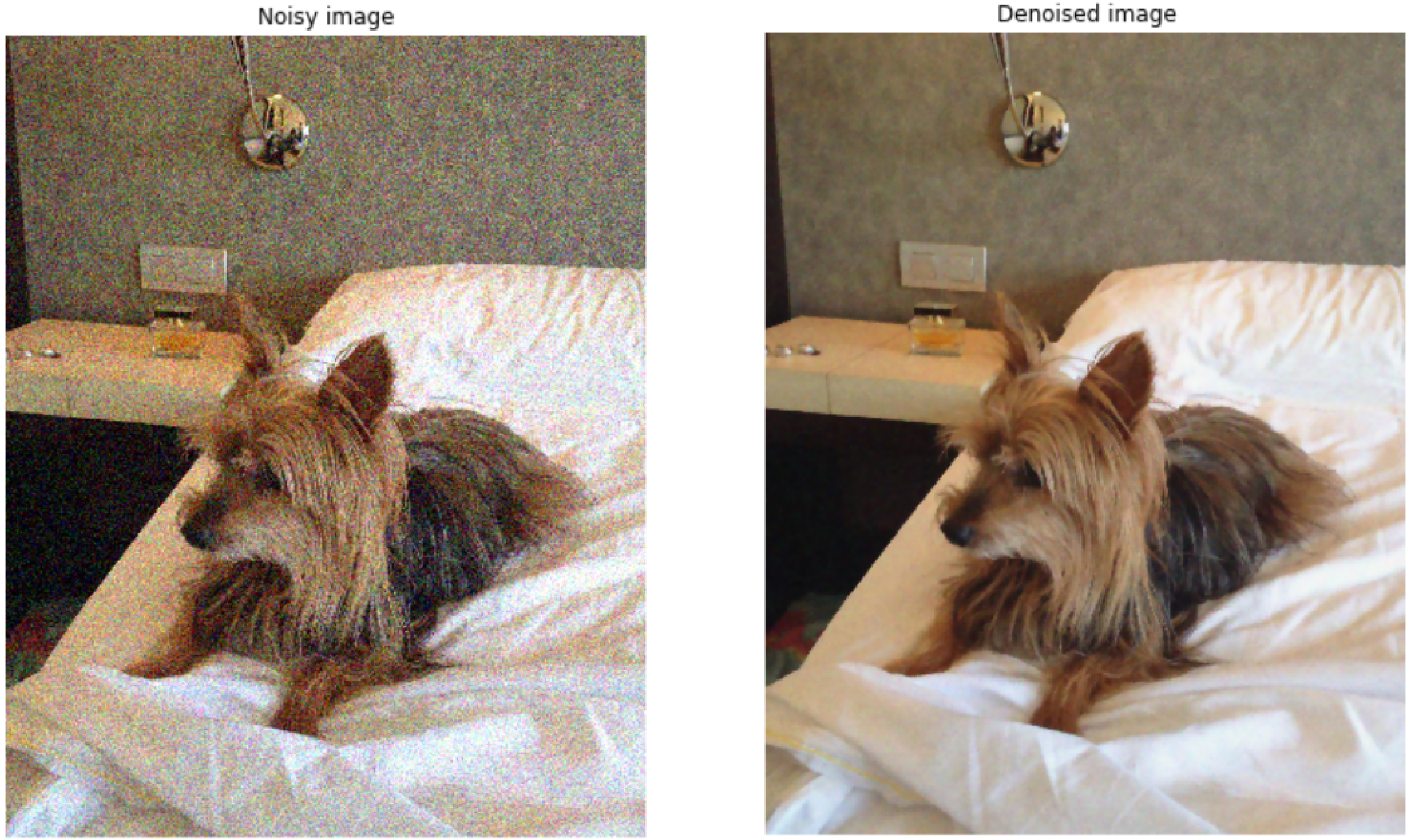
Denoising

Using total variation filter denoising

```python
from skimage.restoration import denoise_tv_chambolle

# Apply total variation filter denoising
denoised_image = denoise_tv_chambolle(noisy_image,
                                      weight=0.1,
                                      multichannel=True)

# Show denoised image
show_image(noisy_image, 'Noisy image')
show_image(denoised_image, 'Denoised image')
```

Denoising

Total variation filter



Denoising

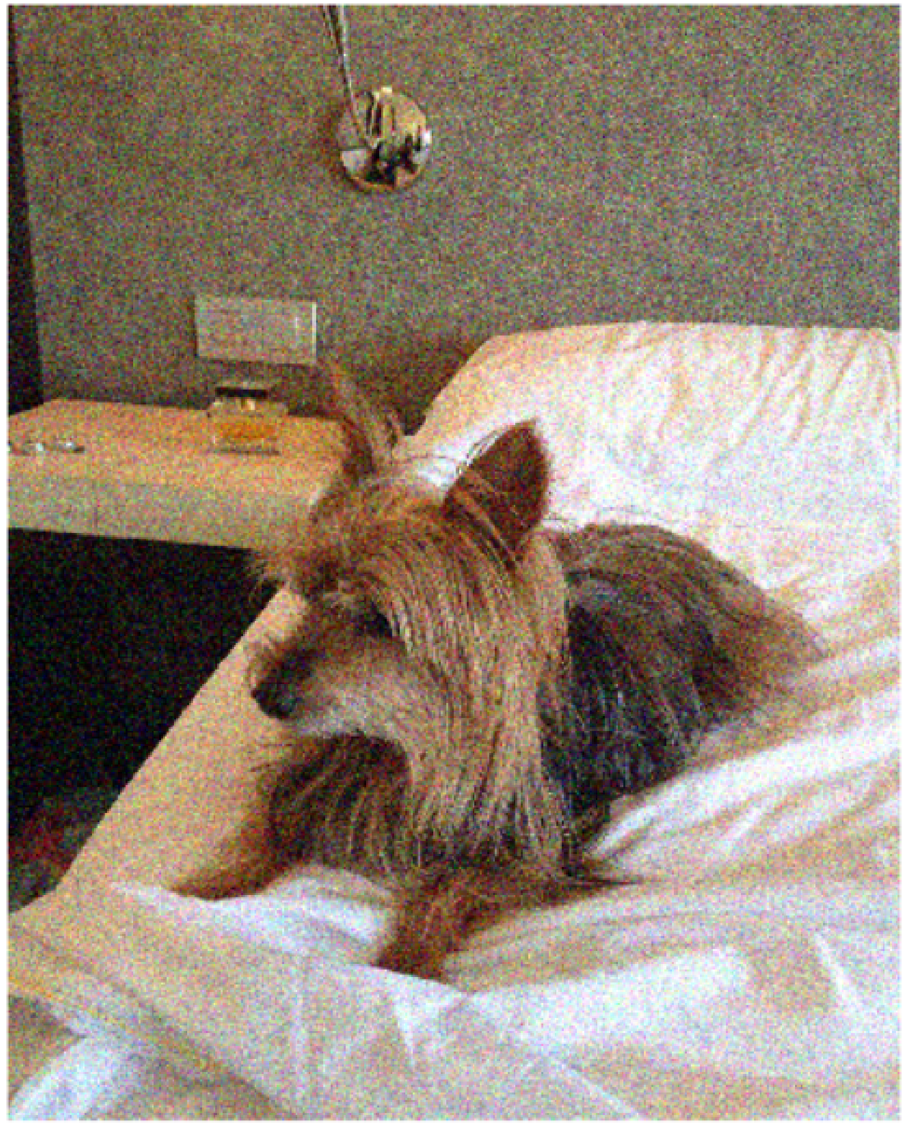
Bilateral filter

```python
from skimage.restoration import denoise_bilateral

# Apply bilateral filter denoising
denoised_image = denoise_bilateral(noisy_image, multichannel=True)

# Show original and resulting images
show_image(noisy_image, 'Noisy image')
show_image(denoised_image, 'Denoised image')
```

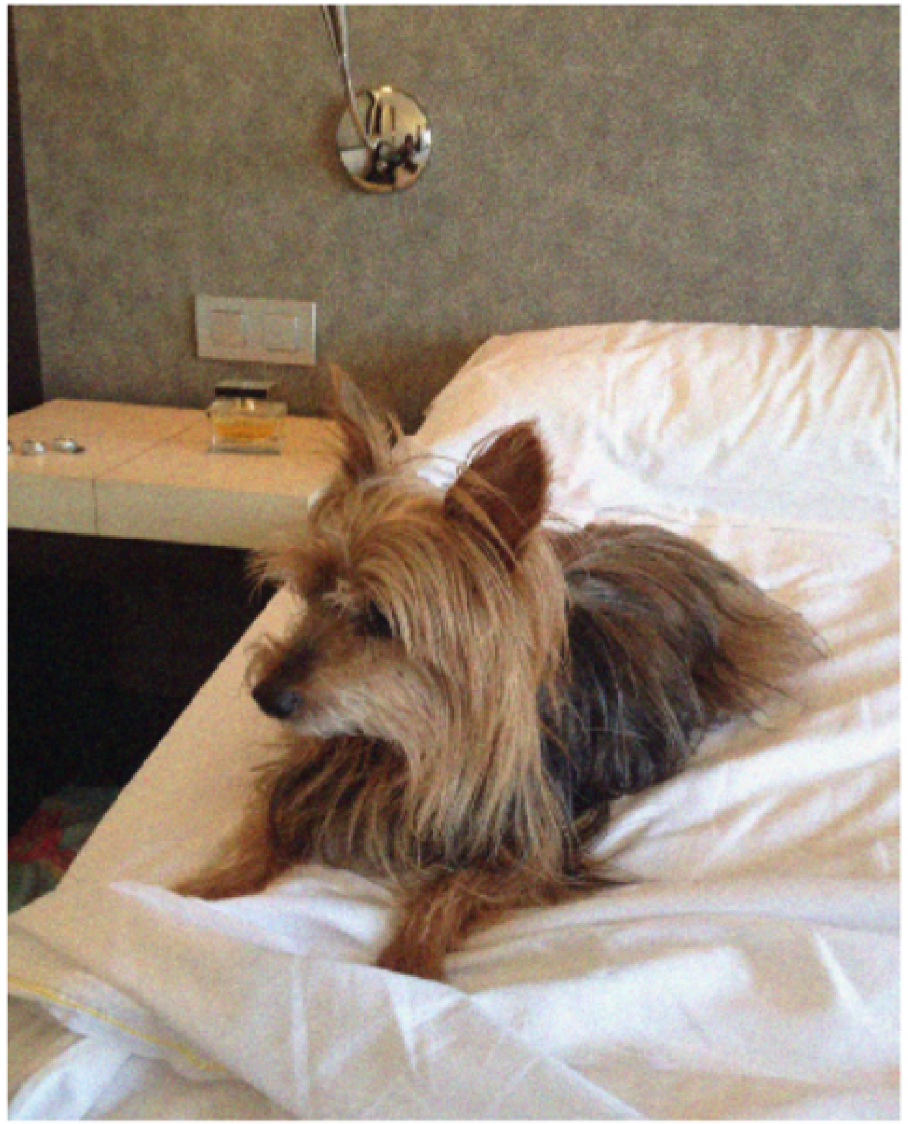
Denoising

Bilateral filter

Noisy image



Denoised image



Let's practice!

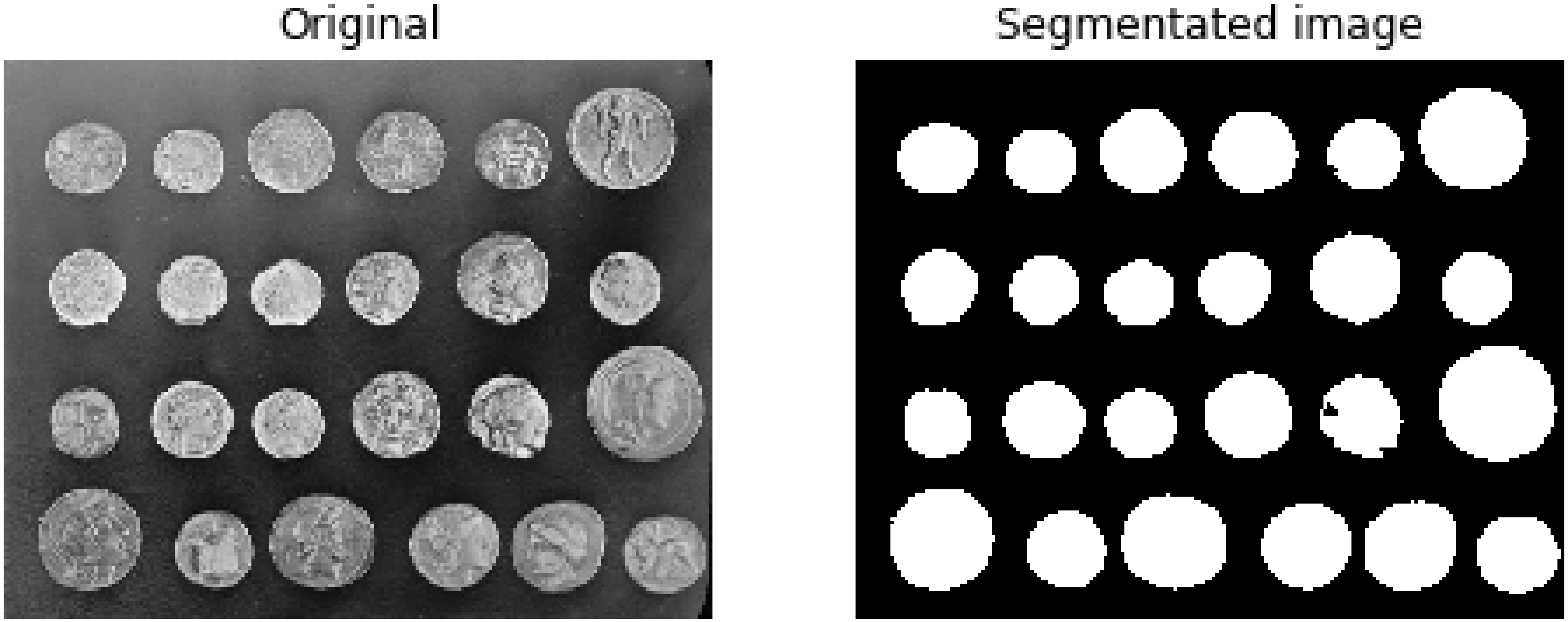
IMAGE PROCESSING IN PYTHON

Superpixels & segmentation

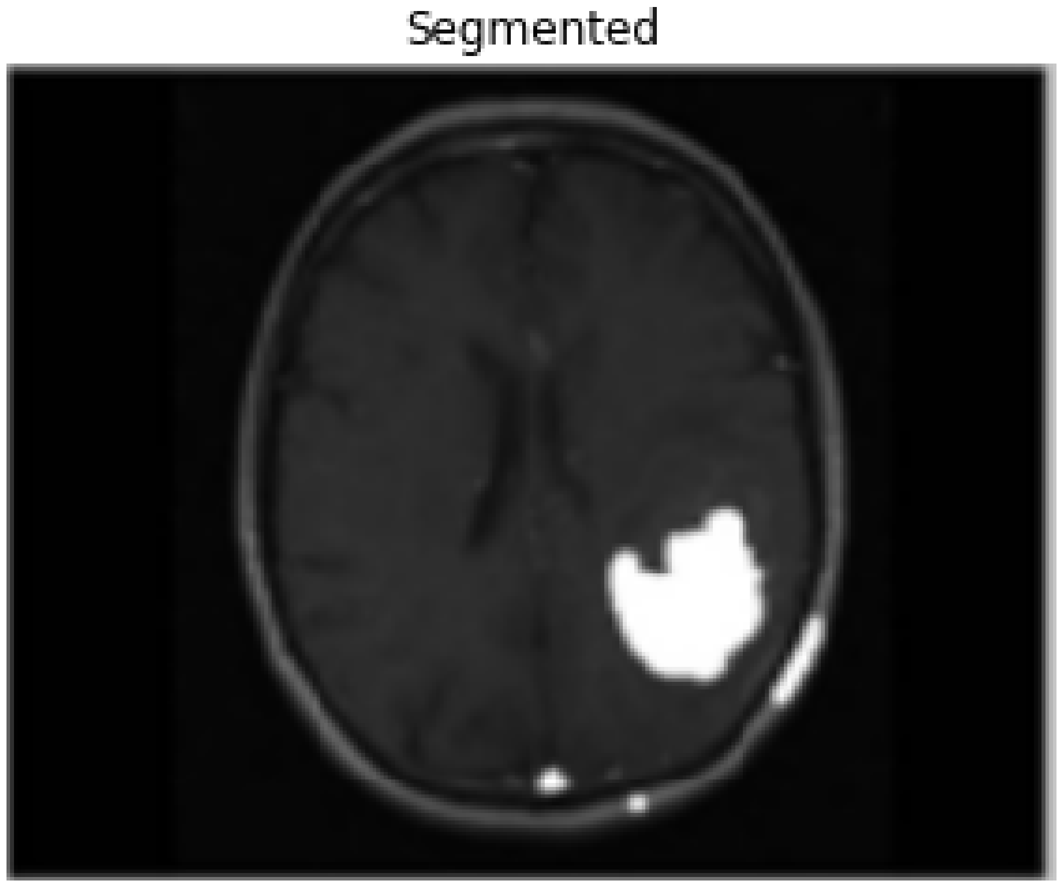
IMAGE PROCESSING IN PYTHON

Rebeca Gonzalez
Data Engineer

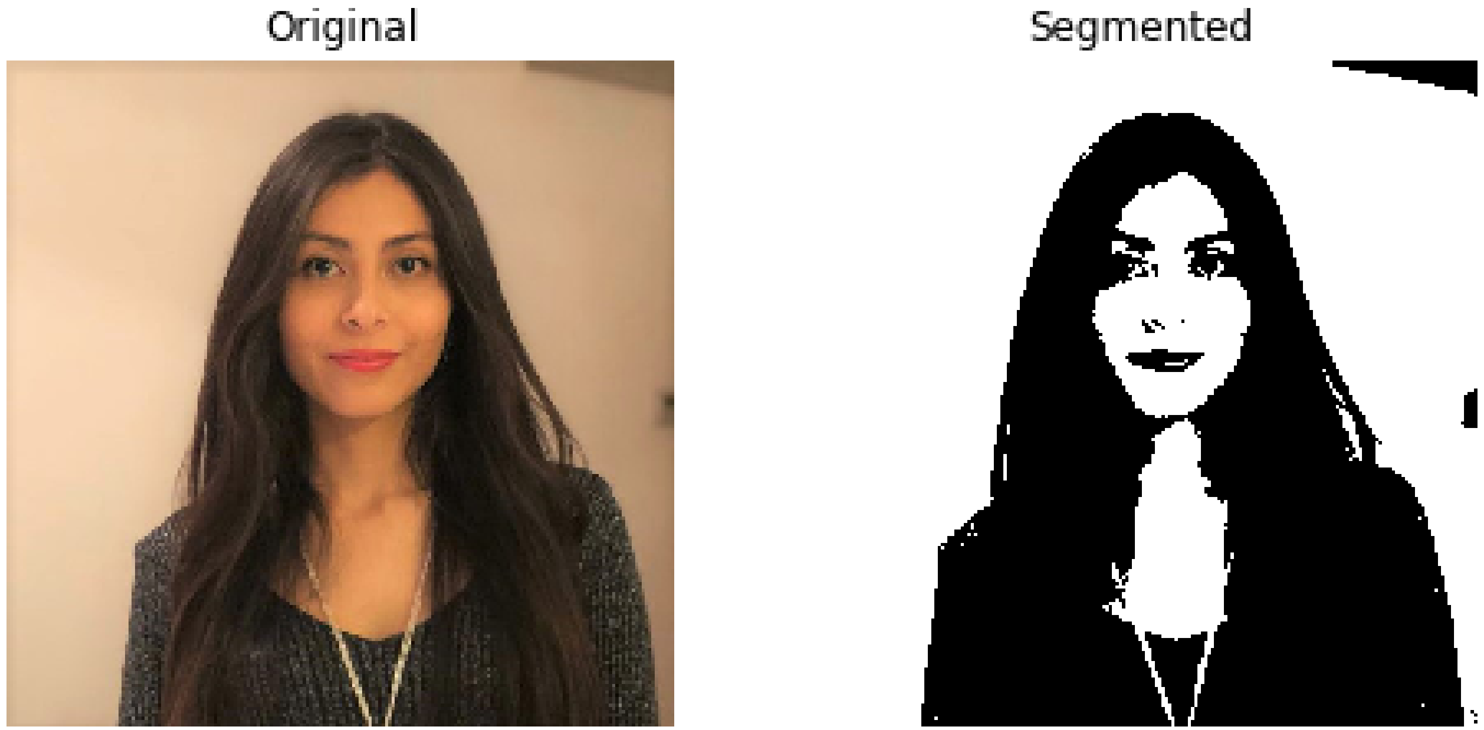
Segmentation



Segmentation



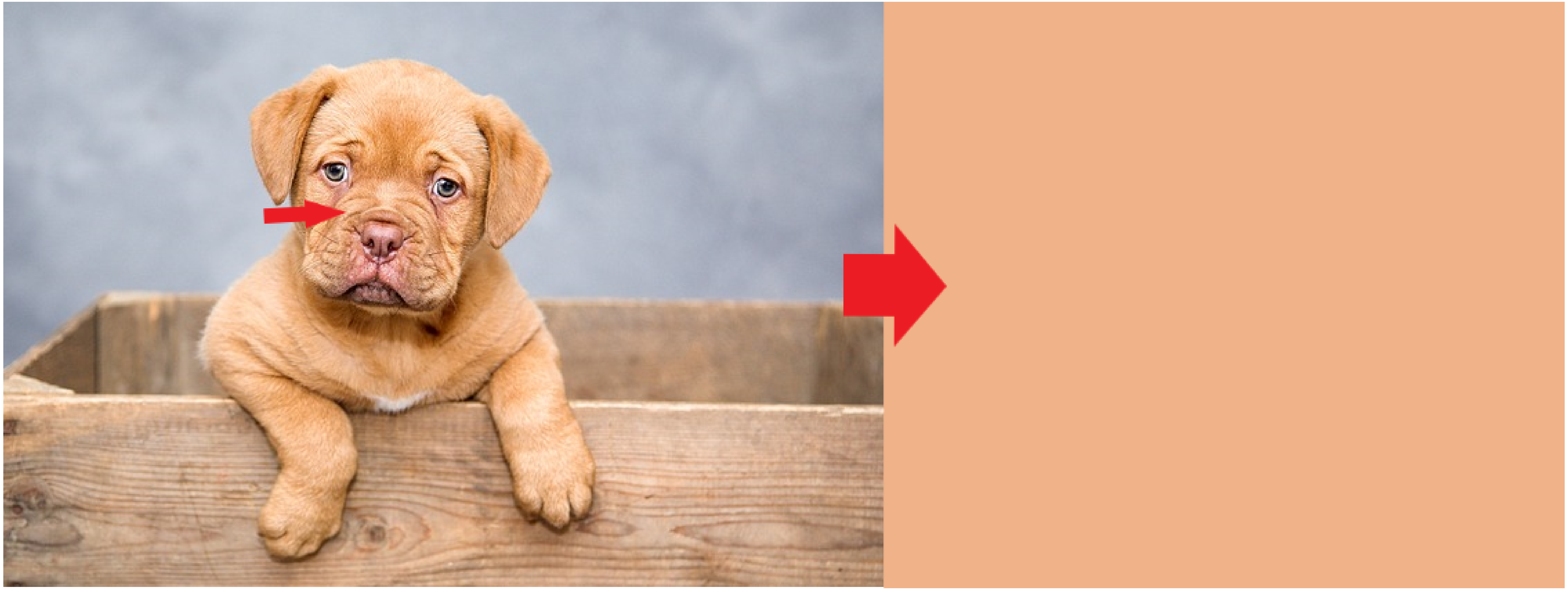
Segmented



Original

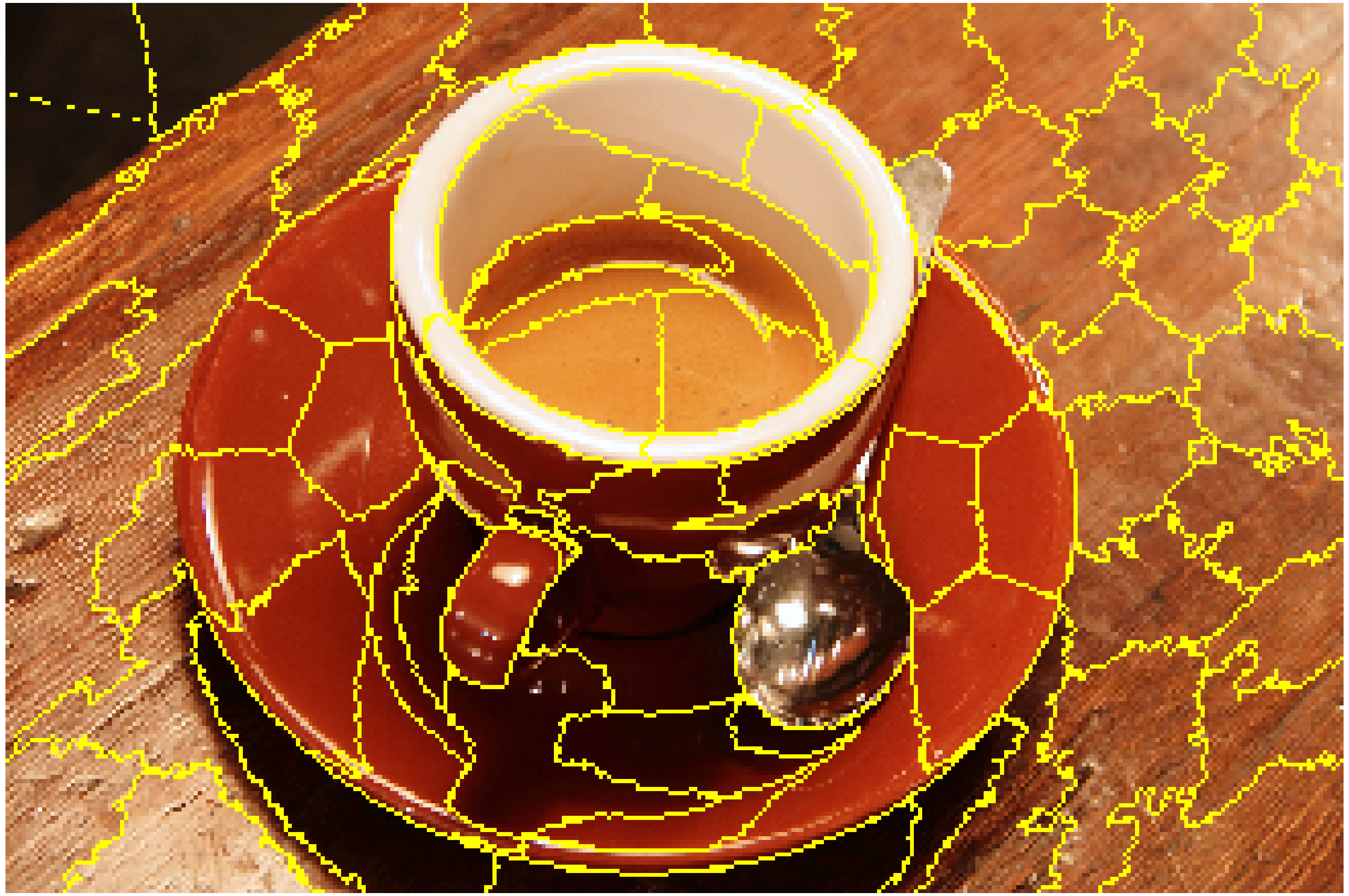
Segmented

Image representation



Superpixels

Superpixel segmentation, 100 segments

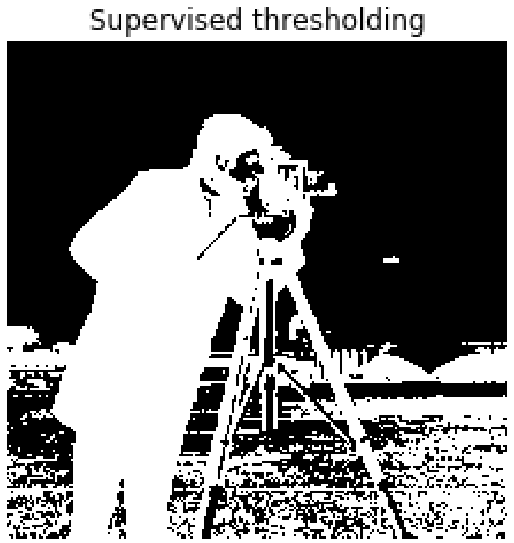


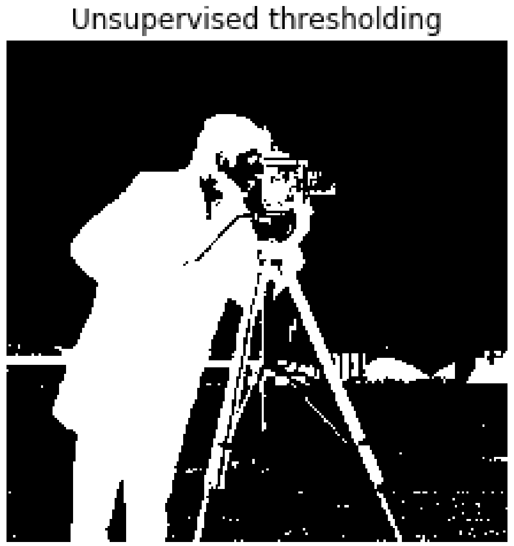
Benefits of superpixels

- More meaningful regions
- Computational efficiency

Segmentation

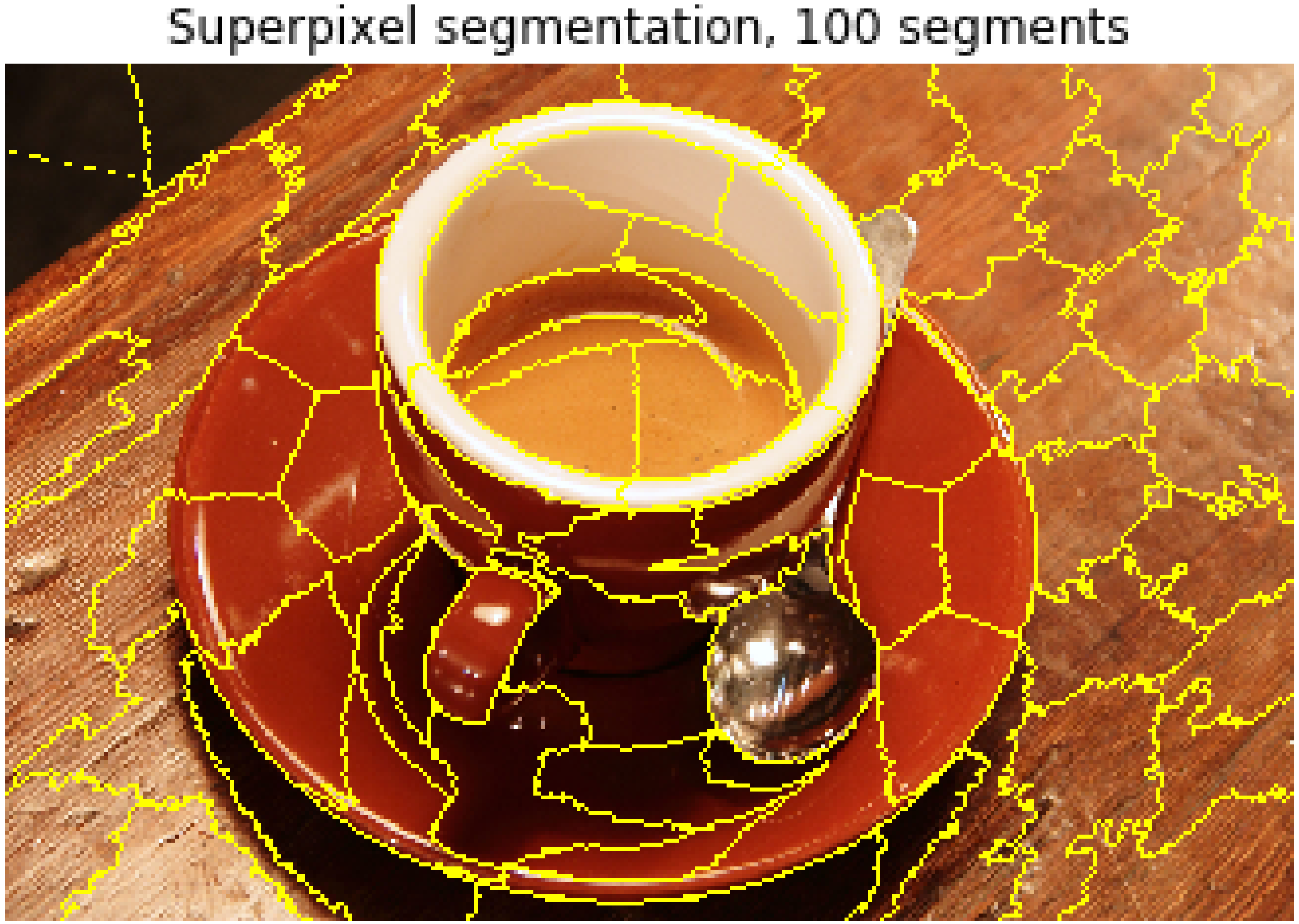
- Supervised
- Unsupervised





Unsupervised segmentation

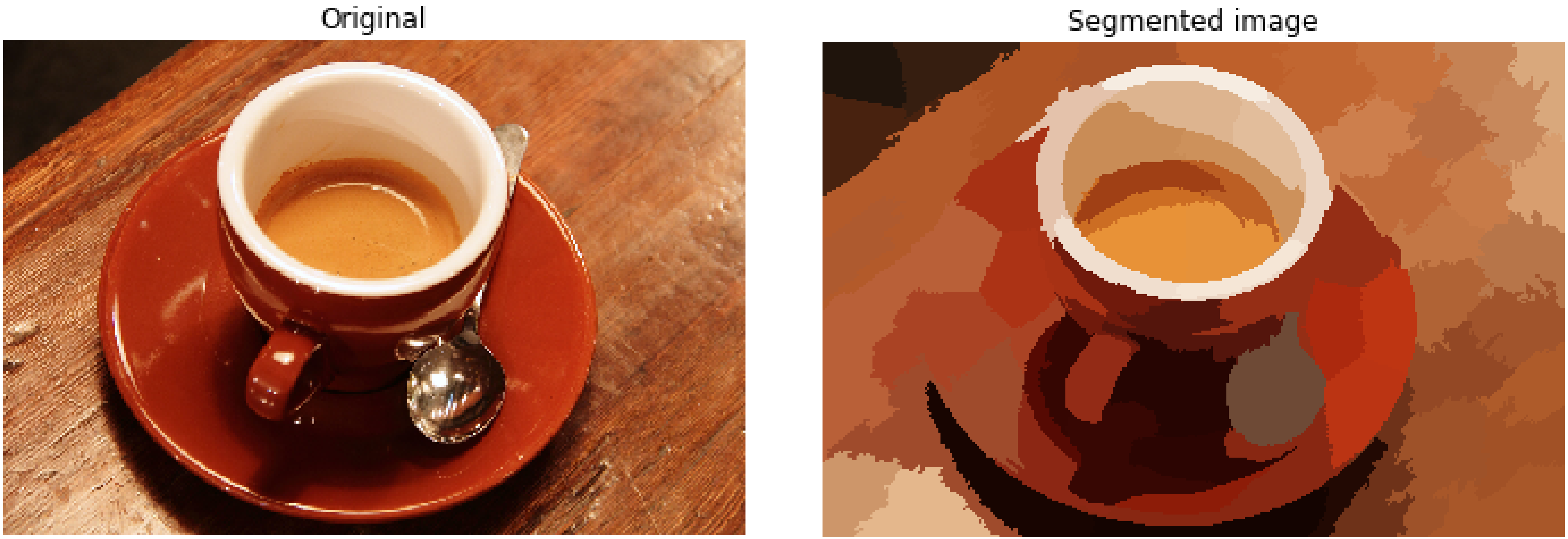
Simple Linear Iterative Clustering (SLIC)



Unsupervised segmentation (SLIC)

```python
# Import the modules
from skimage.segmentation import slic
from skimage.color import label2rgb

# Obtain the segments
segments = slic(image)

# Put segments on top of original image to compare
segmented_image = label2rgb(segments, image, kind='avg')

show_image(image)
show_image(segmented_image, "Segmented image")
```

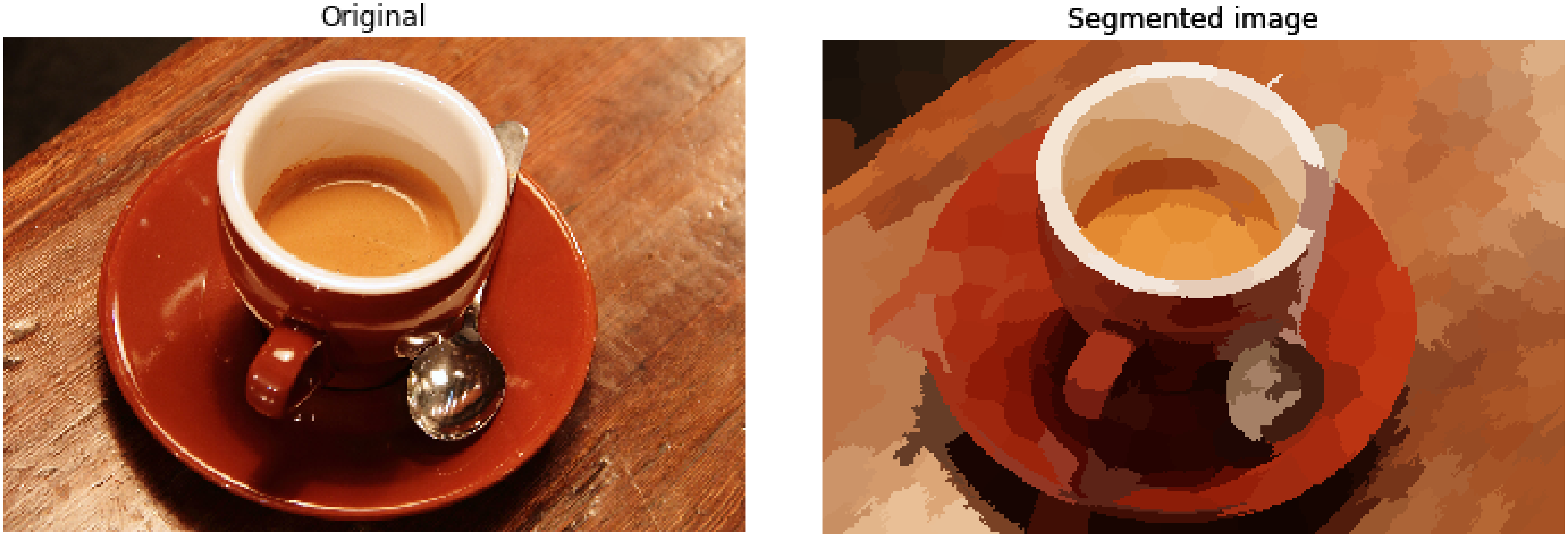
Unsupervised segmentation (SLIC)



More segments

```python
# Import the modules
from skimage.segmentation import slic
from skimage.color import label2rgb

# Obtain the segmentation with 300 regions
segments = slic(image, n_segments= 300)

# Put segments on top of original image to compare
segmented_image = label2rgb(segments, image, kind='avg')

show_image(segmented_image)
```

More segments



Original

Segmented image

Let's practice!

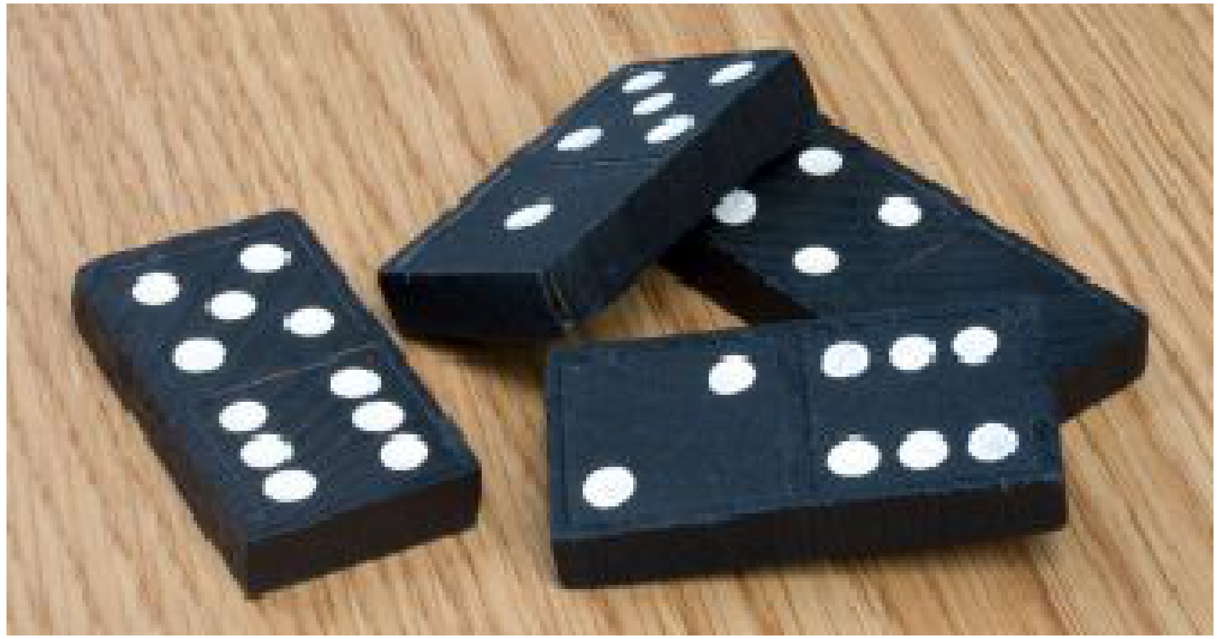
IMAGE PROCESSING IN PYTHON

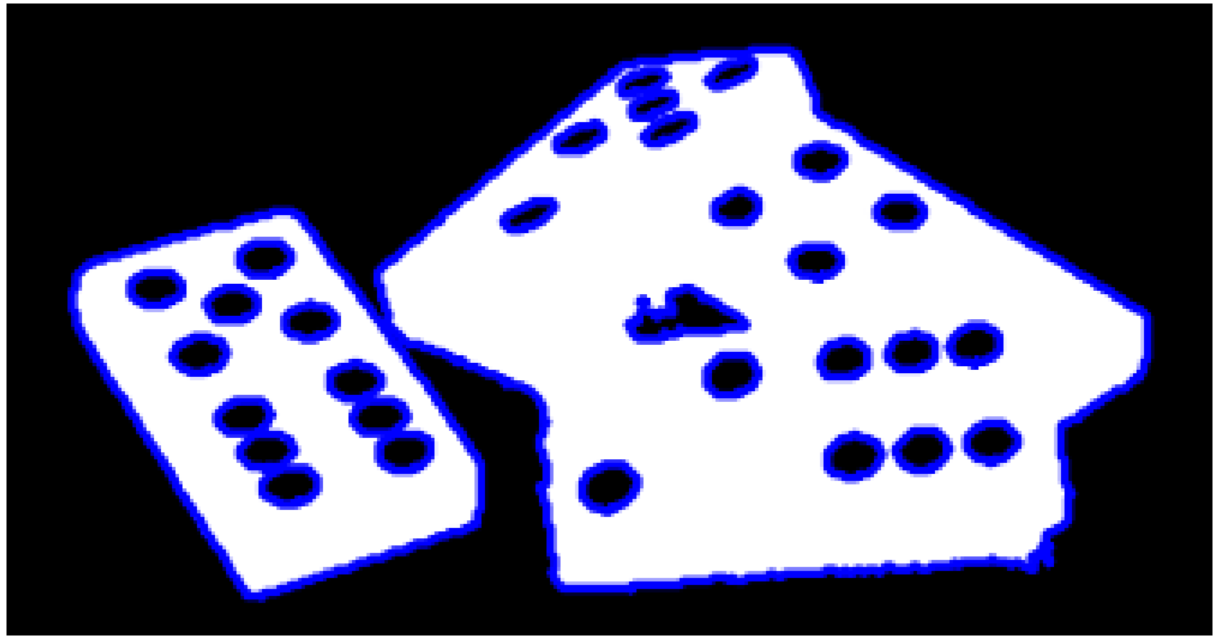
Finding contours

IMAGE PROCESSING IN PYTHON

Rebeca Gonzalez
Data Engineer

Finding contours


Original image

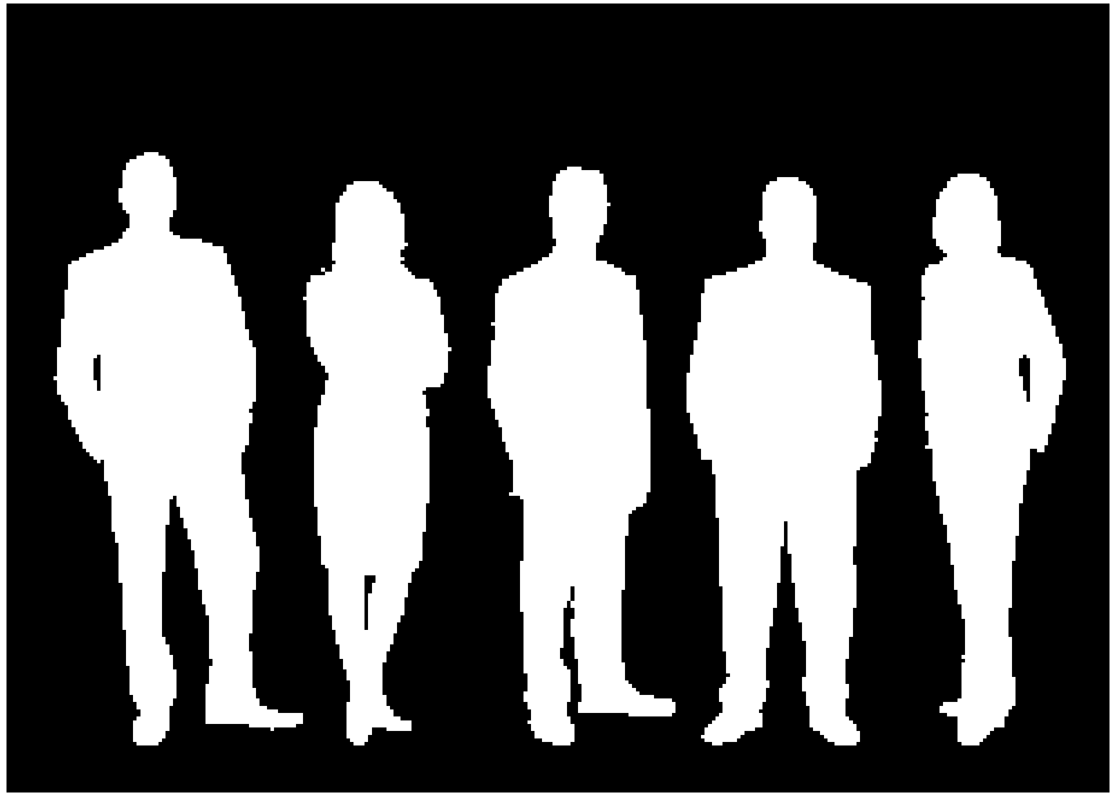

Contours

- Measure size
- Classify shapes
- Determine the number of objects

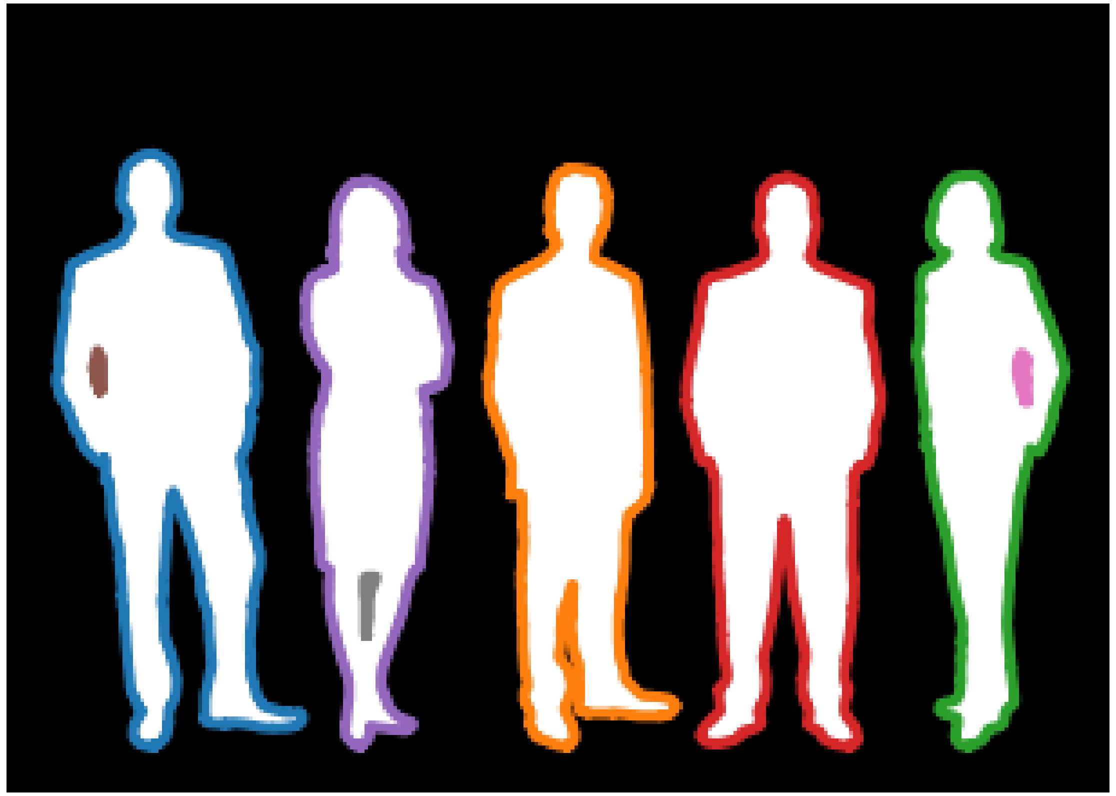
Total points in domino tokens: 29.

Binary images

Thresholded Image



Contours



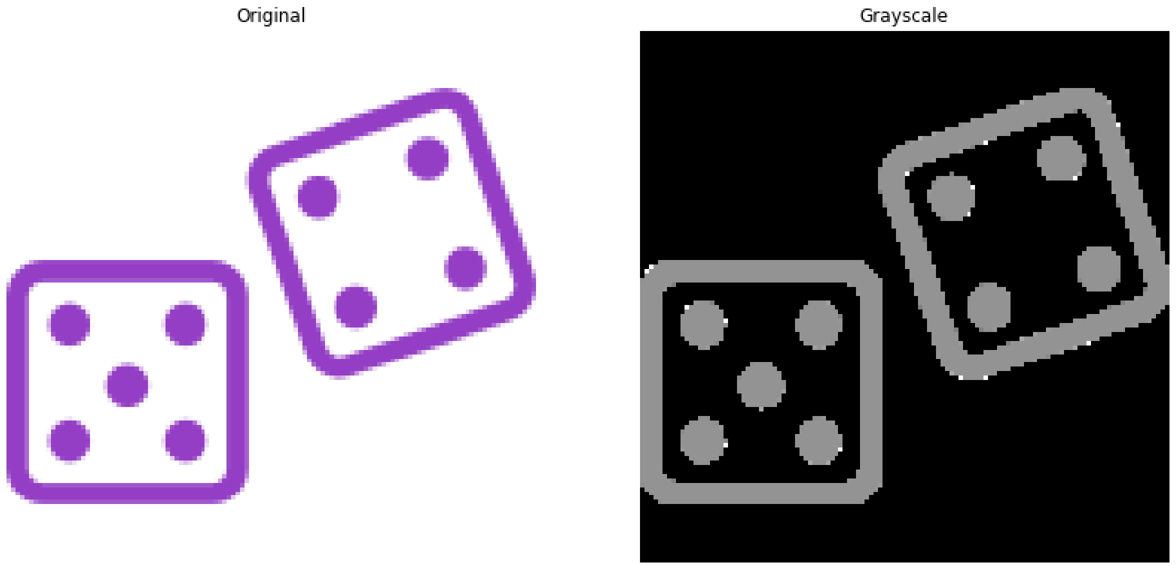
We can obtain a binary image applying **thresholding** or using **edge detection**

Find contours using scikit-image

PREPARING THE IMAGE

Transform the image to 2D grayscale.

```
# Make the image grayscale
image = color.rgb2gray(image)
```

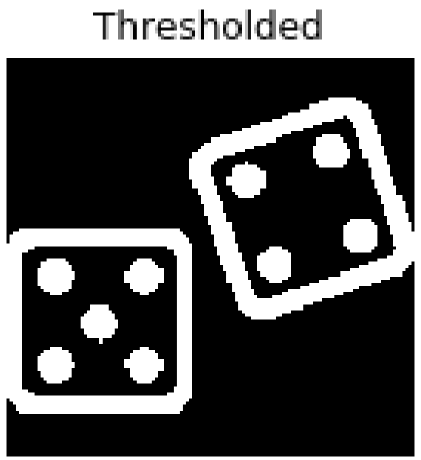


Find contours using scikit-image

PREPARING THE IMAGE

Binarize the image

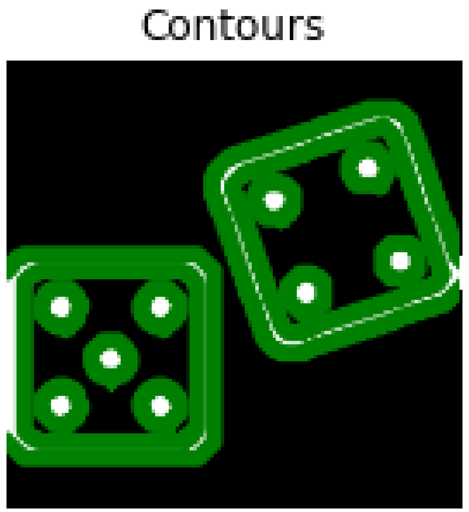
```
# Obtain the thresh value
thresh = threshold_otsu(image)

# Apply thresholding
thresholded_image = image > thresh
```



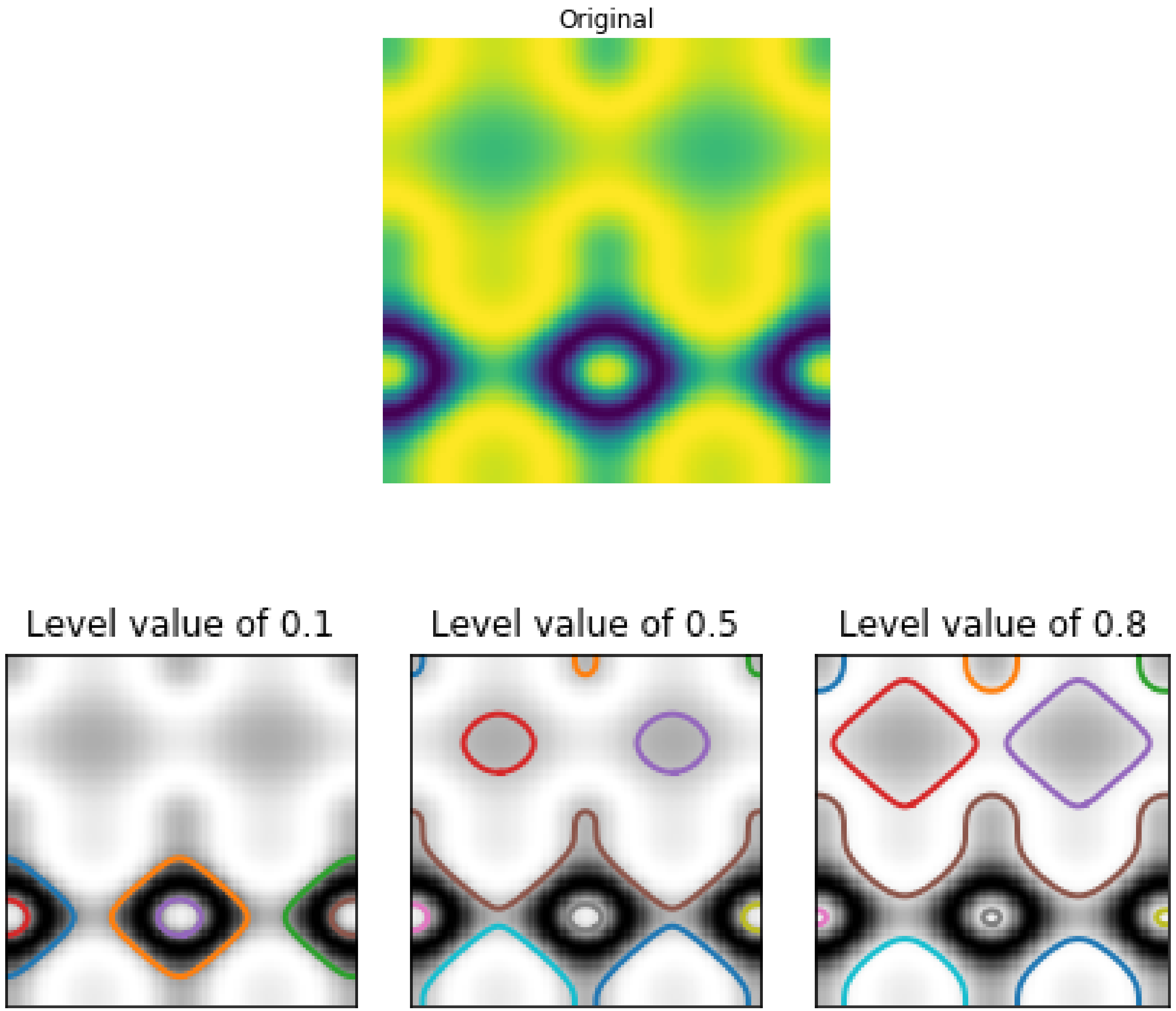
Find contours using scikit-image

And then use `find_contours()`.

```
# Import the measure module
from skimage import measure

# Find contours at a constant value of 0.8
contours = measure.find_contours(thresholded_image, 0.8)
```



Constant level value

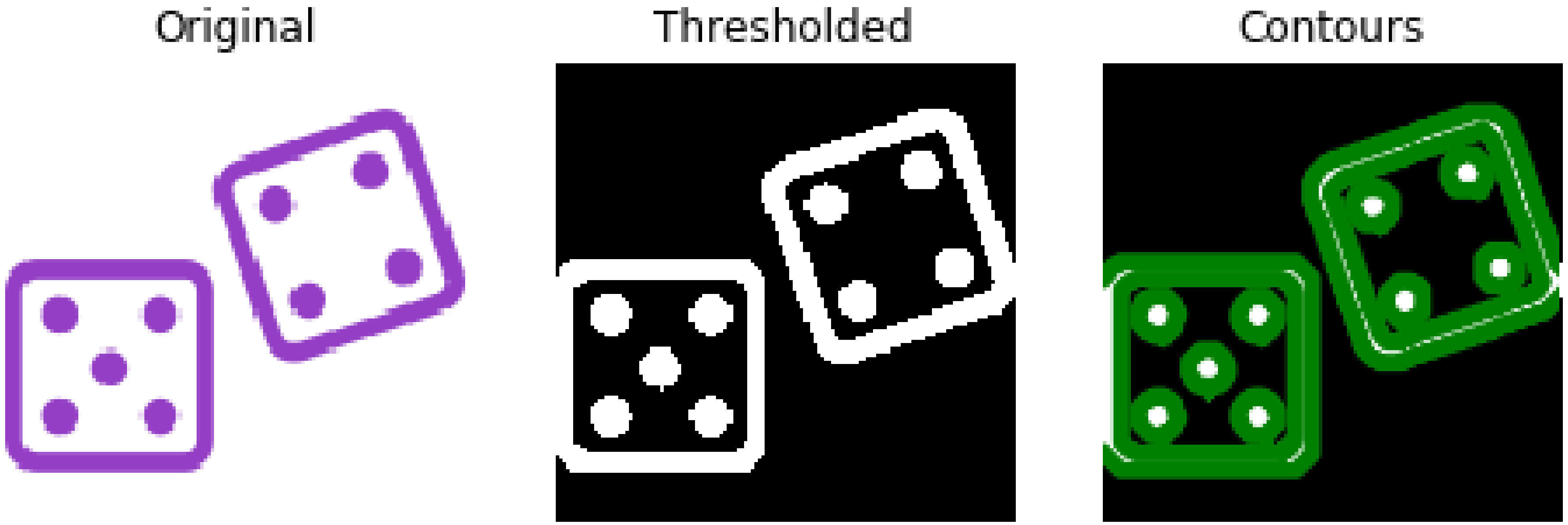


The steps to spotting contours

```
from skimage import measure
from skimage.filters import threshold_otsu

# Make the image grayscale
image = color.rgb2gray(image)
# Obtain the optimal thresh value of the image
thresh = threshold_otsu(image)

# Apply thresholding and obtain binary image
thresholded_image = image > thresh

# Find contours at a constant value of 0.8
contours = measure.find_contours(thresholded_image, 0.8)
```

The steps to spotting contours

Resulting in

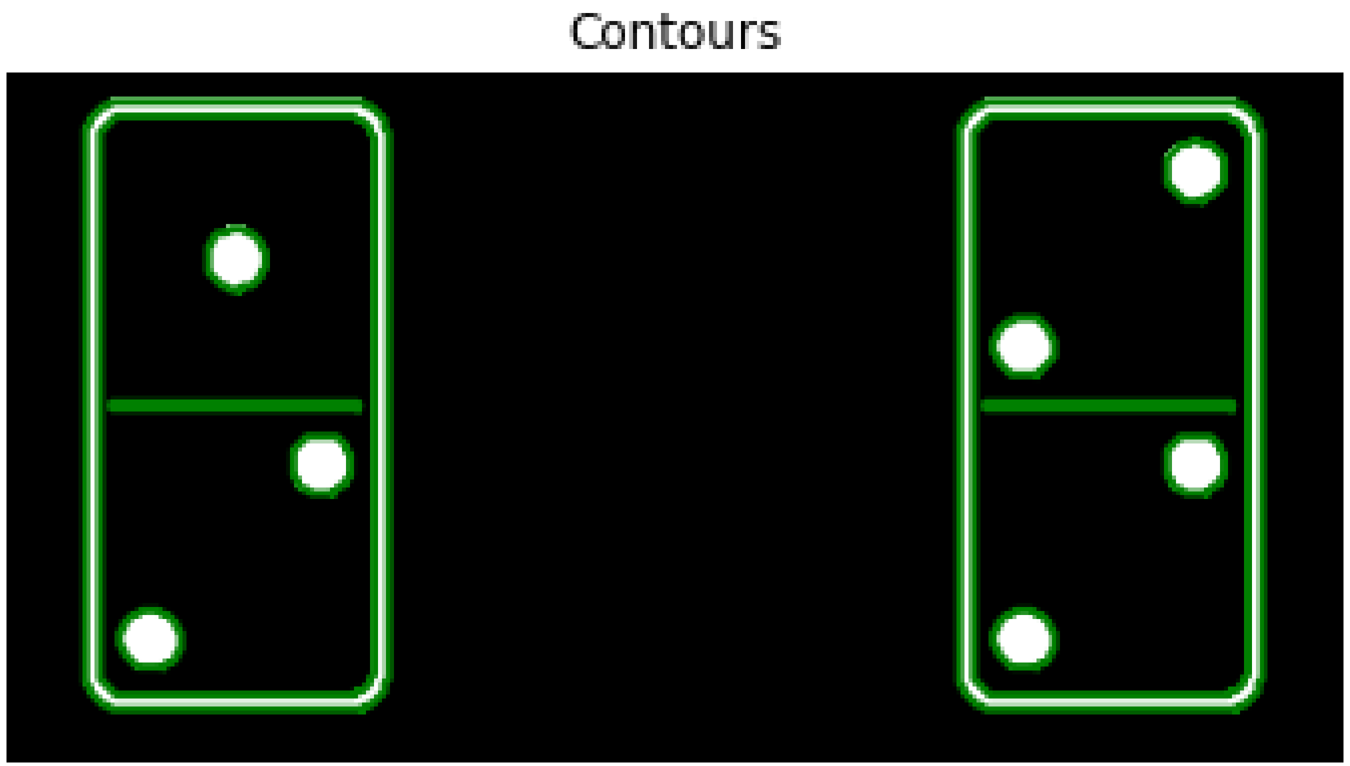


A contour's shape

Contours: list of (n,2) - ndarrays.

```python
for contour in contours:
    print(contour.shape)
```

```
(433, 2)
(433, 2)
(401, 2)
(401, 2)
(123, 2)
(123, 2)
(59, 2)
(59, 2)
(59, 2)
(57, 2)
(57, 2)
(59, 2)
```

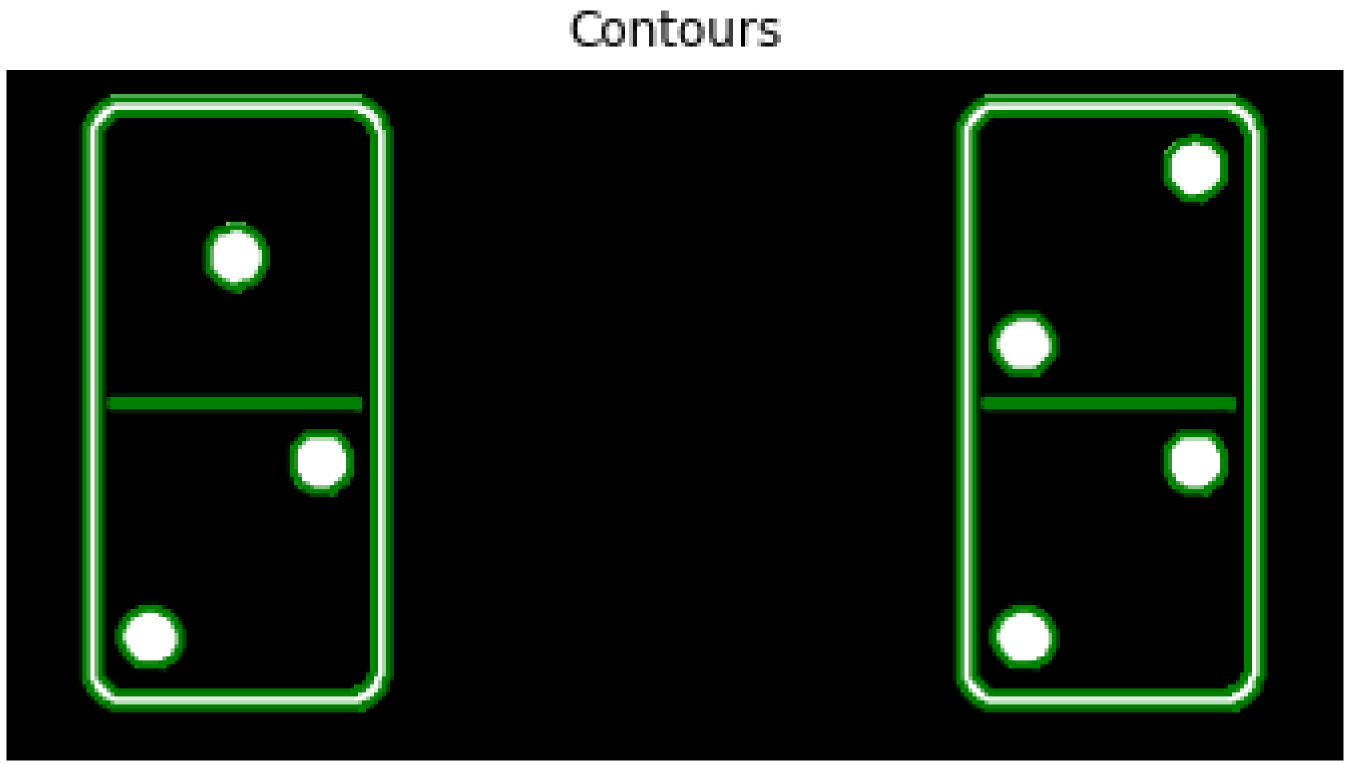


Contours

A contour's shape

```python
for contour in contours:
    print(contour.shape)
```

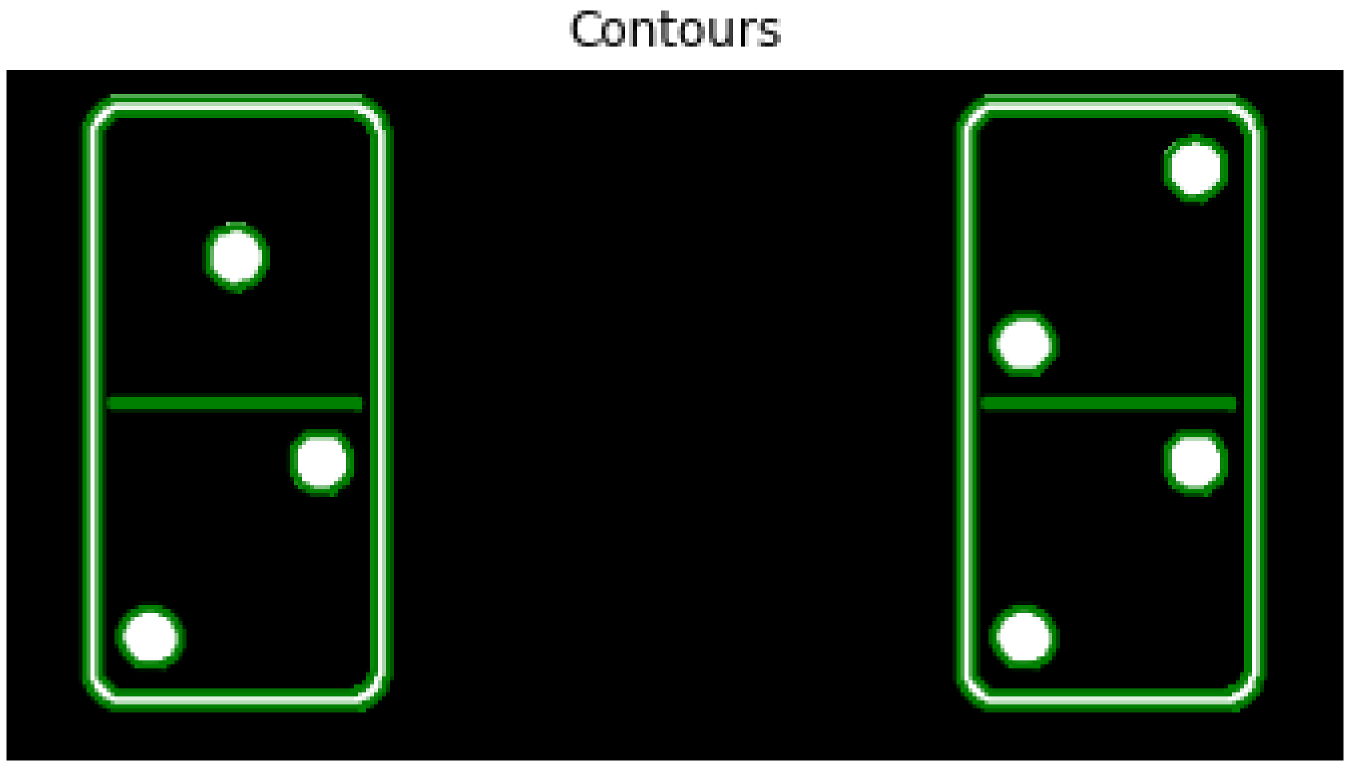
```
(433, 2)
(433, 2) --> Outer border
(401, 2)
(401, 2)
(123, 2)
(123, 2)
(59, 2)
(59, 2)
(59, 2)
(57, 2)
(57, 2)
(59, 2)
(59, 2)
```



A contour's shape

```python
for contour in contours:
    print(contour.shape)
```

```
(433, 2)
(433, 2) --> Outer border
(401, 2)
(401, 2) --> Inner border
(123, 2)
(123, 2)
(59, 2)
(59, 2)
(59, 2)
(57, 2)
(57, 2)
(59, 2)
(59, 2)
```

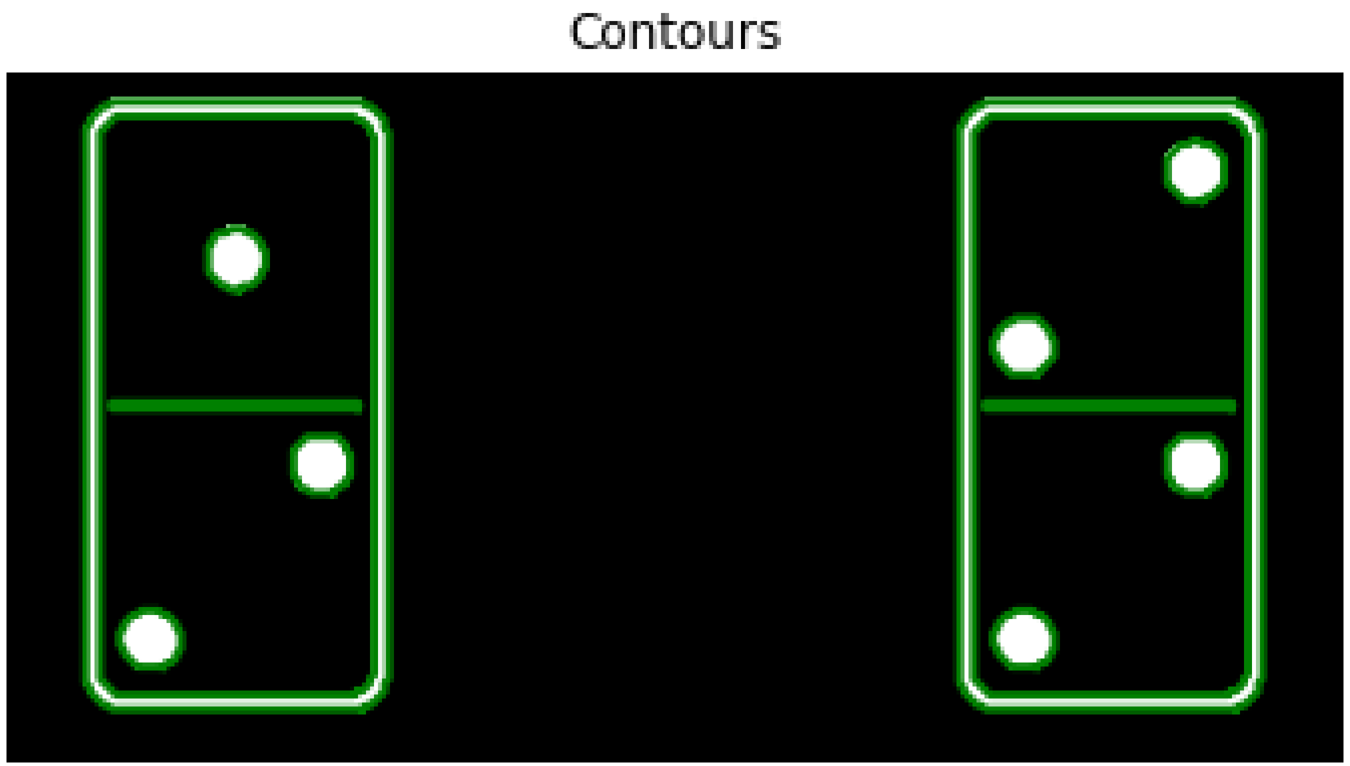


Contours

A contour's shape

```python
for contour in contours:
    print(contour.shape)
```

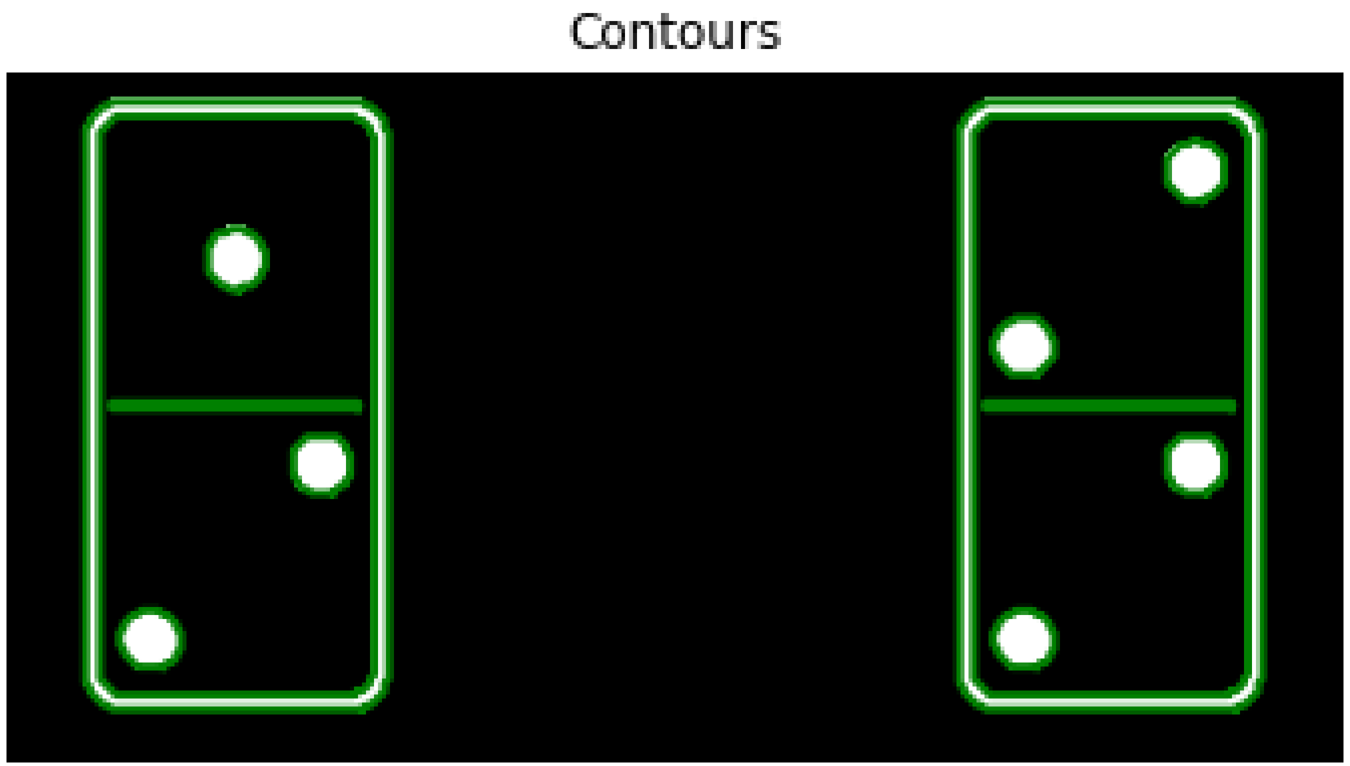
```
(433, 2)
(433, 2) --> Outer border
(401, 2)
(401, 2) --> Inner border
(123, 2)
(123, 2) --> Divisory line of tokens
(59, 2)
(59, 2)
(59, 2)
(57, 2)
(57, 2)
(59, 2)
(59, 2)
```


Contours

A contour's shape

```python
for contour in contours:
    print(contour.shape)
```

```
(433, 2)
(433, 2) --> Outer border
(401, 2)
(401, 2) --> Inner border
(123, 2)
(123, 2) --> Divisory line of tokens
(59, 2)
(59, 2)
(59, 2)
(57, 2)
(57, 2)
(59, 2)
(59, 2) --> Dots
```



Number of dots: 7.

Let's practice!

IMAGE PROCESSING IN PYTHON