

# 04-drawing

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## 1 4. Drawing and Masking

### 1.0.1 Get coordinates of region of interest (ROI)

```
In [ ]: # imports..
import skimage
from skimage.viewer import ImageViewer
import numpy as np

In [ ]: img = skimage.io.imread('../data/maize-roots.tif')

In [ ]: viewer = ImageViewer(img)

In [ ]: viewer.show()
```

### 1.0.2 Creating the Mask

```
In [ ]: # boolean array
mask = np.ones(shape=img.shape[:2], dtype="bool")

In [ ]: # get coordinates of region to unmask
rr, cc = skimage.draw.rectangle(start=(357, 44), end=(740, 720))

In [ ]: viewer = ImageViewer(mask)
viewer.show()
```

### 1.0.3 Exercise: Drawing Practice

Play around with the different draw methods skimage provides: \* `skimage.draw.circle` \* `skimage.draw.line` \* `skimage.draw.polygon` \* ...

Draw a few different shapes in different colors onto a canvas.

```
In [1]: %load ../exercises/04-DrawPractice.py

In [ ]: # display the results
viewer = ImageViewer(image)
viewer.show()
```

**Bonus Exercise 1: Drawing a Grid** Use for-loops to iteratively draw an evenly spaced grid onto a grayscale image.

```
In [ ]: rmax, cmax = 400,400
        step = 20
        canvas = np.zeros( (rmax, cmax), dtype = np.uint8)
        # vertical lines
        for c in np.arange(0, cmax, step):
            rr, cc = skimage.draw.line(r0 = 0, c0 = c, r1 = rmax-1, c1 = c)
            canvas[rr,cc] = 255
        # horizontal lines
        for r in np.arange(0, rmax, step):
            rr, cc = skimage.draw.line(r0 = r, c0 = 0, r1 = r, c1 = cmax-1)
            canvas[rr,cc] = 255

        viewer = ImageViewer(canvas)
        viewer.show()
```

**Bonus Exercise 2: Pretty Random** Randomly place N (say 20..) randomly sized circles onto an image. *Hint: use np.random.randint to generate random coordinates and radii. Include a safety margin so that no circle reaches outside of the canvas and raises an IndexError.*

```
In [ ]: # for better plotting
        import numpy as np
        import skimage
        %matplotlib inline
        import matplotlib.pyplot as plt

        rmax, cmax = 600,600
        Ncircles = 20
        canvas = np.zeros( (rmax, cmax), dtype = np.uint8)

        for i in range(Ncircles):

            # get random center coordinates
            r0 = np.random.randint(0, rmax)
            c0 = np.random.randint(0, cmax)

            # compute safety margin
            max_r = min(r0, rmax - r0)
            max_c = min(c0, cmax - c0)
            rad_max = min(max_r, max_c)

            if rad_max < 2:
                continue

            # get random radius
            rad = np.random.randint(1, rad_max)
```

```

    # draw the circle
    rr,cc = skimage.draw.circle(r0, c0, rad)
    canvas[rr,cc] = 255

plt.figure(figsize = (10,10))
plt.imshow(canvas, cmap = 'gray')

```

#### 1.0.4 Applying the Mask

```

In [ ]: # recreate the rectangular mask
mask = np.ones(img.shape[:2], dtype = bool)
rr,cc = skimage.draw.rectangle( start=(357, 44), end=(740, 720))
mask[rr,cc] = False

In [ ]: # use boolean indexing to apply the mask
img[mask] = 0

In [ ]: # show the masked image
viewer = ImageViewer(img)
viewer.show()

```

#### 1.0.5 Exercise: Masking a 96-well plate image

Given the well coordinates, create a mask with a circular region of interest for each well.

```

In [ ]: %load ../exercises/04-MaskWellplate.py

In [ ]: # create empty mask
mask = np.ones(image.shape[:2], dtype = bool)

In [ ]: # loop over coordinates
for index in df.index:

    well = df.loc[index]
    c = well['c']
    r = well['r']

    rr,cc = skimage.draw.circle(r,c, radius = 15)
    mask[rr,cc] = False

# apply the mask
image[mask] = 0
# show result
viewer = ImageViewer(image)
viewer.show()

```