```python
import os
import numpy as np
import matplotlib.pyplot as plt
from skimage import io

BASE_DIRECTORY = '/Users/laurinerichlitzki/laurinesrepository/semester6/img'

image = io.imread(os.path.join(BASE_DIRECTORY, 'cells.png'))


# teilaufgabe a bildränder, randstreifen von 10 intensität auf 0 -> rand
def rand(image, border):
    # Ränder setzen
    image[:border, :] = 0  # oben
    image[-border:, :] = 0  # unten
    image[:, :border] = 0  # links
    image[:, -border:] = 0  # rechts

    return image


# rand erstellen
border_size = 10
image_with_border = rand(image.copy(), border_size)


# teilaufgabe b bildhelligkewit um 19% erhöhen

def bildaufhellung(image, percent):
    image = image * percent
    image = np.clip(image, 0, 255) # randwerte clippen
    image = image.astype('uint8') # wieder von float zurück konvertieren
    return image


# helligkeit erhöhen
```

```
percent = 1.19
image_lighter = bildaufhellung(image_with_border, percent)

# bild anzeigen
plt.imshow(image_with_border, cmap=plt.cm.gray)
plt.show()

plt.imshow(image_lighter, cmap=plt.cm.gray)
plt.show()
```

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# teilaufgabe a bildbreite und höhe ausgeben

def bilddaten(image):
    height = image.shape[0]
    width = image.shape[1]
    print('Bildhöhe:', height, 'Bildbreite:', width)


bilddaten(image)
# Bildhöhe:489 Bildbreite:640


#teilaufgabe b mittelwert der bildintensoitäten

def mittelwert(image):
    mittel = np.mean(image)
    print('Mittelwert:', mittel)


mittelwert(image)
# Mittelwert: 196.69835


# teilaufgabe c intensitätshistogramm
def histo_intesity(image):
    # histo berechnen
    histo, bins = np.histogram(image, bins=256, range=(0, 256))
    # plotten des histo
    plt.figure(figsize=(8, 5))
    plt.bar(bins[:-1], histo, color='green', width=1)
    plt.plot(histo, color='green')
    plt.title("Intensitätshistogramm")
    plt.xlabel("Pixelwert")
    plt.ylabel("Anzahl der Pixel")
    plt.show()

histo_intesity(image)

# teilaufgabe d
# sinvoller schwellwert : 190 (ca. zwischen 180 und 200)
# Histogrammtyp: bimodales histogramm

```

```python
import os
import numpy as np
import matplotlib.pyplot as plt
from skimage import io
from skimage.filters import threshold_otsu, threshold_yen, threshold_li, threshold_mean, threshold_isodata, \
    threshold_triangle

BASE_DIRECTORY = '/Users/laurinerichlitzki/laurinesrepository/semester6/img'

image = io.imread(os.path.join(BASE_DIRECTORY, 'cells.png'))


#  thresholding mit vorgegebenen schwellwert T
def basic_thresholding(image, threshold):
    result = np.where(image >= threshold, 0, 255).astype(np.uint8)
    return result


# berechnung des schwellwertes mittels optimalen thresholding aus vl
def compute_threshold(image, e=1):
    T = np.mean(image)
    d = float('inf')

    while d >= e:
        values1 = image[image >= T]
        values2 = image[image < T]

        if len(values1) == 0 and len(values2) == 0:
            break

        mü1 = np.mean(values1)
        mü2 = np.mean(values2)

        new_T = (mü1 + mü2) / 2
        d = abs(new_T - T)
        T = new_T

    return int(T)


# hilfsfunktion trheshold anwenden,zellen schwarz
def aplly_thresholding(image, threshold):
    binary = np.where(image >= threshold, 0, 255).astype(np.uint8)
    return binary


# schwellwerte berechnen
T_optimal = compute_threshold(image)
print(f"interativer schwellwert {T_optimal}")
# interativer schwellwert 186
T_otsu = threshold_otsu(image)
print(f"otsu schwellwert {T_otsu}")
# otsu schwellwert 186
T_yen = threshold_yen(image)
print(f"yen schwellwert {T_yen}")
# yen schwellwert 118

T_li = threshold_li(image)
print(f"li-schwellwert {T_li:.4f}")
# li-schwellwert 184.4199
T_mean = threshold_mean(image)
print(f"mean-schwellwert {T_mean:.4f}")
# mean-schwellwert 196.6983
T_triangle = threshold_triangle(image)
print(f"triangle-schwellwert {T_triangle:.4f}")
# triangle-schwellwert 205.0000
T_isodata = threshold_isodata(image)
print(f"isodata-schwellwert {T_isodata:.4f}")
# isodata-schwellwert 186.0000

binary_iterative = aplly_thresholding(image, T_optimal)
binary_otsu = aplly_thresholding(image, T_otsu)
binary_yen = aplly_thresholding(image, T_yen)

```

```python
binary_li = aplly_thresholding(image, T_li)
binary_mean = aplly_thresholding(image, T_mean)
binary_triangle = aplly_thresholding(image, T_triangle)
binary_isodata = aplly_thresholding(image, T_isodata)

titles = ['Original', f'Optimsl (T={T_optimal})', f'Otsu (T={T_otsu})', f'Yen (T={T_yen})', f'Li (T={T_li})', f'Mean (T={T_mean})', f'Triangle (T={T_triangle})',f'Isodata (T={T_isodata})',]
images = [image, binary_iterative, binary_otsu, binary_yen, binary_li, binary_mean,binary_triangle, binary_isodata]

plt.figure(figsize=(16, 6))
for i in range(8):
    plt.subplot(2, 4, i + 1)
    plt.imshow(images[i], cmap='gray')
    plt.title(titles[i])
    plt.axis('off')

plt.tight_layout()
plt.show()
```