Bài tập Biến hình và Xử lý ảnh

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Lớp: 21TTH1

Yêu cầu 1 : Thực hiện tốt hơn việc segmentation bàn tay với các phần xương, da, và background bằng các thuật toán global và local threshoding như trong file hướng dẫn thực hành

(Gợi ý : kiểm tra xem các kênh màu khác hoặc kiểm tra việc áp dụng các chức năng canh chỉnh histogram (histogram equalization) hay gamma correction)

In [ ]:
```
import os

path = os.getcwd()
os.chdir(path)
print(os.listdir())
```

```
['21110256_HuynhNguyenTheDan_ IS Lab01.html', '21110256_HuynhNguyenTheDan_ IS Lab
01.ipynb', '21110256_HuynhNguyenTheDan_ IS Lab01.pdf', '21110259_LeQuocDat_IS lab
01.pdf', 'Object Segmentation Data']
```

In [ ]:
```
os.chdir(os.path.join(path, 'Object Segmentation Data'))
print(os.listdir())
```

```
['Activities.jpeg', 'Barcode.png', 'Bone.jpg', 'Brain.jpg', 'Car.jpg', 'Chest.jp
g', 'Cloths.jpg', 'Code.jpg', 'Crack.jpg', 'Cross.jpg', 'Defect.jpg', 'Dust.jpg',
'Emotion.jpg', 'Face.jpg', 'Fire.jpg', 'Gesture.jpg', 'Hand.jpg', 'Iris.jpg', 'Le
af.jpg', 'Lung.png', 'Mask.jpg', 'Melanoma.jpg', 'QR.jpg', 'Retina.jpg', 'Shelf.j
pg', 'Sign.jpg', 'Tumor.png', 'Writing.png']
```

In [ ]:
```
import numpy as np
import cv2
from matplotlib import pyplot as plt
from skimage.color import rgb2gray
from skimage.filters import threshold_otsu
from skimage.measure import label, regionprops
from skimage.segmentation import mark_boundaries
from scipy import ndimage as ndi
import pandas as pd
import json
import os
import timeit
import random
```

In [ ]:
```
def ShowImage(ImageList, nRows = 1, nCols = 2, WidthSpace = 0.00, HeightSpace =
    from matplotlib import pyplot as plt
    import matplotlib.gridspec as gridspec
```

```
    gs = gridspec.GridSpec(nRows, nCols)
    gs.update(wspace=WidthSpace, hspace=HeightSpace) # set the spacing between a
    plt.figure(figsize=(20,20))
    for i in range(len(ImageList)):
        ax1 = plt.subplot(gs[i])
        ax1.set_xticklabels([])
        ax1.set_yticklabels([])
        ax1.set_aspect('equal')

        plt.subplot(nRows, nCols,i+1)

        image = ImageList[i].copy()
        if (len(image.shape) < 3):
            plt.imshow(image, plt.cm.gray)
        else:
            plt.imshow(image)
        plt.title("Image " + str(i))
        plt.axis('off')

    plt.show()
```

In [ ]:
```
import os
import pandas as pd

def get_subfiles(dir):
    "Get a list of immediate subfiles"
    return next(os.walk(dir))[2]
```

In [ ]:
```
path_Data = os.path.join(path, 'Object Segmentation Data')
os.listdir(path_Data)
```

Out[ ]:
```
['Activities.jpeg',
 'Barcode.png',
 'Bone.jpg',
 'Brain.jpg',
 'Car.jpg',
 'Chest.jpg',
 'Cloths.jpg',
 'Code.jpg',
 'Crack.jpg',
 'Cross.jpg',
 'Defect.jpg',
 'Dust.jpg',
 'Emotion.jpg',
 'Face.jpg',
 'Fire.jpg',
 'Gesture.jpg',
 'Hand.jpg',
 'Iris.jpg',
 'Leaf.jpg',
 'Lung.png',
 'Mask.jpg',
 'Melanoma.jpg',
 'QR.jpg',
 'Retina.jpg',
 'Shelf.jpg',
 'Sign.jpg',
 'Tumor.png',
 'Writing.png']
```

In [ ]:
```
path_Data = os.path.join(path, 'Object Segmentation Data')
all_names = sorted(get_subfiles(path_Data))
print("Number of Images:", len(all_names))
IMG = []
for i in range(len(all_names)):
  tmp = cv2.imread(os.path.join(path_Data,all_names[i]))
  IMG.append(tmp)

ImageDB = IMG.copy()
NameDB = all_names
print(NameDB)
```

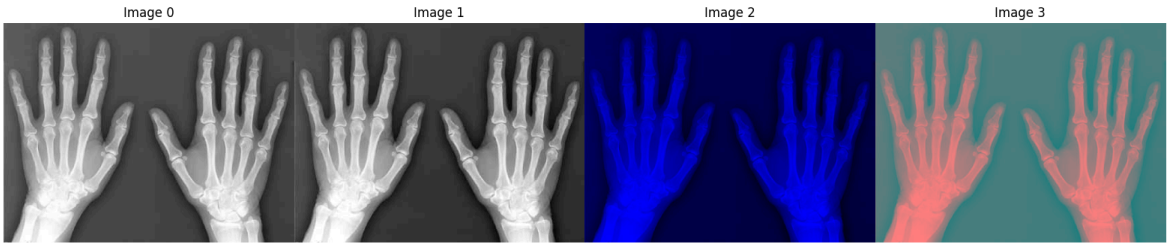
```
Number of Images: 28
['Activities.jpeg', 'Barcode.png', 'Bone.jpg', 'Brain.jpg', 'Car.jpg', 'Chest.jp
g', 'Cloths.jpg', 'Code.jpg', 'Crack.jpg', 'Cross.jpg', 'Defect.jpg', 'Dust.jpg',
'Emotion.jpg', 'Face.jpg', 'Fire.jpg', 'Gesture.jpg', 'Hand.jpg', 'Iris.jpg', 'Le
af.jpg', 'Lung.png', 'Mask.jpg', 'Melanoma.jpg', 'QR.jpg', 'Retina.jpg', 'Shelf.j
pg', 'Sign.jpg', 'Tumor.png', 'Writing.png']
```

Segmentation phần da của tay

In [ ]:
```
FileName = 'Hand.jpg'
idx = NameDB.index(FileName)
print("Selected Image : ", "\nIndex ", idx, "\nName ", NameDB[idx])

image_orig = ImageDB[idx]
image_gray = cv2.cvtColor(image_orig,cv2.COLOR_BGR2GRAY)
image_hsv = cv2.cvtColor(image_orig, cv2.COLOR_BGR2HSV)
image_ycbcr = cv2.cvtColor(image_orig, cv2.COLOR_BGR2YCR_CB)
ShowImage([image_orig, image_gray, image_hsv, image_ycbcr], 1, 4)
```

```
Selected Image :
Index  16
Name  Hand.jpg
```



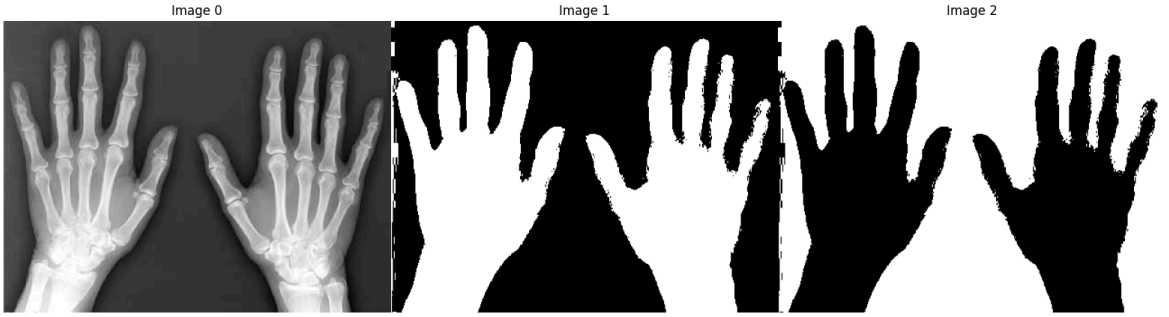
In [ ]:
```python
def p_tile_threshold(image, pct):
  n_pixels = pct * image.shape[0] * image.shape[1]
  hist = np.histogram(image, bins=range(256))[0]
  hist = np.cumsum(hist)

  return np.argmin(np.abs(hist - n_pixels))
```

In [ ]:
```python
T = p_tile_threshold(image_gray, pct = 0.55)
print(T)

mask_obj = image_gray > T
mask_bg = image_gray <= T
ShowImage([image_gray, mask_obj, mask_bg], 1, 3)
```

```
96
```



In [ ]:
```python
def otsu(gray):
  pixel_number = gray.shape[0] * gray.shape[1]
  mean_weigth = 1.0/pixel_number
  his, bins = np.histogram(gray, np.array(range(0, 256)))
  final_thresh = -1
  final_value = -1

  WBackground = []
  WForeground = []
  Values = []

  for t in bins[1:-1]: # This goes from 1 to 254 uint8 range (Pretty sure wont b
      Wb = np.sum(his[:t]) * mean_weigth
      Wf = np.sum(his[t:]) * mean_weigth

      mub = np.mean(his[:t])
      muf = np.mean(his[t:])

      value = Wb * Wf * (mub - muf) ** 2
      # print("Wb", Wb, "Wf", Wf)
      # print("t", t, "value", value)
      WBackground.append(Wb)
      WForeground.append(Wf)
```

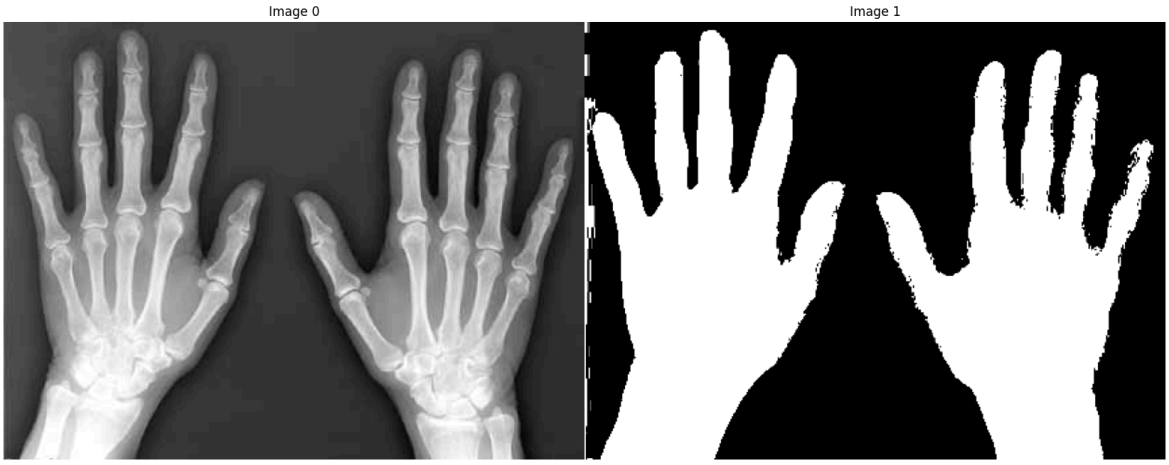
```
        Values.append(value)

        if value > final_value:
            final_thresh = t
            final_value = value

    final_img = gray.copy()
    print(final_thresh)
    final_img[gray > final_thresh] = 255
    final_img[gray < final_thresh] = 0
    return final_img, final_thresh, [WBackground, WForeground, Values]
```

In [ ]:
```
final_img, final_thresh, parms = otsu(image_gray)
ShowImage([image_gray, final_img], 1, 2)
```

97



In [ ]:
```
WBackground, WForeground, Values = parms[0], parms[1], parms[2]
print(WBackground)
print(WForeground)
print(Values)

plt.plot(Values)
plt.show()
plt.plot(WBackground)
plt.plot(WForeground)
plt.show()
```

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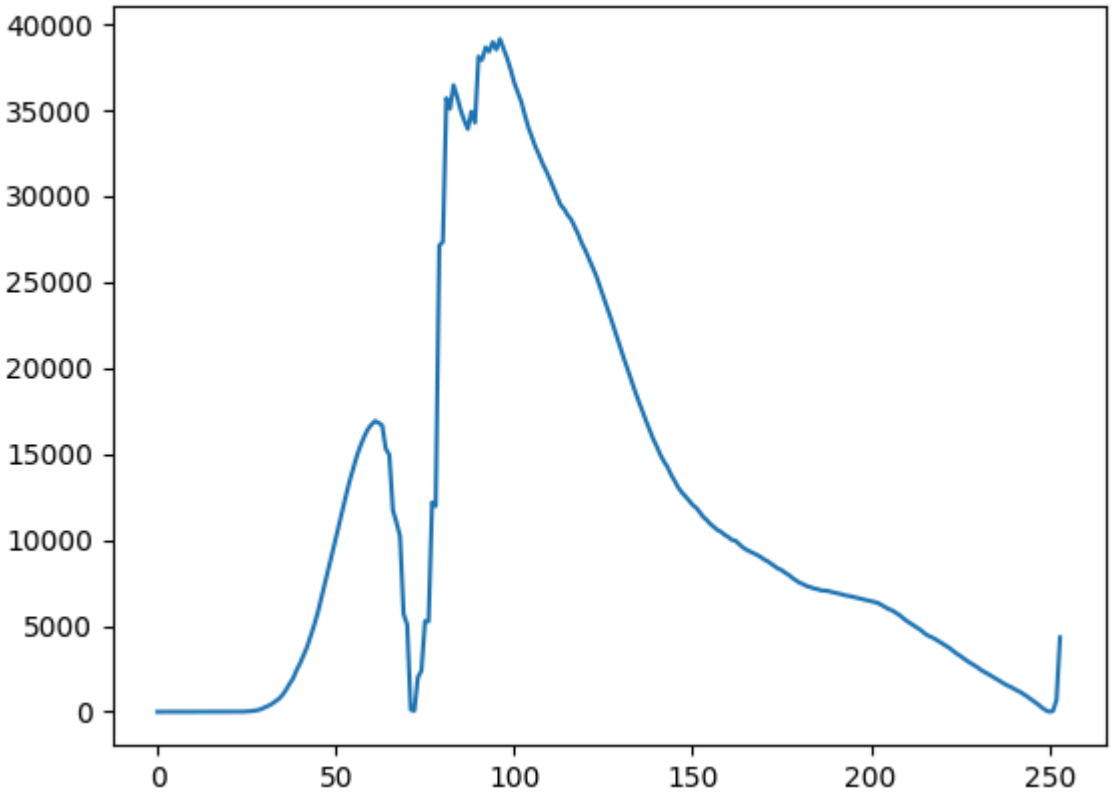
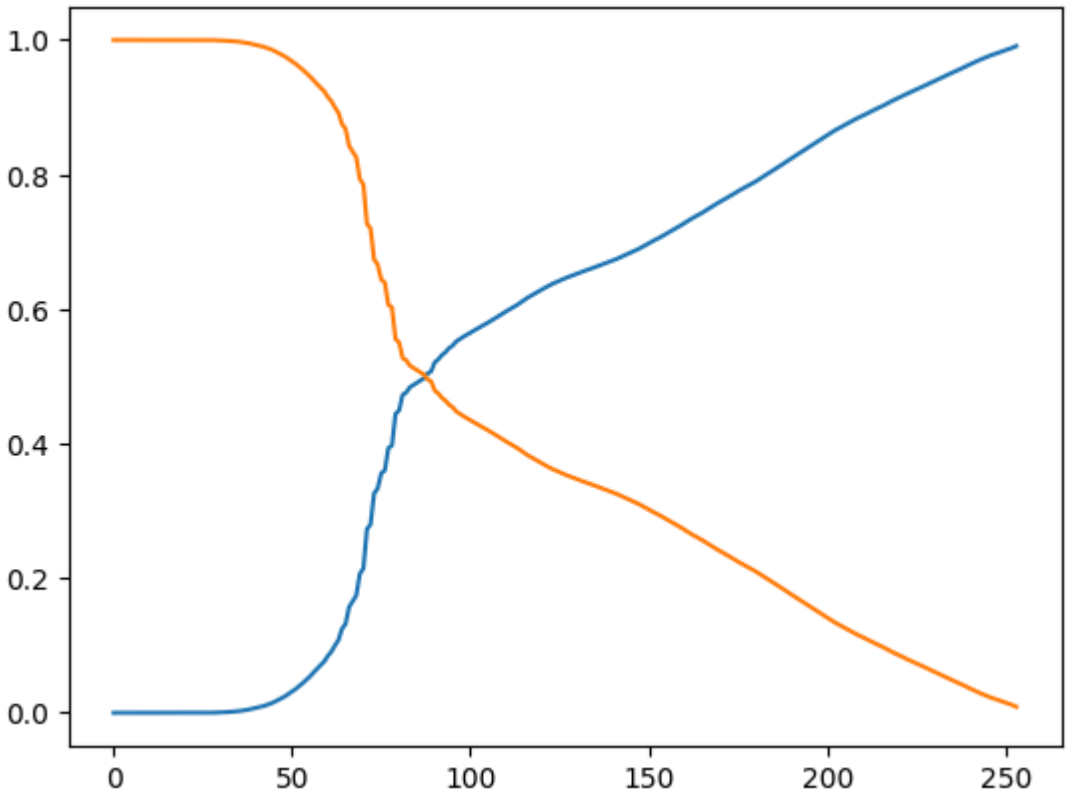


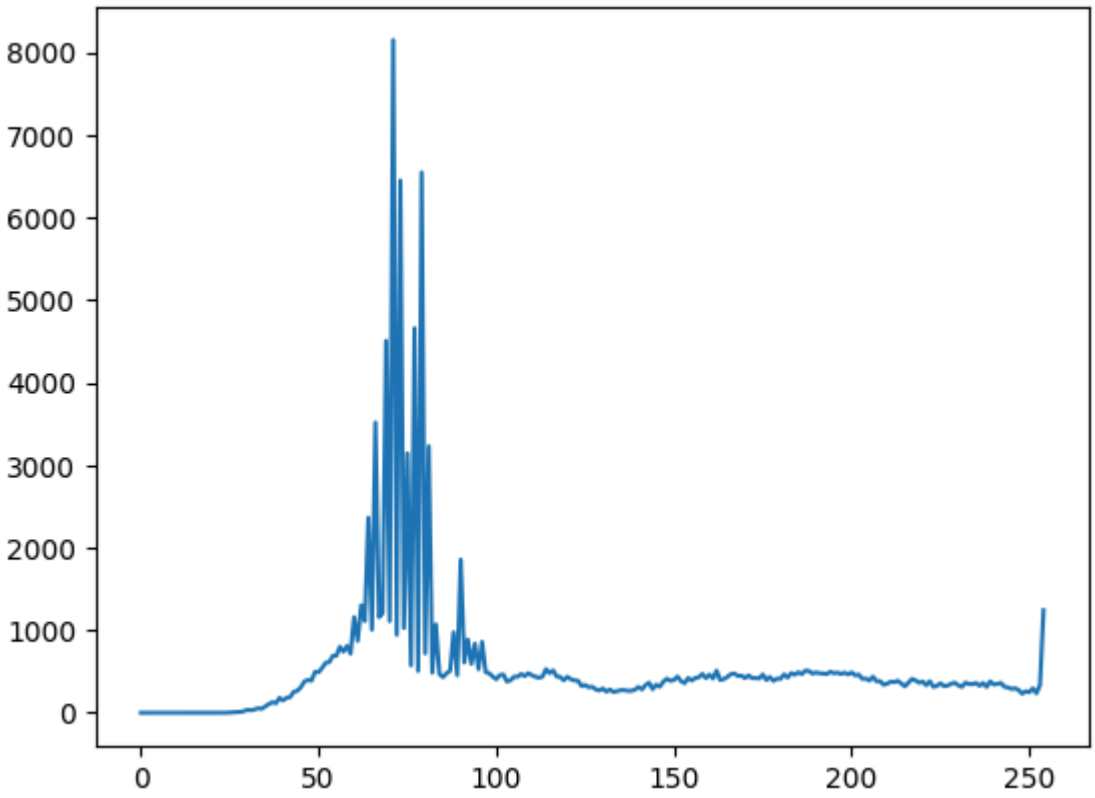


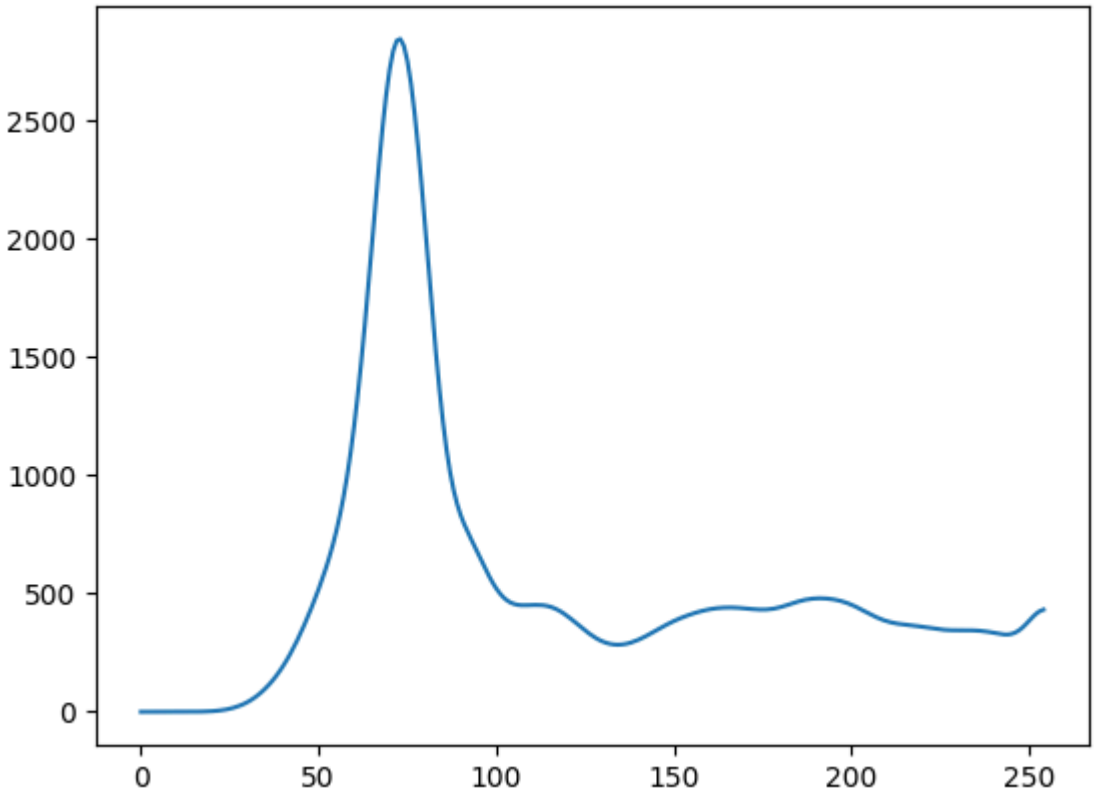
Segmentation với phần xương của tay

In [ ]:
```
def two_peaks_threshold(image, smooth_hist=True, sigma=5):
    from scipy.ndimage import gaussian_filter

    hist = np.histogram(image, bins=range(256))[0].astype(np.float64)
    plt.plot(hist)
    plt.show()
```

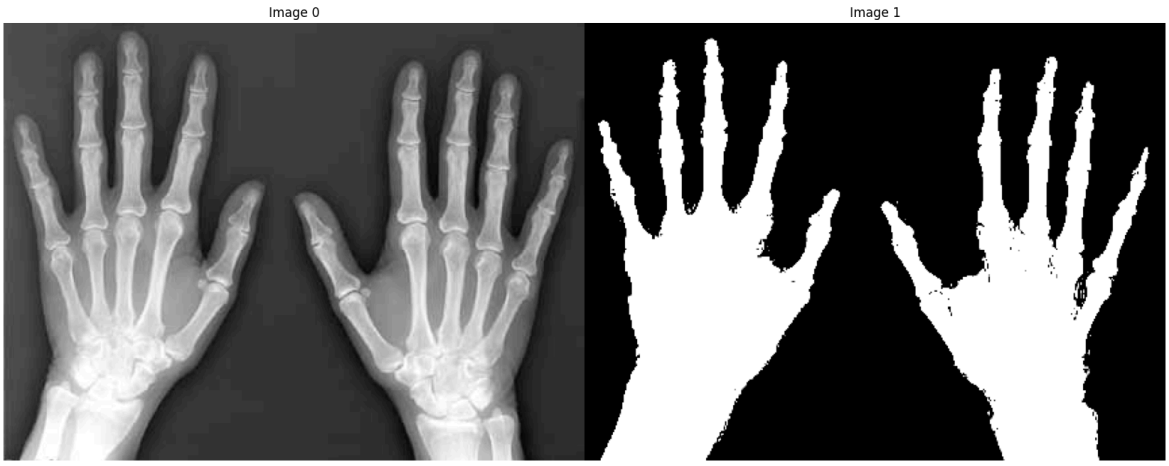
```
    if smooth_hist:
        hist = gaussian_filter(hist, sigma=sigma)
        plt.plot(hist)
        plt.show()

    f_peak = np.argmax(hist)

    # finding second peak
    s_peak = np.argmax((np.arange(len(hist)) - f_peak) ** 2 * hist)

    thr = np.argmin(hist[min(f_peak, s_peak): max(f_peak, s_peak)])
    thr += min(f_peak, s_peak)

    final_img = image.copy()
    print(thr)
    final_img[image > thr] = 255
    final_img[image < thr] = 0

    return final_img, thr, hist
```

In [ ]:
```
final_img, final_thresh, hist = two_peaks_threshold(image_gray)
ShowImage([image_gray, final_img], 1, 2)
```





134

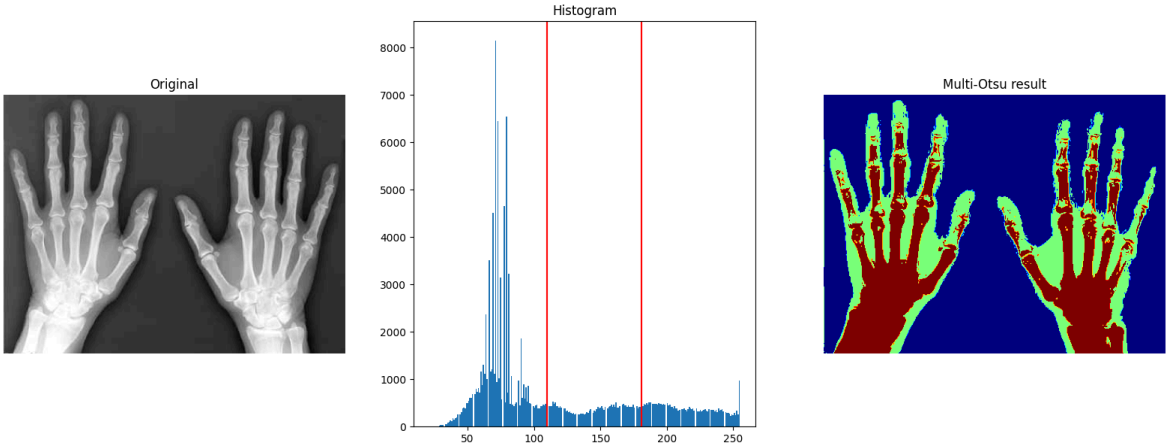


Multi-Otsu (Segmentation với background của phần tay)

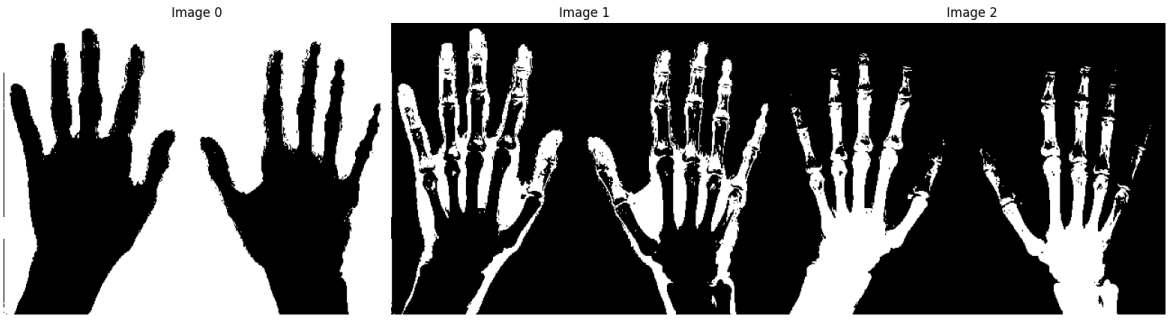
In [ ]:

```
from skimage.filters import threshold_multiotsu
# Applying multi-Otsu threshold for the default value, generating
# three classes.
thresholds = threshold_multiotsu(image_gray)
# Using the threshold values, we generate the three regions.
regions = np.digitize(image_gray, bins=thresholds)

fig, ax = plt.subplots(nrows=1, ncols=3, figsize=(20, 7))
# Plotting the original image.
ax[0].imshow(image_gray, cmap='gray')
ax[0].set_title('Original')
ax[0].axis('off')
# Plotting the histogram and the two thresholds obtained from
# multi-Otsu.
ax[1].hist(image_gray.ravel(), bins=255)
ax[1].set_title('Histogram')
```

```
for thresh in thresholds:
    ax[1].axvline(thresh, color='r')
# Plotting the Multi Otsu result.
ax[2].imshow(regions, cmap='jet')
ax[2].set_title('Multi-Otsu result')
ax[2].axis('off')
plt.subplots_adjust()
plt.show()
```

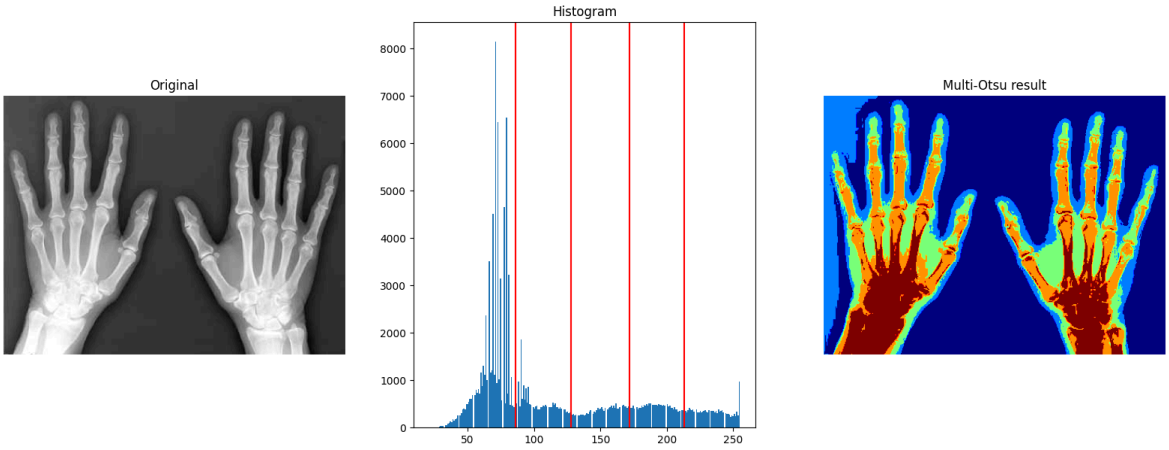


In [ ]:
```
Segments = []
for idx in list(np.unique(regions)):
  mask = regions == idx
  Segments.append(mask)

ShowImage(Segments, 1, len(Segments))
```



In [ ]:
```
thresholds = threshold_multiotsu(image_gray, classes=5)
regions = np.digitize(image_gray, bins=thresholds)

fig, ax = plt.subplots(nrows=1, ncols=3, figsize=(20, 7))
# Plotting the original image.
ax[0].imshow(image_gray, cmap='gray')
ax[0].set_title('Original')
ax[0].axis('off')
# Plotting the histogram and the two thresholds obtained from
# multi-Otsu.
ax[1].hist(image_gray.ravel(), bins=255)
ax[1].set_title('Histogram')
for thresh in thresholds:
    ax[1].axvline(thresh, color='r')
# Plotting the Multi Otsu result.
ax[2].imshow(regions, cmap='jet')
ax[2].set_title('Multi-Otsu result')
ax[2].axis('off')
```

```
plt.subplots_adjust()
plt.show()
```



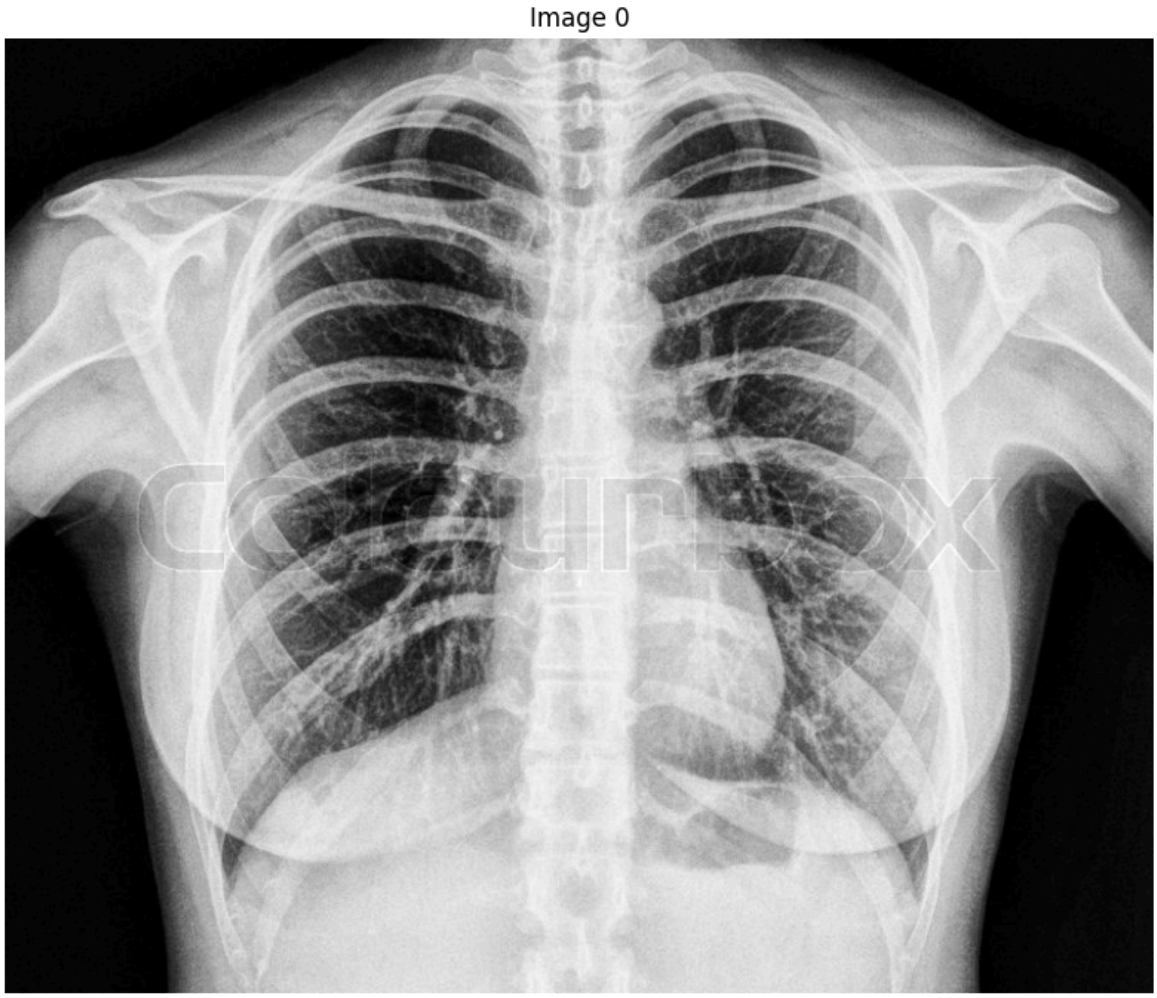
Yêu cầu 2 : Chọn thêm 2 ví dụ trong danh sách hình và định nghĩa object cần segment trong các hình là gì và thực hiện segmentation tốt nhất bằng global và local thresholdin

In [ ]:
```
import numpy as np
import cv2
from matplotlib import pyplot as plt
from pylab import imread
from skimage.color import rgb2gray
from skimage.filters import threshold_otsu
from skimage.measure import label, regionprops
from skimage.segmentation import mark_boundaries
from scipy import ndimage as ndi
import pandas as pd
import json
import os
import timeit
import random
```

Segment object Chest

In [ ]:
```
FileName = 'Chest.jpg'
idx = NameDB.index(FileName)
print("Selected Image : ", "\nIndex ", idx, "\nName ", NameDB[idx])

image_orig = ImageDB[idx]
ShowImage([image_orig], 1)
```

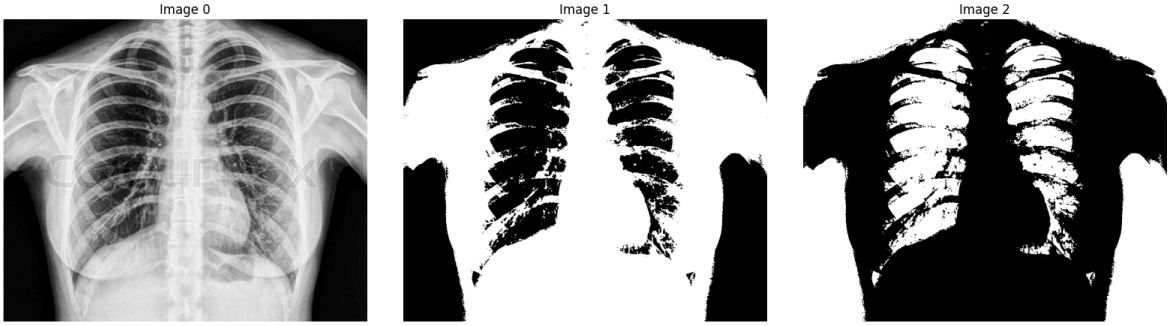
```
Selected Image :
Index  5
Name  Chest.jpg
```



In [ ]:
```
def p_tile_threshold(image, pct):
  n_pixels = pct * image.shape[0] * image.shape[1]
  hist = np.histogram(image, bins=range(256))[0]
  hist = np.cumsum(hist)
  return np.argmin(np.abs(hist - n_pixels))
```

In [ ]:
```
image_color = image_orig.copy()
image_gray = cv2.cvtColor(image_color, cv2.COLOR_RGB2GRAY)

T = p_tile_threshold(image_gray, pct = 0.40)
print(T)

mask_obj = image_gray > T
mask_bg = image_gray <= T
ShowImage([image_gray, mask_obj, mask_bg], 1, 3, WidthSpace = 0.10, HeightSpace
```

138



Segment object People

In [ ]:
```
FileName = 'Cloths.jpg'
idx = NameDB.index(FileName)
print("Selected Image : ", "\nIndex ", idx, "\nName ", NameDB[idx])

image_orig = ImageDB[idx]
ShowImage([image_orig], 1)
```

```
Selected Image :
Index  6
Name  Cloths.jpg
```

Image 0

In [ ]:

```
def p_tile_threshold(image_orig, pct):
    n_pixels = pct * image_orig.shape[0] * image_orig.shape[1]
    hist = np.histogram(image_orig, bins=range(256))[0]
    hist = np.cumsum(hist)

    return np.argmin(np.abs(hist - n_pixels))
```

In [ ]:
```
image_color = image_orig.copy()
image_gray = cv2.cvtColor(image_color, cv2.COLOR_RGB2GRAY)
T = p_tile_threshold(image_gray, pct = 0.35)
print(T)
mask_obj = image_gray > T
mask_bg = image_gray <= T
ShowImage([image_gray, mask_obj, mask_bg], 1, 3, WidthSpace = 0.10, HeightSpace
```

```
155
```