SoC: Image Processing and object Detection

Week 5 and 6

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Determine the % porosity of the surface

Idea

- First read the image using openCV in grayscale

- Find total number of pixels using shape of image

- We have to convert image into black and white using appropriate threshold

- find number of pixels which are black i.e, equal to zero (number of void pixels)

- Hence, find % porosity of the surface

First import the necessary packages cv2 and numpy

```
1 # import packages
2 import cv2
3 import numpy as np
```
Listing 1: Import packages

Read image in gray-scale and convert it into a black-white image using a threshold value. We are using cv2.THRESH_BINARY_INVERSE this changes pores into white and remaining into black.

```
1 # threshold values
2 threshold = 5
3
4 # Read image in grayscale
5
6 image = cv2.imread('Image-detection/demo/Resources/Photos/Sample Image.jpg'
    , cv2.IMREAD_GRAYSCALE)
7
8 #  Convert into black and white image
9 _, binary_image = cv2.threshold(image, threshold, 255, cv2.
    THRESH_BINARY_INV)
```
Listing 2: Image transform

Find total number of pixels and number of white pixels in the binary image and hence find porosity.

```python
# find total pixels in the image
total_pixels = image.shape[0] * image.shape[1]

# find number of black pixels
pore_pixels = cv2.countNonZero(binary_image)

# Calculate porosity_percentage = (black pixels)/(total pixels)* 100
porosity_percentage = (pore_pixels / total_pixels) * 100

# print porosity upto 2 decimals
print(f"Porosity Percentage: {porosity_percentage:.2f}%")
```

Listing 3: Porosity

Close windows upon keyboard input.

```python
# wait and destroy all windows upon keyboard input
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Listing 4: Delete windows

Tunable parameters that could affect accuracy of porosity

We need to adjust the threshold value so that all the pore pixels have value less than threshold and white pixels more then thrshold. How to find threshold? Lets look at a graph between colour_value and number of pixels for that certain colour value

Pixel Value Histogram
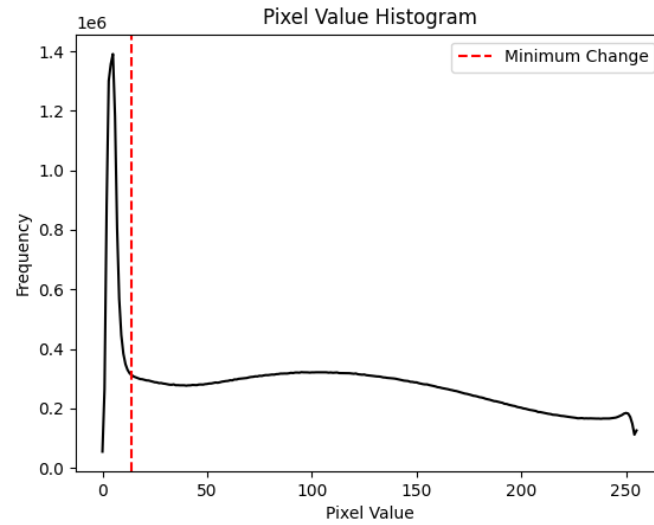
We can see that most of the pore pixels are under the color value of 14.
So if we set the threshold value as 14, we might get the best approximate value.
If we run our code for a threshold of 14, we obtain a porosity of 13.66%.

Porosity Percentage vs Threshold Value
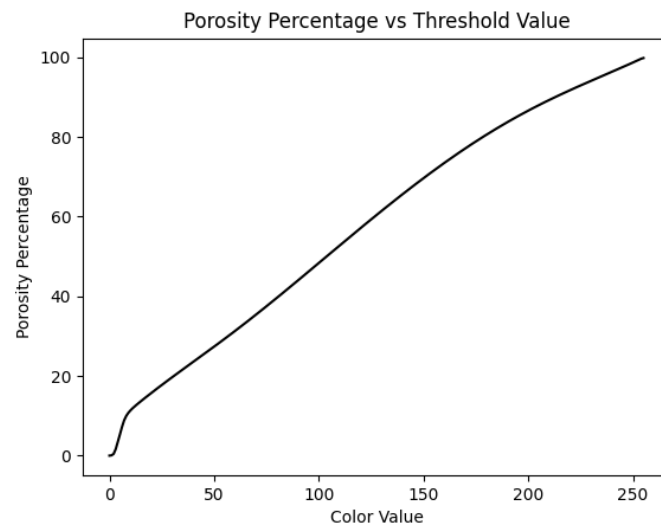
Above is the graph between threshold and porosity percentage
The kink at the start is the most accurate value of porosity.

```python
# import packages
import cv2
import numpy as np

# threshold values
threshold = 14

# Read image in grayscale

image = cv2.imread('Image-detection/demo/Resources/Photos/Sample Image.jpg'
    , cv2.IMREAD_GRAYSCALE)

#  Convert into black and white image
_, binary_image = cv2.threshold(image, threshold, 255, cv2.
    THRESH_BINARY_INV)

# find total pixels in the image
total_pixels = image.shape[0] * image.shape[1]

# find number of black pixels
pore_pixels = cv2.countNonZero(binary_image)

# Calculate porosity_percentage = (black pixels)/(total pixels)* 100
porosity_percentage = (pore_pixels / total_pixels) * 100

# print porosity upto 2 decimals
print(f"Porosity Percentage: {porosity_percentage:.2f}%")

# wait and destroy all windows upon keyboard input
cv2.waitKey(0)
cv2.destroyAllWindows()
```

Listing 5: Complete script