SciComp with Py

CVIP

Basic Image Processing with OpenCV

Part 04

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Review

Splitting and Amplifying Channels

```
image = cv2.imread(args['image'])
## split the image into 3 channels
B, G, R = cv2.split(image)
## show each channel
print "B's shape:", B.shape
print "G's shape:", G.shape
print "R's shape:", R.shape

cv2.imshow('Red', R)
cv2.imshow('Green', G)
cv2.imshow('Blue', B)
cv2.waitKey(0)
cv2.destroyAllWindows()

## merge B, G, R channels back to get the original image
merged = cv2.merge([B, G, R])
cv2.imshow('Merged', merged)

## amplifying blue by adding 100 to it
amplified_blue = cv2.merge([B+100, G, R])
cv2.imshow('Amplified Blue', amplified_blue)
```

Merging Single Channels

Get the height and width of the image

split_merge.py

```
image = cv2.imread(args['image'])

B, G, R = cv2.split(image)

zeros = np.zeros(image.shape[:2], dtype='uint8')

cv2.imshow('Red', cv2.merge([zeros, zeros, R]))
cv2.imshow('Green', cv2.merge([zeros, G, zeros]))
cv2.imshow('Blue', cv2.merge([B, zeros, zeros]))

cv2.waitKey(0)
cv2.destroyAllWindows()
```

3 Big M's of Statistics

3 Big M's

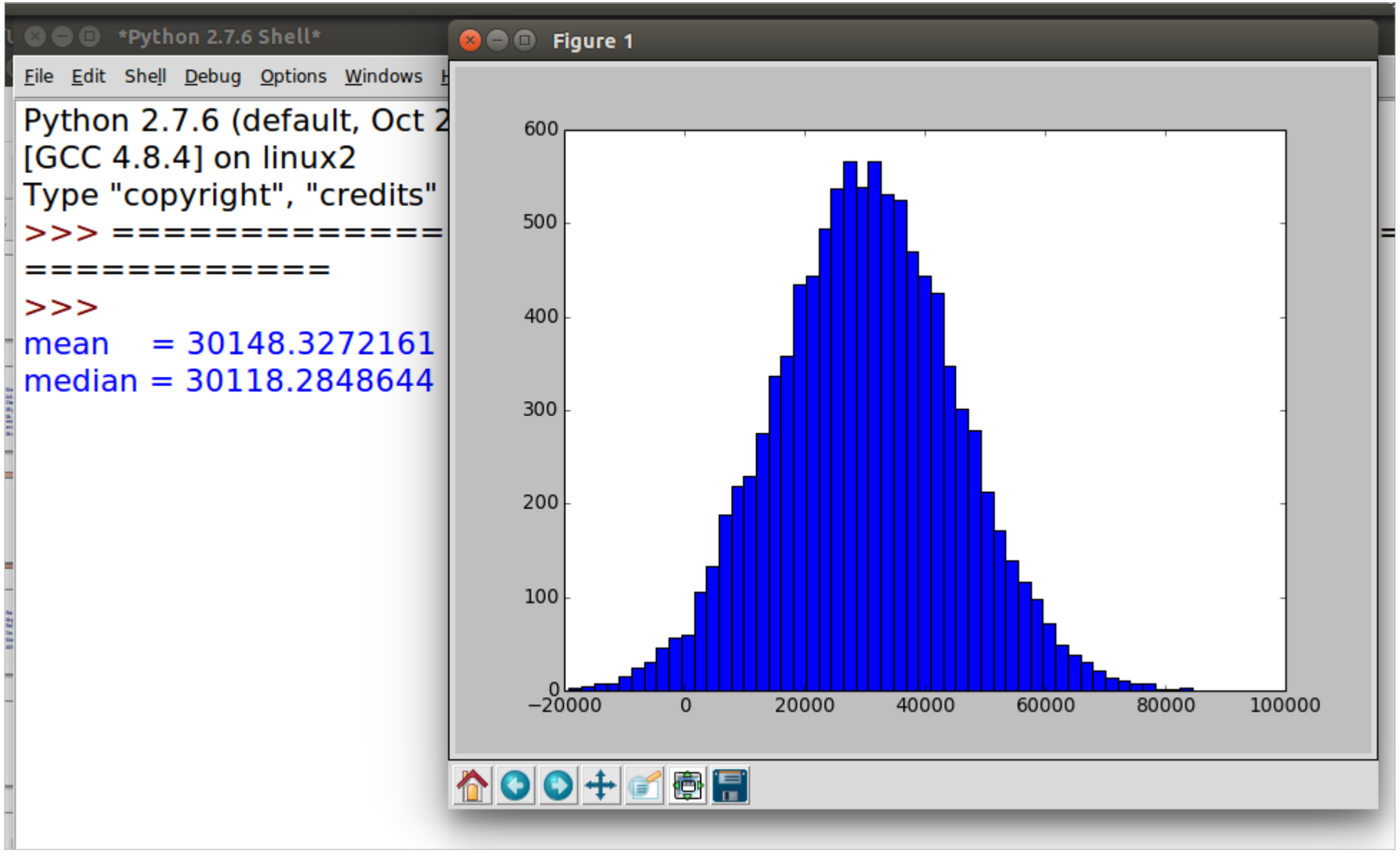
- Mean – is the average of a set of values
- Median – a numerical value **v** right in the middle of the sorted sequence of values so that exactly half of the values in the sequence are less than v and half are greater than **v**
- Mode – the most frequent value in a set of values

Plotting Mean & Median

source in mean_median_mode.py

```
import numpy as np
import matplotlib.pyplot as plt
from scipy import stats
## use normal distribution to generate 10,000 points
## centered on 30,000 with an STD = 15,000
incomes = np.random.normal(30000, 15000, 10000)
## if you want to see an outlier, add this
## billionaire's income to the list of incomes
#incomes = np.append(incomes, [1000000000])
mn = np.mean(incomes)
print('mean    = ' + str(mn))
md = np.median(incomes)
print('median = ' + str(md))
## if you want to see a plot of incomes
plt.hist(incomes, 50)
plt.show()
```

Incomes w/o Billionaire's Salary



Computing Mode

source in mean_median_mode.py

```
import numpy as np
import matplotlib.pyplot as plt
from scipy import stats
## create a random array of 500 ages from 10 up to 90.
ages = np.random.randint(10, high=90, size=500)
print(ages)
mo = stats.mode(ages)
## the result will print like (array([ 22.]), array([ 18.])),
## where the first number, 22, is the most frequent age
## and the second number, 18, is the number of times
##that age occurs in ages.
print(mo)
```

Mode Test Run

[26 45 69 33 68 66 22 66 65 34 48 46 88 53 84 87 85 68 11 54 12 81 38 84 49 16 81 66 22 47 19 69 89 33 80 79 62 63 46 59 88 51 63 83 60 59 61 19 17 60
52 40 49 56 56 69 43 33 56 68 21 39 31 41 75 35 79 50 25 80 43 16 38 72 32 22 86 41 10 89 19 27 72 39 29 77 88 36 84 26 14 38 16 64 73 20 25 29 26 53
28 54 45 45 62 85 51 74 39 30 25 17 59 32 58 49 70 52 37 13 72 12 82 86 88 72 12 31 35 31 13 74 30 89 85 17 22 78 53 67 52 47 86 77 40 15 62 30 41 52
40 27 76 26 65 86 81 36 76 32 41 24 24 24 83 72 61 60 51 80 47 33 47 32 82 22 18 61 79 34 36 28 54 41 80 58 38 56 46 12 64 84 65 59 55 66 72 50 54 60
65 45 32 64 55 85 56 11 20 67 56 85 15 46 84 48 70 72 23 60 89 73 71 55 23 27 87 85 70 77 42 27 87 22 12 35 33 13 53 37 11 62 78 75 20 11 41 51 11 33
29 83 29 70 33 33 75 65 10 14 89 19 33 76 85 63 80 57 76 22 84 88 42 53 34 33 74 69 41 14 13 26 51 58 89 86 48 64 21 31 41 10 76 73 65 30 83 61 40 35
76 58 81 73 36 46 71 61 53 37 18 78 29 48 60 14 10 55 77 69 35 76 82 21 35 66 61 20 59 18 26 40 36 77 42 22 57 86 40 86 65 16 41 70 19 71 85 60 68 52
52 51 84 28 27 82 34 84 59 73 58 65 35 37 40 67 36 56 39 11 17 71 75 48 12 30 17 24 53 27 35 40 60 17 69 37 83 85 28 16 61 40 67 44 73 21 70 71 47 69
69 56 86 44 44 67 41 76 49 24 46 11 13 56 15 55 56 10 55 63 40 28 87 53 32 62 82 79 66 40 26 80 30 65 34 49 47 78 17 23 65 62 62 52 66 29 64 15 58 78
41 40 71 71 48 73 41 75 73 66 51 60 23 31 31 79 23 16 31 23 67 78 34 59 13 74 26 16 37 75 14 58 55 82 74 29 30 25 37 63 41 15 17 66 64 84 11 49 52 18]

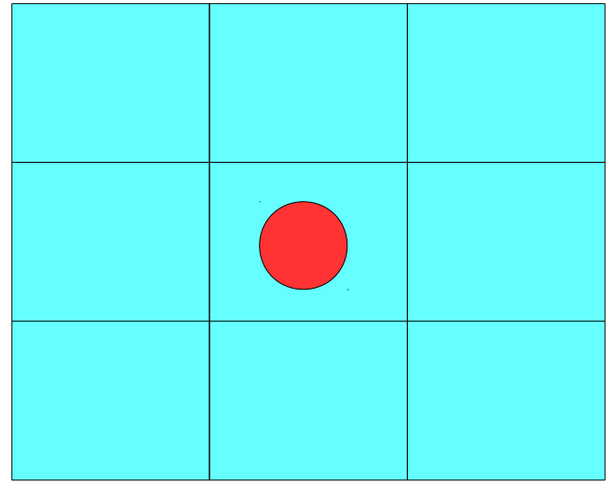
(array([41.]), array([13.]))

Pixel Masks

Pixel Masks

	0	1	2	...	N
0	128	255	10	201	203
1	120	35	50	25	137
2	34	89	190	197	108
...	180	178	215	37	45
M	24	25	91	225	225

3 x 3 Pixel Mask



Pixel masks are used to compute various properties of the center pixel

Pixel Masks

	0	1	2	...	N
0	128	255	10	201	203
1	120	35	50	25	137
2	34	89		197	108
...	180	178	215	37	45
M	24	25	91	225	225

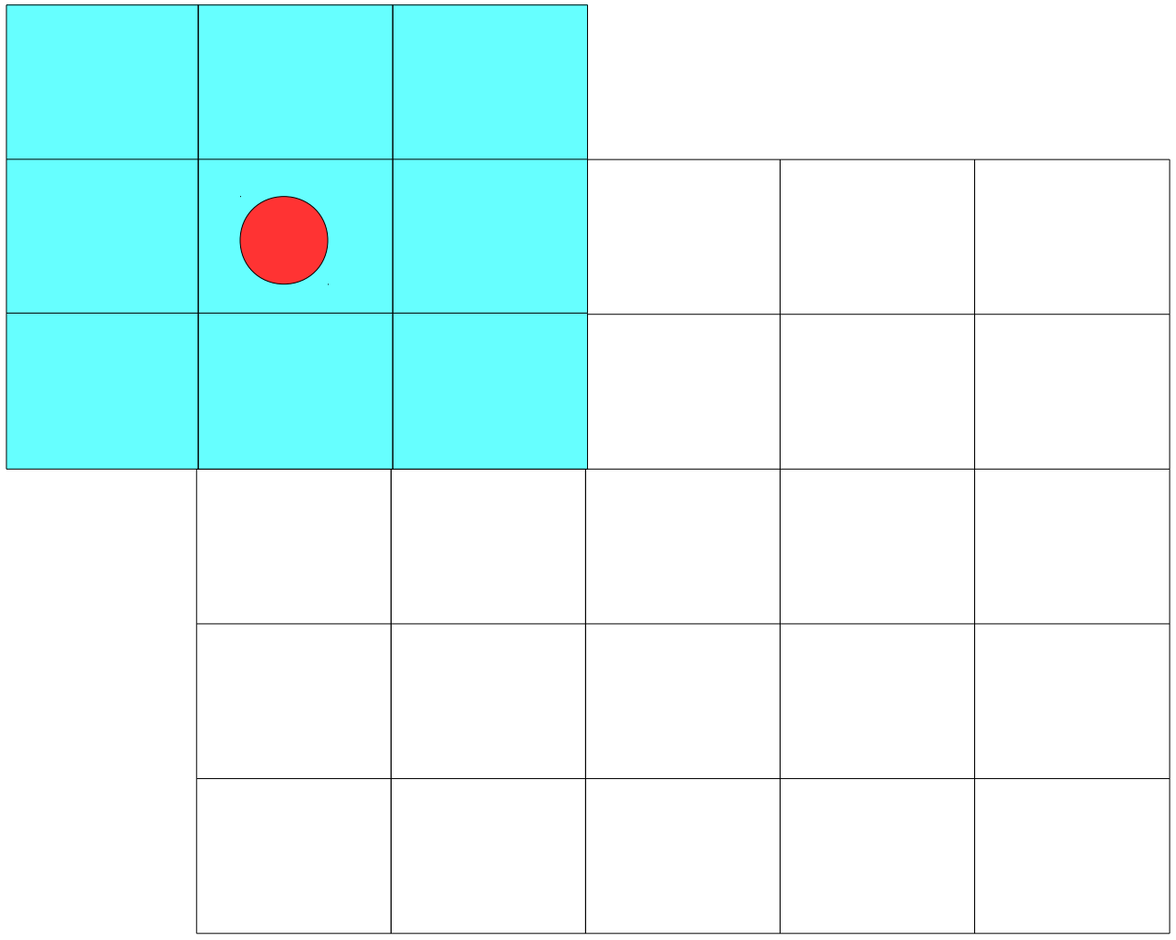
Pixel masks are superimposed on the image to compute various properties of the center pixel.

Computing Cell Properties

	0	1	2	3	4
0	128	255	10	201	203
1	120	35	50	25	137
2	34	89		197	108
3	180	178	215	37	45
4	24	25	91	225	225

Properties of cell I[2, 2] can be computed in terms of cells I[1,1], I[2, 1], I[3, 1], I[1, 2], I[3,2], I[1, 3], I[2, 3], and I[3,3].

Border Pixel Problem



What happens when the mask is centered at a border pixel? Some pixels covered by the mask do not exist.

Two possible approaches:
1) Pad the image; this can be done virtually.
2) Do not center the mask at the border pixels.

Image Convolution: Applying Masks to Images

- Given an image **I** and a mask **M**, **M** is centered at each pixel (or a subset of pixels) and a value **v** is computed
- This value **v** is saved in an new image or the value of the current pixel on which **M** is centered is destructively modified with **v**
- This process is referred to as *image convolution*

References

- www.opencv.org