RINEX

Machine Learning

Major Project: 2

K-Means Clustering & Image Processing

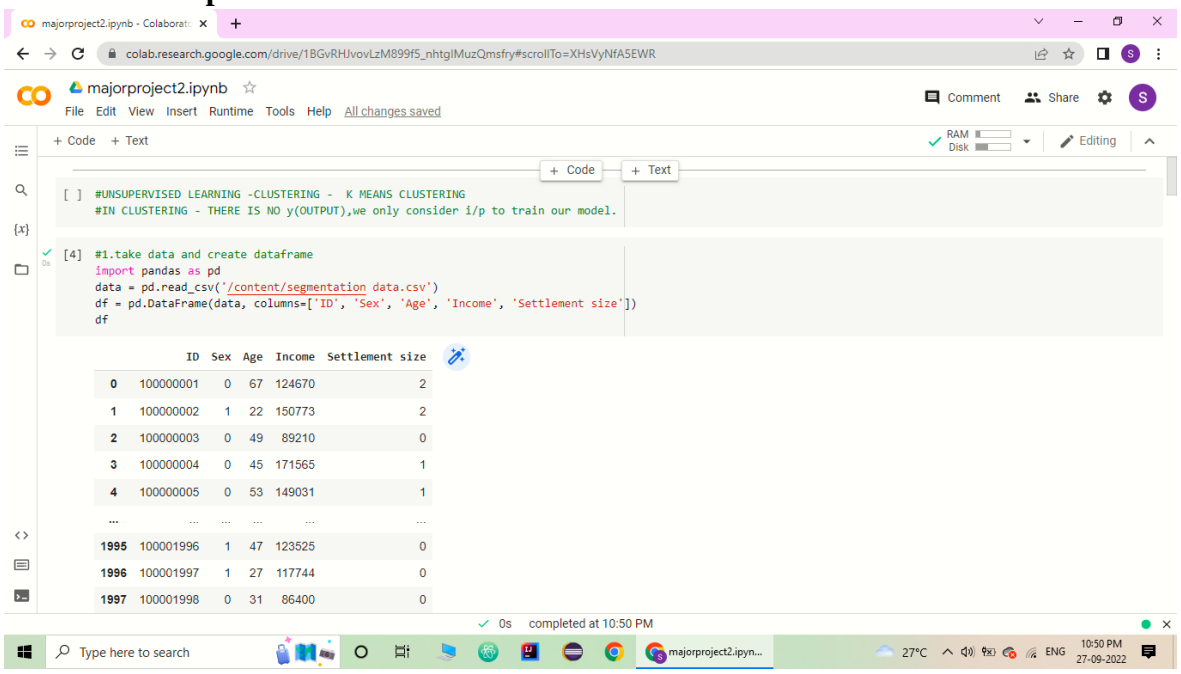
Harsh Singh

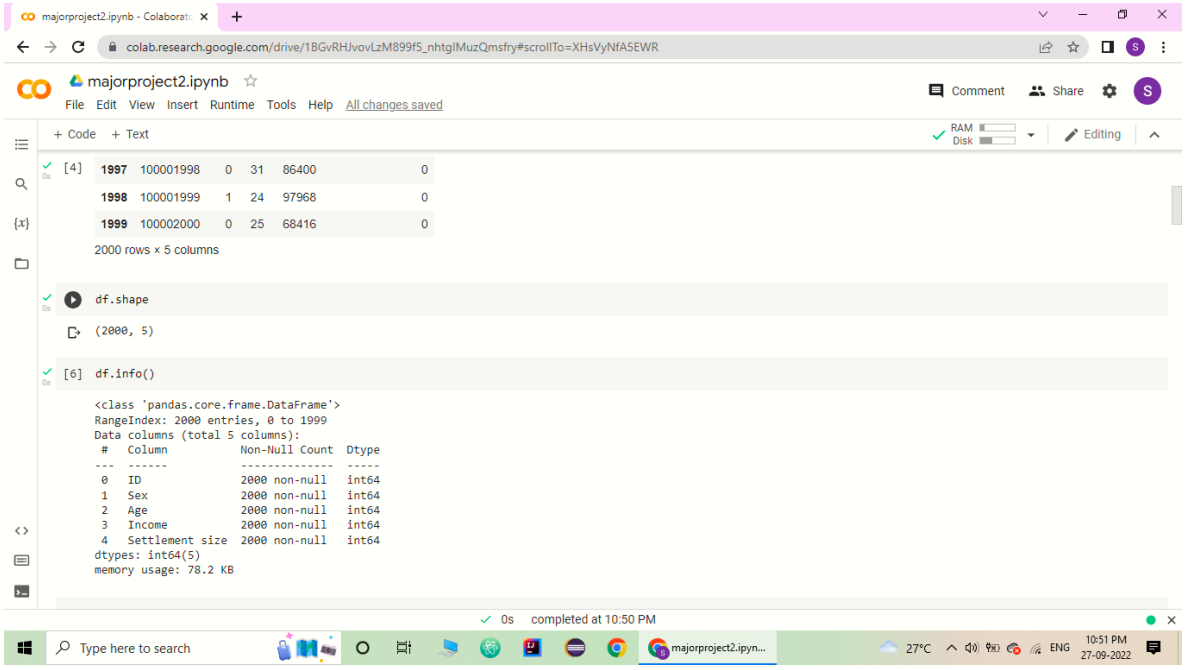
Thakur College of Engineering and Technology-(TCET)

B.E. Electronics

Third Year-[TE]

Code with Outputs:





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majorproject2.ipynb - Colaborat

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majorproject2.ipynb

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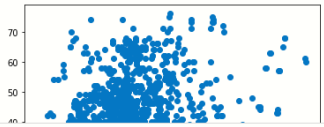
```
[34] #Input - Age and Annual Income
     #4.divide the into i/p
     x = df.iloc[:,2:4].values
     x
```

```
array([[    67, 124670],
       [    22, 150773],
       [    49,  89210],
       ...,
       [    31,  86400],
       [    24,  97968],
       [    25,  68416]])
```

```
[36] #VISUALISATION
     import matplotlib.pyplot as plt
     plt.scatter(df['Income'],df['Age'])
     #Here we have got only one cluster before applying any clustering technique
```

```
<matplotlib.collections.PathCollection at 0x7faffb262310>
```



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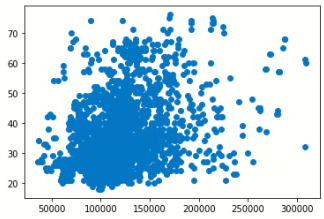
```




```
[37] #Here our main task is to find out the number of clusters(k)
     import numpy as np
     np.sqrt(2000) # 2000 is the total no of points
     #k value should not exceed the square root of the total no of points
     #Hence k value should be in the range of 2 to 45
```

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     #k value should not exceed the square root of the total no of points
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```

```
44.721359549995796
```

```
[38] #1.ELBOW METHOD
     from sklearn.cluster import KMeans
     k = range(2,45)# my range is in between 2 and 45

     sse = [] #blank list

     #for i in range(2,45):
     for i in k :
       model_demo = KMeans(n_clusters = i,random_state = 0)
       model_demo.fit(x)
       sse.append(model_demo.inertia_)#.inertia_ - calculates the sum of squared error
     plt.scatter(k,sse)
     plt.plot(k,sse)
```

```
[<matplotlib.lines.Line2D at 0x7faffb1d2790>]
```

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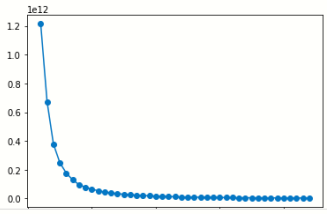
plt.scatter(k,sse)
plt.plot(k,sse)

[<matplotlib.lines.Line2D at 0x7faffb1d2790>]



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```
[14] #We will now consider the point at which the eblow is more prominent(projecting from something)
     # We will consider k as 7 for now , but we are not sure
```

```
[39] #2.SILHOUETTE SCORE METHOD
     from sklearn.metrics import silhouette_score
     k = range(2,45)
     for i in k:
       model_demo = KMeans(n_clusters = i,random_state = 0)
       model_demo.fit(x)
       y_pred = model_demo.predict(x)
       print(f"{i} Clusters ,Score = {silhouette_score(x,y_pred)}")
       plt.bar(i,silhouette_score(x,y_pred))
```

```
2 Clusters ,Score = 0.5834469068936822
3 Clusters ,Score = 0.5116316441491894
4 Clusters ,Score = 0.54299218077665
5 Clusters ,Score = 0.5401520680025738
6 Clusters ,Score = 0.5425446774454399
7 Clusters ,Score = 0.5352530115610864
8 Clusters ,Score = 0.5407443028572397
9 Clusters ,Score = 0.5331090406504704
10 Clusters ,Score = 0.5316509306525833
11 Clusters ,Score = 0.5346461939922239
12 Clusters ,Score = 0.546748013211452
13 Clusters ,Score = 0.5447936152017392
14 Clusters ,Score = 0.5383651685808202
15 Clusters ,Score = 0.5427850042355558
16 Clusters ,Score = 0.5361798352934857
```

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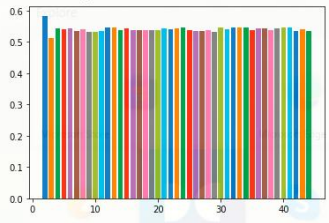
```
[39] 34 Clusters ,Score = 0.5453154143947548
     35 Clusters ,Score = 0.5374254054900658
     36 Clusters ,Score = 0.5424415889395845
     37 Clusters ,Score = 0.5428894570784082
     38 Clusters ,Score = 0.5377151746685831
     39 Clusters ,Score = 0.5441584908541304
     40 Clusters ,Score = 0.5455518774893595
     41 Clusters ,Score = 0.546018914770708
     42 Clusters ,Score = 0.5343244917777215
     43 Clusters ,Score = 0.5390358089729894
     44 Clusters ,Score = 0.5346308270140177
```




```
[ ] #CONFIRMATION : THE No of CLUSTERS TO BE CONSIDERED IS 2 not 7.
```

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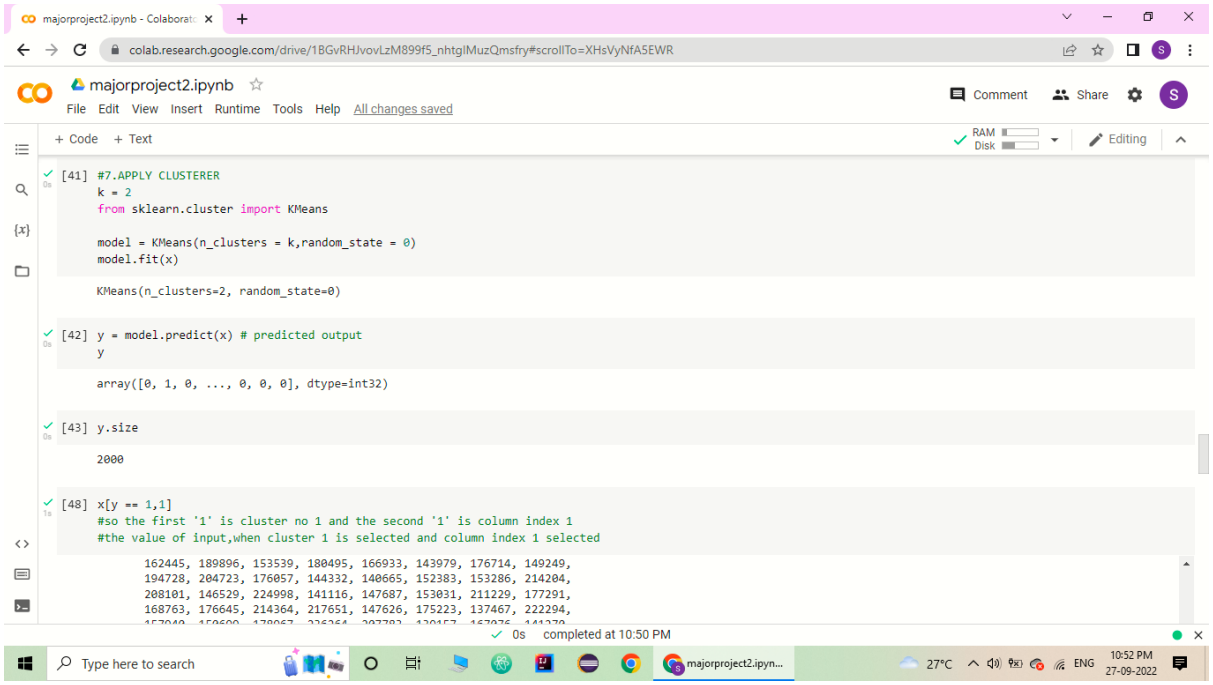
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[41] #7.APPLY CLUSTERER
k = 2
from sklearn.cluster import KMeans
model = KMeans(n_clusters = k,random_state = 0)
model.fit(x)
KMeans(n_clusters=2, random_state=0)
[42] y = model.predict(x) # predicted output
y
array([0, 1, 0, ..., 0, 0, 0], dtype=int32)
[43] y.size
2000
[48] x[y == 1,1]
#so the first '1' is cluster no 1 and the second '1' is column index 1
#the value of input,when cluster 1 is selected and column index 1 selected
162445, 189896, 153539, 180495, 166933, 143979, 176714, 149249,
194728, 204723, 176057, 144332, 140665, 152383, 153286, 214204,
208101, 146529, 224998, 141116, 147687, 153031, 211229, 177291,
168763, 176645, 214364, 217651, 147626, 175223, 137467, 222294,
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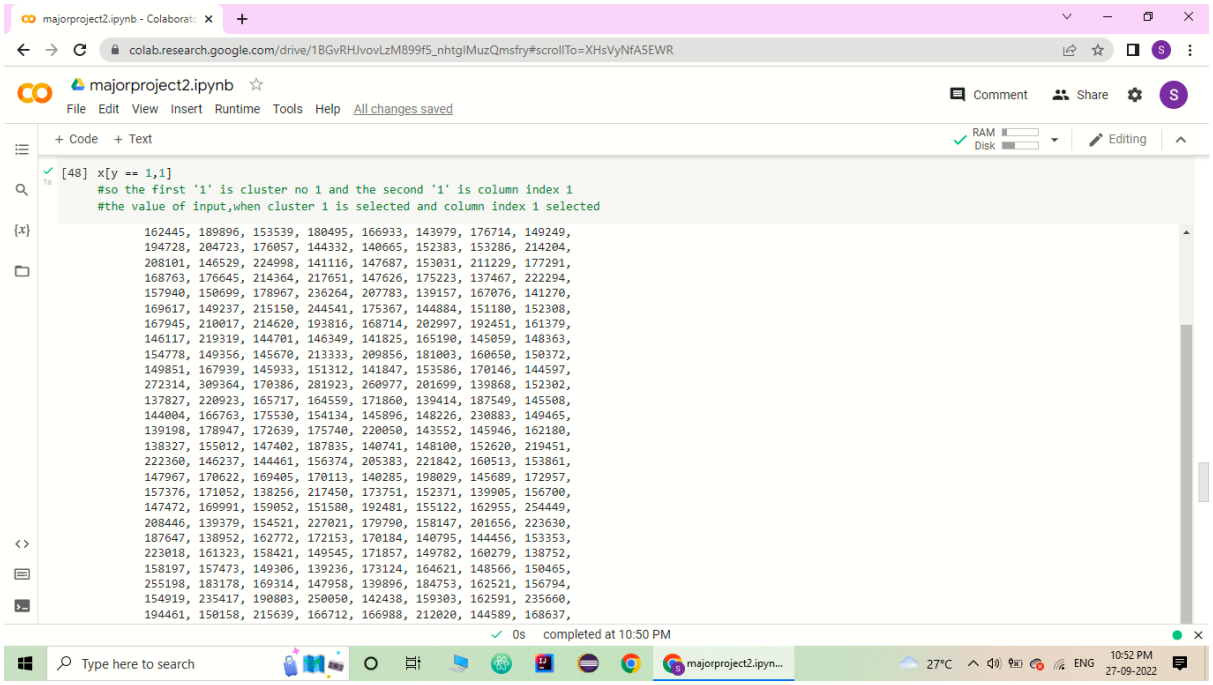
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[48] x[y == 1,1]
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162445, 189896, 153539, 180495, 166933, 143979, 176714, 149249,
194728, 204723, 176057, 144332, 140665, 152383, 153286, 214204,
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157940, 150699, 178967, 236264, 207783, 139157, 167076, 141270,
169617, 149237, 215150, 244541, 175367, 144884, 151180, 152308,
167945, 210017, 214620, 193816, 168714, 202997, 192451, 161379,
146117, 219319, 144701, 146349, 141825, 165190, 145059, 148363,
154778, 149356, 145670, 213333, 209856, 181003, 160650, 150372,
149851, 167939, 145933, 151312, 141847, 153586, 170146, 144597,
272314, 309364, 170386, 281923, 260977, 201699, 139868, 152302,
137827, 220923, 165717, 164559, 171860, 139414, 187549, 145508,
144004, 166763, 175530, 154134, 145896, 148226, 230883, 149465,
139198, 178947, 172639, 175740, 220050, 143552, 145946, 162180,
138327, 155012, 147402, 187835, 140741, 148100, 152620, 219451,
222360, 146237, 144461, 156374, 205383, 221842, 160513, 153861,
147967, 170622, 169405, 170113, 140285, 198029, 145689, 172957,
157376, 171052, 138256, 217450, 173751, 152371, 139905, 156700,
147472, 169991, 159052, 151580, 192481, 155122, 162955, 254449,
208446, 139379, 154521, 227021, 179790, 158147, 201656, 223630,
187647, 138952, 162772, 172153, 170184, 140795, 144456, 153353,
223018, 161323, 158421, 149545, 171857, 149782, 160279, 138752,
158197, 157473, 149306, 139236, 173124, 164621, 148566, 150465,
255198, 183178, 169314, 147958, 139896, 184753, 162521, 156794,
154919, 235417, 190803, 250050, 142438, 159303, 162591, 235660,
194461, 150158, 215639, 166712, 166988, 212020, 144589, 168637,
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```
[48]        178991, 159739, 167763, 145174, 176292, 151938, 161999, 147968,
            157576, 203738, 280570, 214126, 174337, 167139, 170113, 192698,
            144197, 171052, 171804, 192167, 146716, 267872, 142193, 183765,
            218664, 145174, 224961, 262634, 287106, 166298, 281084, 160678,
            167532, 178591, 273063, 149410, 153645, 308529, 155062, 199654,
            157595, 166264, 147259, 161116, 139380, 213768, 163940, 173378,
            166712, 189166, 161714, 214364, 184680, 214732, 152527, 170366,
            194532, 159880, 165519, 149653, 159378, 205476, 280566, 211572,
            176372, 169020, 169324, 192561, 145781, 169002, 170644, 192360,
            260847, 285647, 164816, 281647, 157305, 163654, 155540, 154031,
            164931, 168904, 137576, 180940, 138011, 144850, 137338, 159745,
            181262, 169044, 178549, 159716, 170118, 143886, 160524, 143994,
            152401, 157453, 142870, 145385, 146519, 149419, 176646, 169579,
            142305, 181926, 152864, 182274, 149040, 154196, 177171, 159559,
            171203, 139844, 156431, 143081, 155870, 145227, 159500, 159714,
            141271, 143723, 154003, 177179, 182822, 177215, 157231, 151421,
            178081, 154585, 144704, 141632, 160164, 151754, 155551, 175800,
            169076, 140341, 151781, 158683, 193879, 151947, 141493, 154339,
            158193, 143734, 175504, 165495, 165340, 154344, 151914, 139490,
            155708, 142345, 148675, 150237, 159216, 139547, 154549, 149315,
            138906, 151339, 170387, 139427, 137925, 144843, 139112, 147603,
            139229, 143321, 147691, 143489, 139468, 141502, 137689, 137705,
            137736, 143319, 145231, 145373, 141993, 138967, 142280, 153880,
            140178, 141453, 145140, 138307, 143343, 138525, 140673])
```

```
[49] np.unique(y,return_counts = True)
```

```
(array([0, 1], dtype=int32), array([1489,  511]))
```

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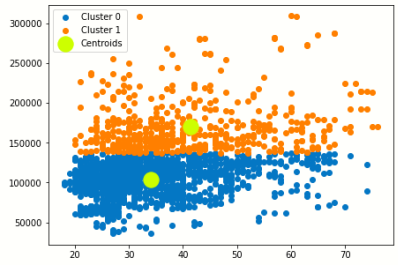
```
#FINAL VISUALISATION
plt.figure(figsize = (7,5))
for i in range(k):
  plt.scatter(x[y == i,0],x[y == i,1],label = f'Cluster {i}')
plt.scatter(model.cluster_centers_[:,0],model.cluster_centers_[:,1],s = 300,c = 'yellow',
            label = 'Centroids')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7faffb0be2d0>
```



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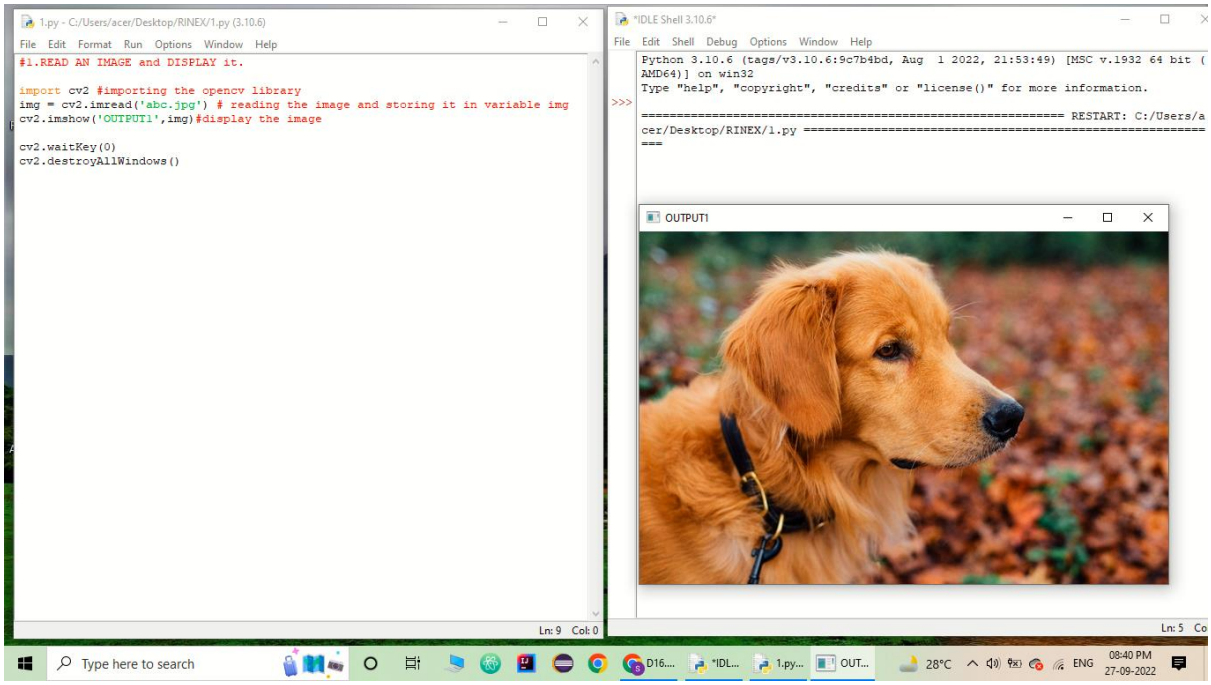
1.py - C:/Users/acer/Desktop/RINEX/1.py (3.10.6)
File Edit Format Run Options Window Help
#1.READ AN IMAGE and DISPLAY it.
import cv2 #importing the opencv library
img = cv2.imread('abc.jpg') # reading the image and storing it in variable img
cv2.imshow('OUTPUT1',img)#display the image
cv2.waitKey(0)
cv2.destroyAllWindows()
Ln: 9 Col: 0
IDLE Shell 3.10.6
File Edit Shell Debug Options Window Help
Python 3.10.6 (tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49) [MSC v.1932 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/1.py ==========
OUTPUT1
Ln: 5 Co
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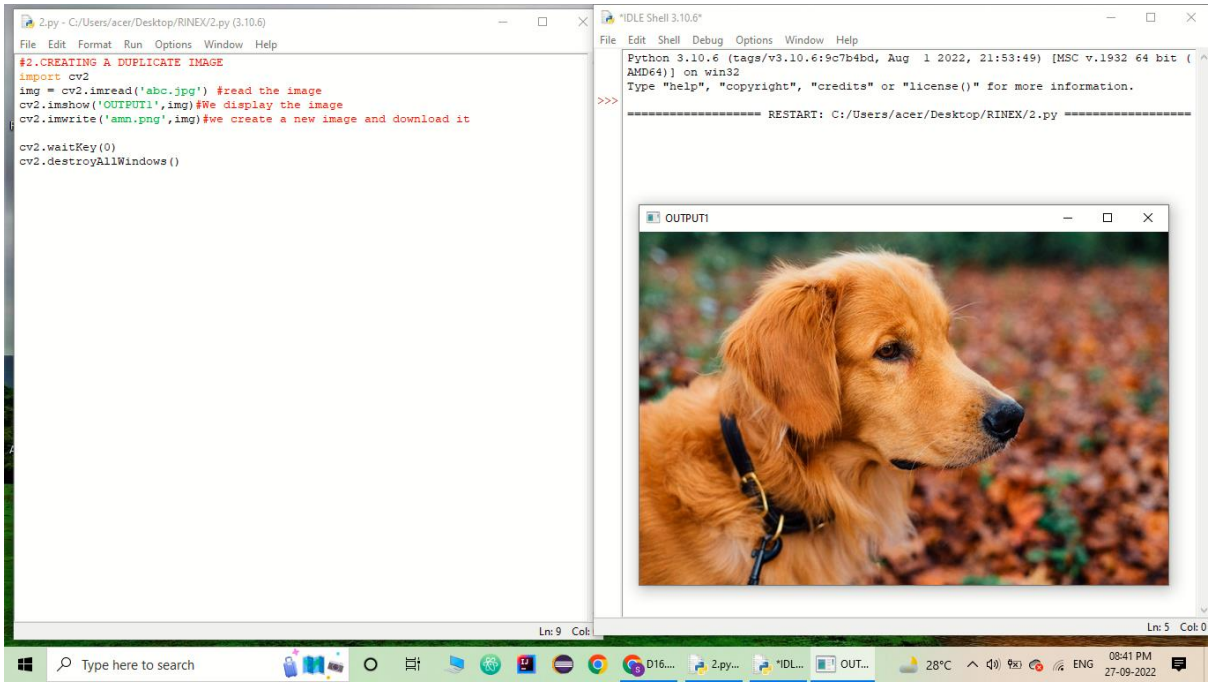
2.py - C:/Users/acer/Desktop/RINEX/2.py (3.10.6)
File Edit Format Run Options Window Help
#2.CREATING A DUPLICATE IMAGE
import cv2
img = cv2.imread('abc.jpg') #read the image
cv2.imshow('OUTPUT1',img)#We display the image
cv2.imwrite('amn.png',img)#we create a new image and download it
cv2.waitKey(0)
cv2.destroyAllWindows()
Ln: 9 Col:
IDLE Shell 3.10.6
File Edit Shell Debug Options Window Help
Python 3.10.6 (tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49) [MSC v.1932 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/2.py ==========
OUTPUT1
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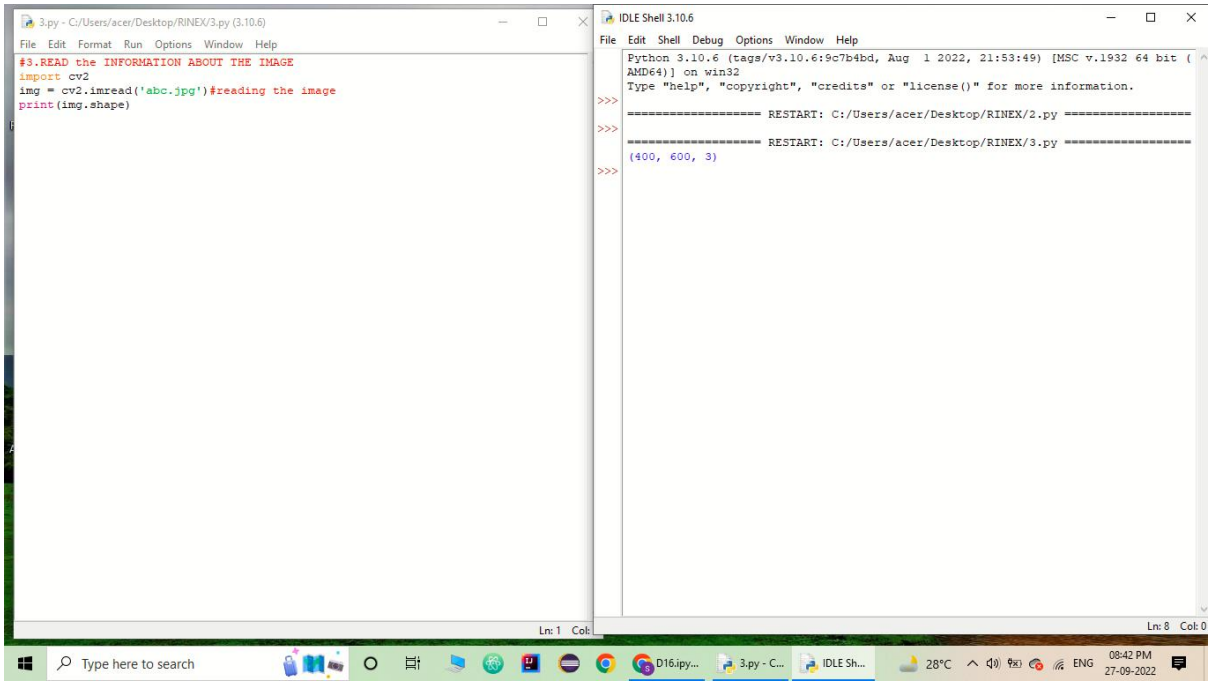
3.py - C:/Users/acer/Desktop/RINEX/3.py (3.10.6)
File Edit Format Run Options Window Help
#3.READ the INFORMATION ABOUT THE IMAGE
import cv2
img = cv2.imread('abc.jpg')#reading the image
print(img.shape)
Ln: 1 Col:
IDLE Shell 3.10.6
File Edit Shell Debug Options Window Help
Python 3.10.6 (tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49) [MSC v.1932 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/2.py ==========
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/3.py ==========
(400, 600, 3)
>>>
Ln: 8 Col: 0
Type here to search
D16.ipy...
3.py - C...
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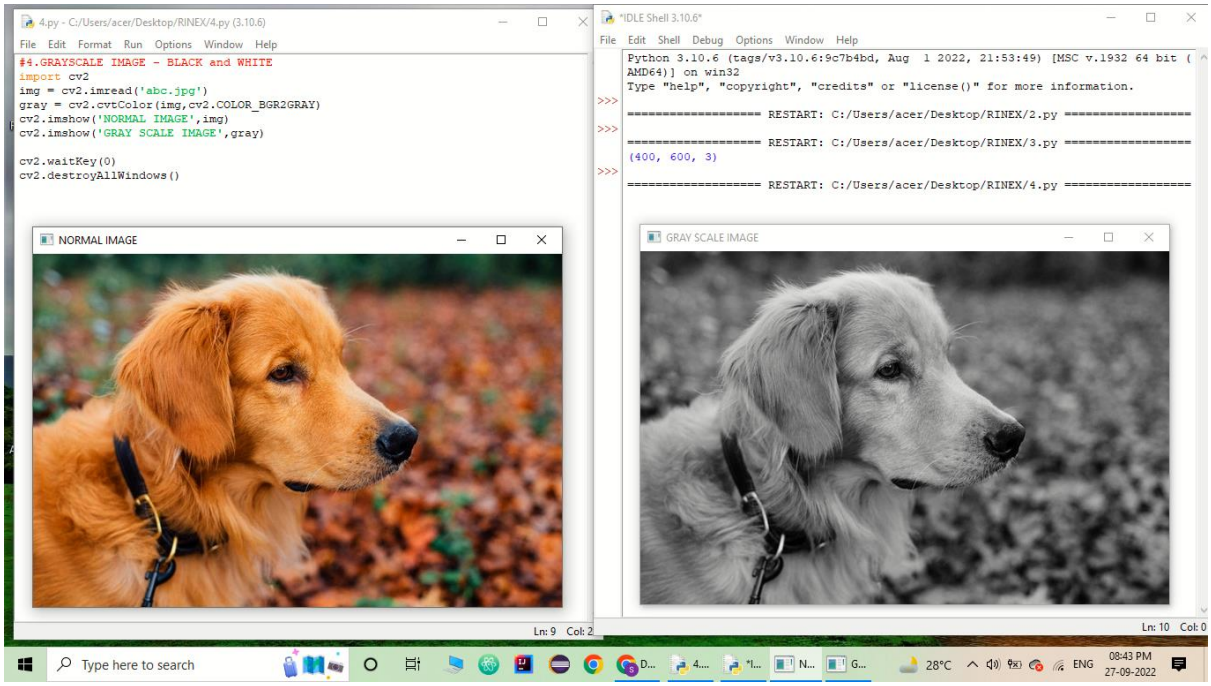
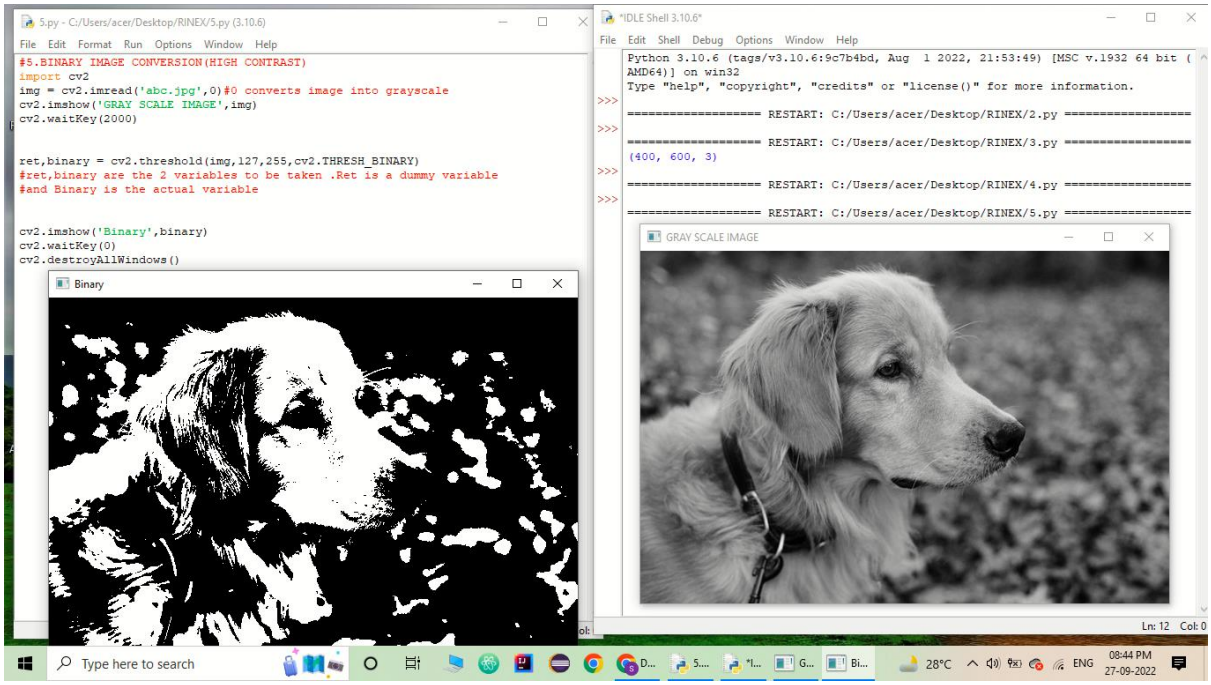
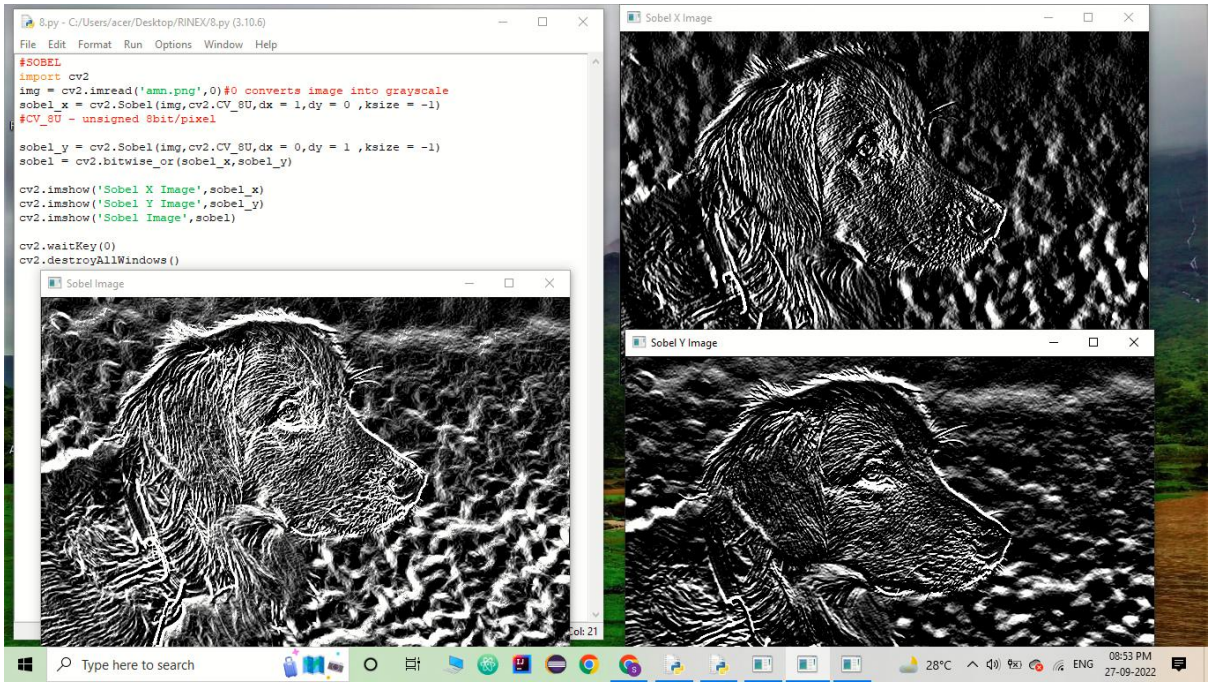
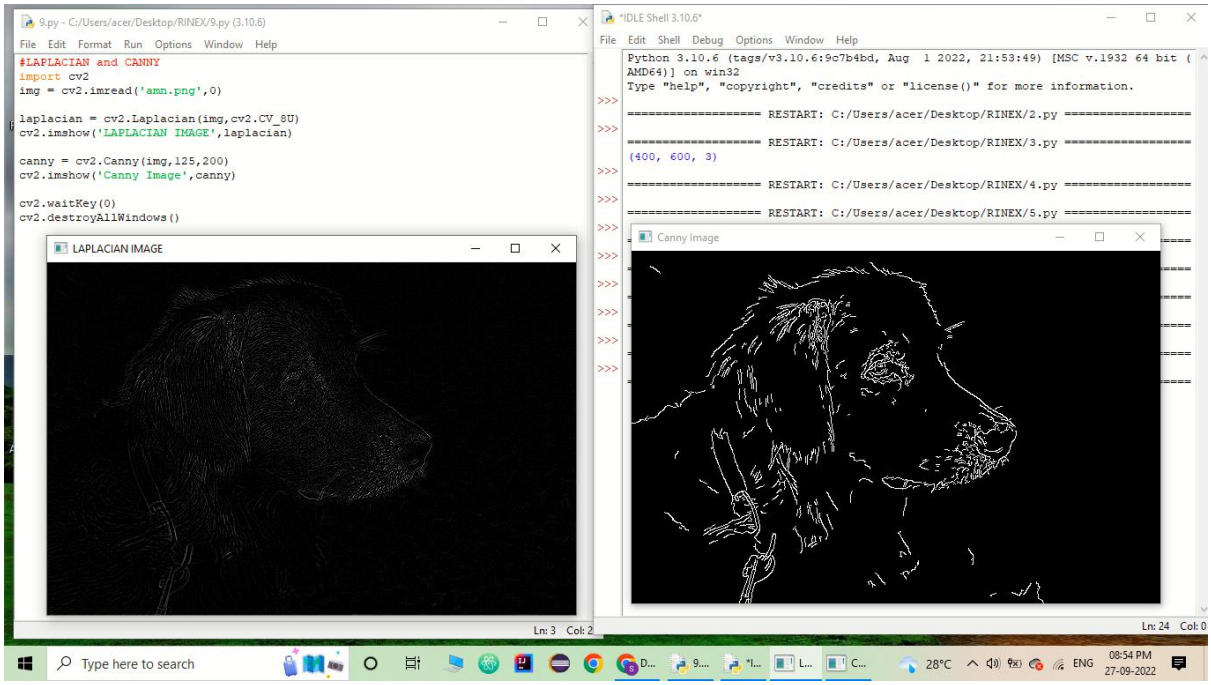

4.py - C:/Users/acer/Desktop/RINEX/4.py (3.10.6)
File Edit Format Run Options Window Help
#4.GRAYSCALE IMAGE - BLACK and WHITE
import cv2
img = cv2.imread('abc.jpg')
gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
cv2.imshow('NORMAL IMAGE',img)
cv2.imshow('GRAY SCALE IMAGE',gray)
cv2.waitKey(0)
cv2.destroyAllWindows()
NORMAL IMAGE
Ln: 9 Col: 2
IDLE Shell 3.10.6
File Edit Shell Debug Options Window Help
Python 3.10.6 (tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49) [MSC v.1932 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/2.py ==========
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/3.py ==========
(400, 600, 3)
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/4.py ==========
GRAY SCALE IMAGE
Ln: 10 Col: 0
Type here to search
28°C
ENG
08:43 PM
27-09-2022

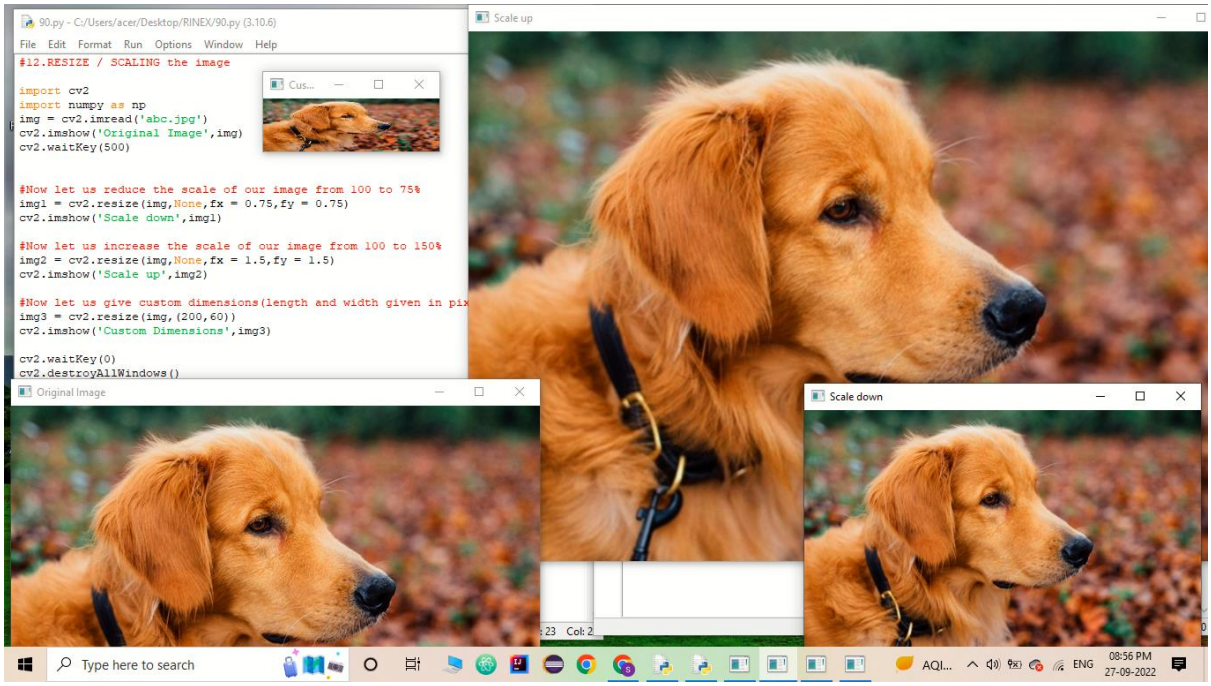
RINEX


5.py - C:/Users/acer/Desktop/RINEX/5.py (3.10.6)
File Edit Format Run Options Window Help
#5.BINARY IMAGE CONVERSION(HIGH CONTRAST)
import cv2
img = cv2.imread('abc.jpg',0)#0 converts image into grayscale
cv2.imshow('GRAY SCALE IMAGE',img)
cv2.waitKey(2000)
ret,binary = cv2.threshold(img,127,255,cv2.THRESH_BINARY)
#ret,binary are the 2 variables to be taken .Ret is a dummy variable
#and Binary is the actual variable
cv2.imshow('Binary',binary)
cv2.waitKey(0)
cv2.destroyAllWindows()
Binary
IDLE Shell 3.10.6
File Edit Shell Debug Options Window Help
Python 3.10.6 (tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49) [MSC v.1932 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/2.py ==========
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/3.py ==========
(400, 600, 3)
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/4.py ==========
>>>
========== RESTART: C:/Users/acer/Desktop/RINEX/5.py ==========
GRAY SCALE IMAGE
Ln: 12 Col: 0
Type here to search
28°C
ENG
08:44 PM
27-09-2022


8.py - C:/Users/acer/Desktop/RINEX/8.py (3.10.6)
File Edit Format Run Options Window Help
#SOBEL
import cv2
img = cv2.imread('amn.png',0)#0 converts image into grayscale
sobel_x = cv2.Sobel(img,cv2.CV_8U,dx = 1,dy = 0 ,ksize = -1)
#CV_8U - unsigned 8bit/pixel
sobel_y = cv2.Sobel(img,cv2.CV_8U,dx = 0,dy = 1 ,ksize = -1)
sobel = cv2.bitwise_or(sobel_x,sobel_y)
cv2.imshow('Sobel X Image',sobel_x)
cv2.imshow('Sobel Y Image',sobel_y)
cv2.imshow('Sobel Image',sobel)
cv2.waitKey(0)
cv2.destroyAllWindows()
Sobel Image
Sobel X Image
Sobel Y Image
Ln: 21
Type here to search
28°C
ENG
08:53 PM
27-09-2022

RINEX





Google Drive link: https://drive.google.com/drive/folders/1wNawEyjY5Q-J_6Q1PRjcH5h9yjgOP_jz