OpenCV image beautification

Before running the example program, you need to switch to the directory where the code is located. After SSH connects to the car, run in the terminal,

```
cd /home/sunrise/yahboomcar_ws/src/yahboomcar_astra/opencv_examples
```

4.1, Image Inpainting

> Image inpainting is a class of algorithms in computer vision, whose goal is to fill in areas within an image or video. The area is identified using a binary mask, and the filling is usually done based on the boundary information of the area to be filled. The most common application of image inpainting is to restore old scanned photos. It is also used to remove small unwanted objects in images.

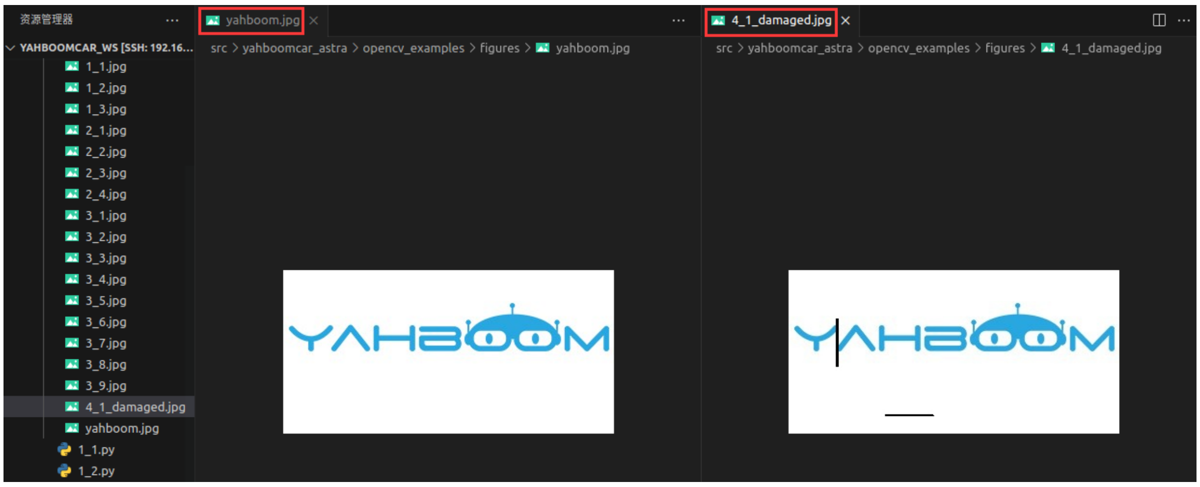
(1) First, add damage to the intact image, which can be understood as modifying the pixel value of a specific part of it.

After the car terminal switches to the directory where the code is located, run the program,

```
python3 4_1_1.py
```

```
import cv2
if __name__ == '__main__':
img = cv2.imread('figures/yahboom.jpg')
for i in range(50,100):
img[i,50] = (0,0,0)
img[i,50+1] = (0,0,0)
img[i,50-1] = (0,0,0)
for i in range(100,150):
img[150,i] = (0,0,0)
img[150,i+1] = (0,0,0)
img[150-1,i] = (0,0,0)
cv2.imwrite('figures/4_1_damaged.jpg',img)
```

The resulting image is shown in the figure, which can be regarded as a damaged image of the original image.



(2) Repair the photo just created. First read it, then create a mask, and finally use the function to repair it

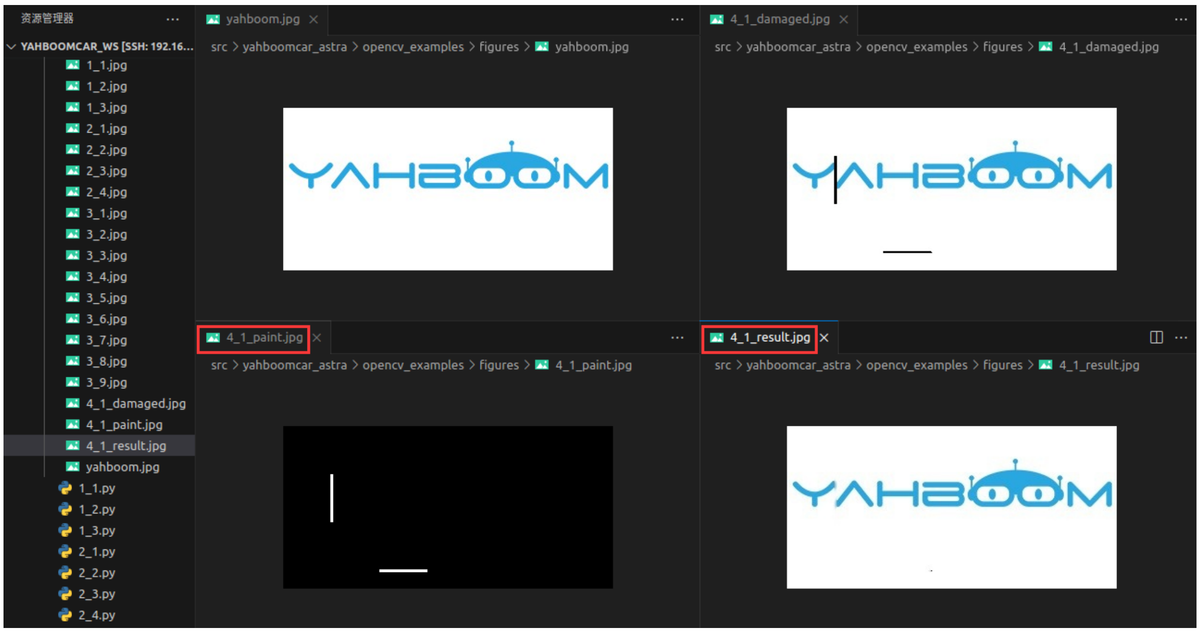
After switching to the directory where the code is located in the car terminal, run the program,

```
python3 4_1_2.py
```

```
import cv2
import numpy as np
if __name__ == '__main__':
dam_img = cv2.imread('figures/4_1_damaged.jpg')
imgInfo = dam_img.shape
height = imgInfo[0]
width = imgInfo[1]
paint = np.zeros((height,width,1),np.uint8)
for i in range(50,100):
paint[i,50] = 255
paint[i,50+1] = 255
paint[i,50-1] = 255
for i in range(100,150):
paint[150,i] = 255
paint[150+1,i] = 255
paint[150-1,i] = 255
dst_img = cv2.inpaint(dam_img,paint,3,cv2.INPAINT_TELEA)
cv2.imwrite("figures/4_1_paint.jpg",paint)
cv2.imwrite("figures/4_1_result.jpg",dst_img)

'''
Draw text: dst = cv2.inpaint(src,inpaintMask,inpaintRadius,flags)
src: source image, that is, the image to be repaired
inpaintMask: binary mask indicating the pixels to be repaired
dst: result image
inpaintRadius: indicates the radius of the repair
flags: repair algorithm, mainly including,
INPAINT_NS (Navier-Stokes based method)
INPAINT_TELEA (Fastmarching based method)
'''
```

The final image is as shown in the figure,


资源管理器
YAHBOOMCAR_WS [SSH: 192.16...
1_1.jpg
1_2.jpg
1_3.jpg
2_1.jpg
2_2.jpg
2_3.jpg
2_4.jpg
3_1.jpg
3_2.jpg
3_3.jpg
3_4.jpg
3_5.jpg
3_6.jpg
3_7.jpg
3_8.jpg
3_9.jpg
4_1_damaged.jpg
4_1_paint.jpg
4_1_result.jpg
yahboom.jpg
1_1.py
1_2.py
1_3.py
2_1.py
2_2.py
2_3.py
2_4.py
yahboom.jpg
src > yahboomcar_astra > opencv_examples > figures > yahboom.jpg
4_1_damaged.jpg
src > yahboomcar_astra > opencv_examples > figures > 4_1_damaged.jpg
4_1_paint.jpg
src > yahboomcar_astra > opencv_examples > figures > 4_1_paint.jpg
4_1_result.jpg
src > yahboomcar_astra > opencv_examples > figures > 4_1_result.jpg
YAHBOOM

The lower left corner is the mask image, and the lower right corner is the repaired image, which is consistent with the original image in the upper left corner.

4.2, Brightness enhancement

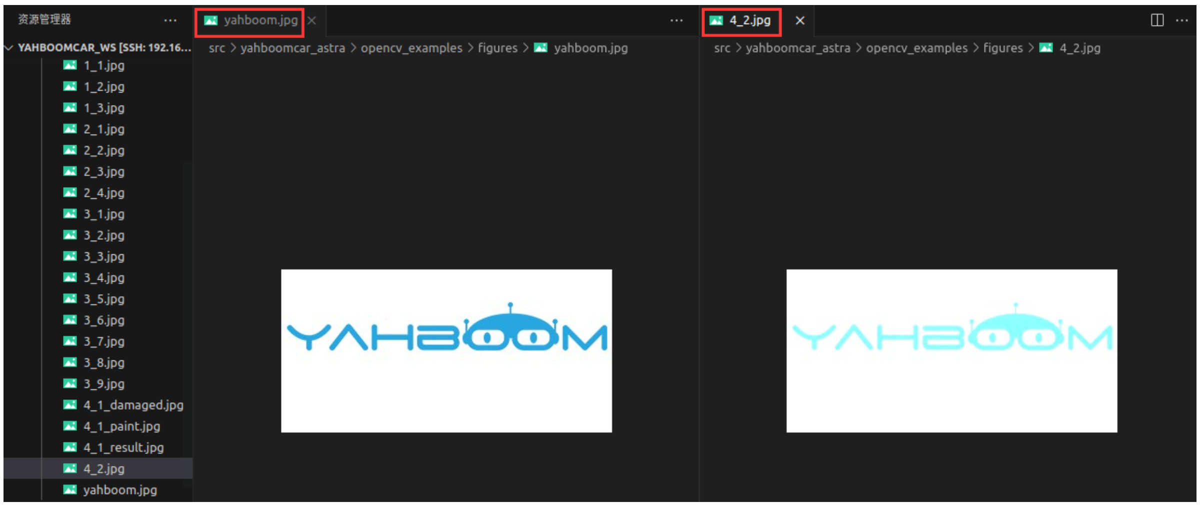
> Implementation process: Synchronously amplify the three-channel values of each pixel point, while keeping the channel value between 0-255. In fact, it is to traverse each pixel point, add or subtract values to them, and then determine whether the three channels rgb are in the range of 0-255. If it is greater or less than, it takes the value of 255 or 0.

After switching to the directory where the code is located in the car terminal, run the program,

```
python3 4_2.py
```

```
import cv2
import numpy as np
if __name__ == '__main__':
img = cv2.imread('figures/yahboom.jpg')
imgInfo = img.shape
height = imgInfo[0]
width = imgInfo[1]
dst = np.zeros((height,width,3),np.uint8)
for i in range(0,height):
for j in range(0,width):
(b,g,r) = img[i,j]
bb = int(b) + 100
gg = int(g) + 100
rr = int(r) + 100
if bb > 255:
bb = 255
if gg > 255:
gg = 255
if rr > 255:
rr = 255
dst[i,j] = (bb,gg,rr)
cv2.imwrite('figures/4_2.jpg',dst)
```

The final image is as shown in the figure,



4.3, skin smoothing and whitening

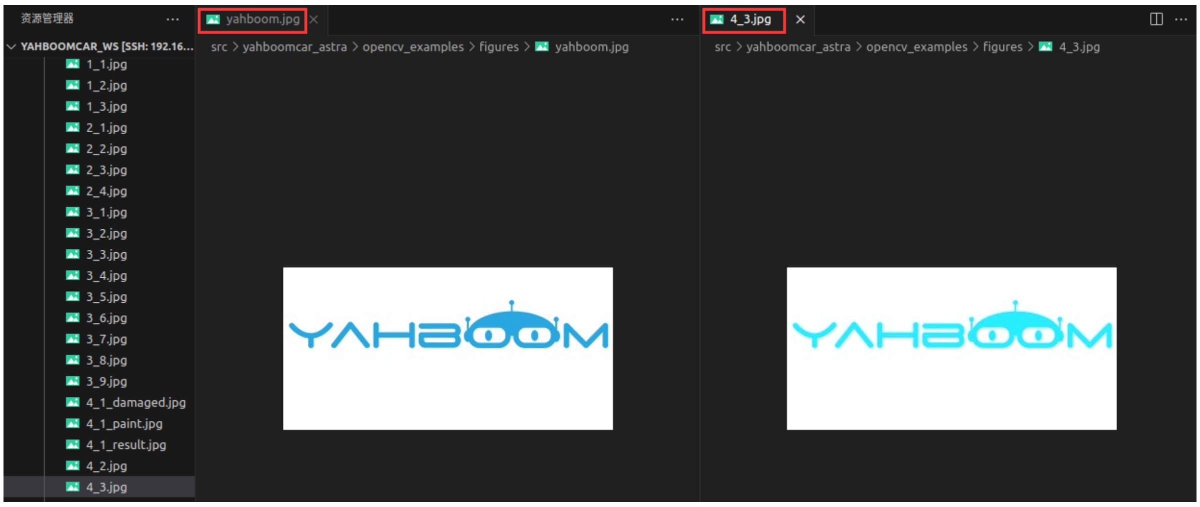
> OpenCV implements the function of skin smoothing and whitening for pictures. The principle of implementation is basically the same as the principle of brightness enhancement, but here we do not need to process the r value, just follow this formula, p = p(x)*1.4+ y, where p(x) represents the b channel or the g channel, and y represents the value to be increased or decreased. Similarly, after adding the value, we need to judge the value.

After switching to the directory where the code is located in the car terminal, run the program,

```
python3 4_3.py
```

```
import cv2
import numpy as np
if __name__ == '__main__':
img = cv2.imread('figures/yahboom.jpg')
imgInfo = img.shape
height = imgInfo[0]
width = imgInfo[1]
dst = np.zeros((height,width,3),np.uint8)
for i in range(0,height):
for j in range(0,width):
(b,g,r) = img[i,j]
bb = int(b*1.4) + 5
gg = int(g*1.4) + 5
if bb > 255:
bb = 255
if gg > 255:
gg = 255
dst[i,j] = (bb,gg,r)
cv2.imwrite('figures/4_3.jpg',dst)
```

The final image is as shown in the figure,



You can change the input image and try it yourself.