10.Affine transformation

Affine transformation (Affine Transformation or Affine Map) is a linear transformation from two-dimensional coordinates (x, y) to two-dimensional coordinates (u, v). Its mathematical expression is as follows:

$$\begin{cases} u = a_1 x + b_1 y + c_1 \\ v = a_2 x + b_2 y + c_2 \end{cases}$$

The corresponding homogeneous coordinate matrix representation is:

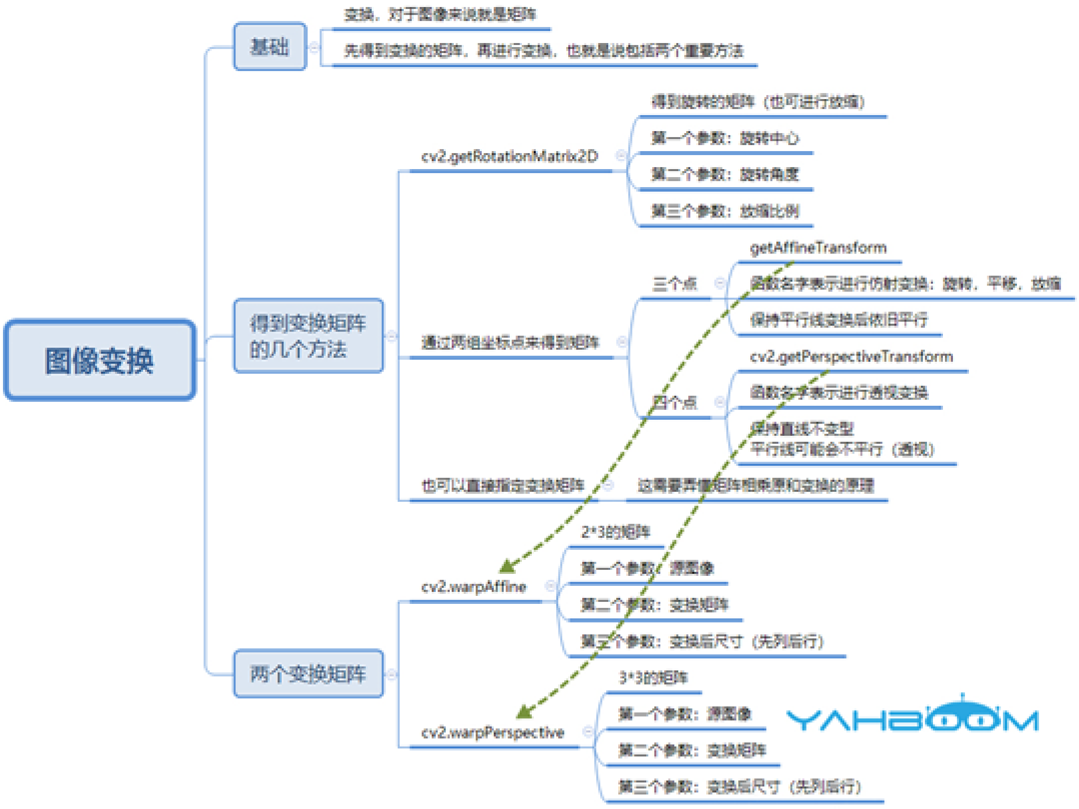
$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Affine transformation maintains the "flatness" (straight lines remain straight lines after affine transformation) and "parallelism" (the relative positional relationship between straight lines remains unchanged) of two-dimensional graphics,parallel lines are still parallel lines after affine transformation, and the position order of the points on the straight line will not change).Three non-collinear pairs of corresponding points determine a unique affine transformation. The rotation of the image plus the lifting is the image affine transformation. Affine change also requires an M matrix. However, because the affine transformation is more complicated, it is generally difficult to find this matrix directly.
OpenCV provides an automatic solution for M based on the correspondence between the three points before and after the transformation. This function is:

```
M=cv2.getAffineTransform(pos1,pos2)
```

Two of the positions are the corresponding position relationships before and after the transformation. The output is the affine matrix M. Then use the function cv2.warpAffine().

Let’s look at the block diagram of the entire affine transformation and perspective transformation: two methods of image transformation:cv2.warpAffine and cv2.warpPerspective

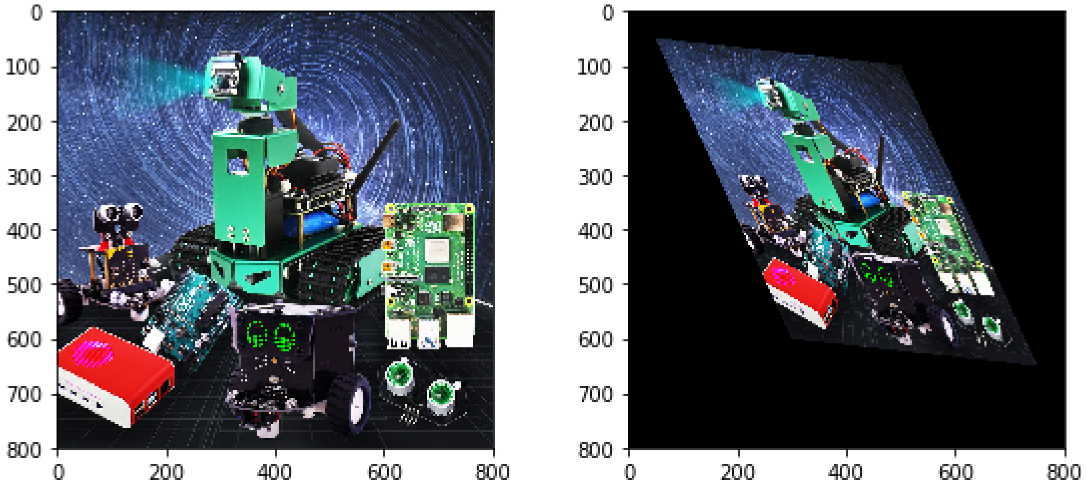


Code path： /home/dofbot/Dofbot/4.opencv/2.Transform/05_Radiation.ipynb

```
import cv2
import  numpy as np
import  matplotlib.pyplot as plt

img =  cv2.imread('yahboom.jpg',1)
img_bgr2rgb  = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
plt.imshow(img_bgr2rgb)
plt.show()
#  cv2.waitKey(0)
```

```
imgInfo =  img.shape
height =  imgInfo[0]
width =  imgInfo[1]
#src  3->dst 3 (upper left corner lower left corner upper right corner)
matSrc =  np.float32([[0,0], [0,height-1], [width-1,0]])
matDst =  np.float32([[50,50], [300,height-200], [width-300,100]])
#combination
matAffine =  cv2.getAffineTransform(matSrc,matDst)# mat 1 src 2 dst
dst =  cv2.warpAffine(img,matAffine,(width,height))
img_bgr2rgb  = cv2.cvtColor(dst, cv2.COLOR_BGR2RGB)
plt.imshow(img_bgr2rgb)
```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