

### 3. Image translation

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The original image `src` is converted into the target image `dst` through the transformation matrix `M`:

$$\text{dst}(x, y) = \text{src}(M_{11}x + M_{12}y + M_{13}, M_{21}x + M_{22}y + M_{23})$$

Move the original image `src` to the right by 200 and down by 100 pixels, then the corresponding relationship is:

$$\text{dst}(x, y) = \text{src}(x+200, y+100)$$

Complete the above expression, that is:

$$\text{dst}(x, y) = \text{src}(1 \cdot x + 0 \cdot y + 200, 0 \cdot x + 1 \cdot y + 100)$$

According to the above expression, it can be determined that the value of each element in the corresponding transformation matrix `M` is:

$$M_{11}=1$$

$$M_{12}=0$$

$$M_{13}=200$$

$$M_{21}=0$$

$$M_{22}=1$$

$$M_{23}=100$$

Substituting the above values into the transformation matrix `M`, we get:

$$M = \begin{bmatrix} 1 & 0 & 200 \\ 0 & 1 & 100 \end{bmatrix}$$

Next, we directly use the transformation matrix `M` to call the function `cv2.warpAffine()` to complete the translation of the image.

**The code is running on jupyter lab**

```
import cv2

import numpy as np

img = cv2.imread('yahboom.jpg',1)

#cv2.imshow('src',img)

imgInfo = img.shape

height = imgInfo[0]

width = imgInfo[1]

####

matshift = np.float32([[1,0,200],[0,1,100]])# 2*3
```

```

dst = cv2.warpAffine(img, matShift, (height, width)) #1 data 2 mat 3 info

# shift matrix

# cv2.imshow('dst',dst)

#cv2.waitKey(0)

```

The following will display the comparison between the original image and the translated image in the jupyterLab control:

```

#bgr8 to jpeg format

import enum

import cv2

def bgr8_to_jpeg(value, quality=75):

    return bytes(cv2.imencode('.jpg', value)[1])

```

```

import ipywidgets.widgets as widgets

image_widget1 = widgets.Image(format='jpg', )

image_widget2 = widgets.Image(format='jpg', )

# create a horizontal box container to place the image widget next to each other
image_container = widgets.HBox([image_widget1, image_widget2])

# display the container in this cell's output

display(image_container)

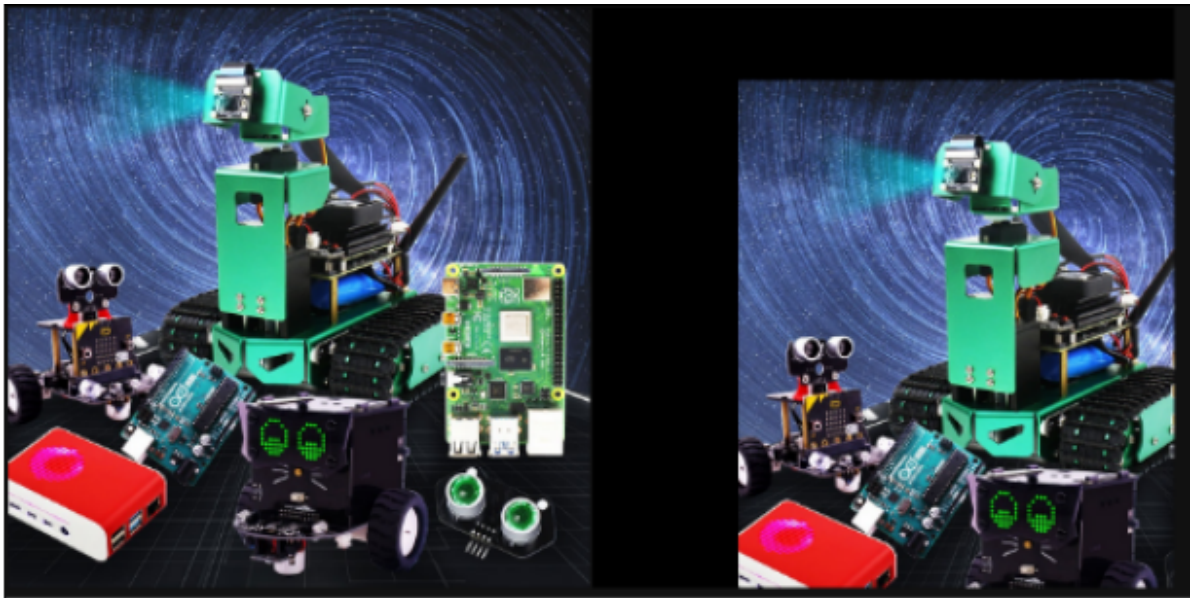
#display(image_widget2)

img1 = cv2.imread('yahboom.jpg',1)

image_widget1.value = bgr8_to_jpeg(img1)

image_widget2.value = bgr8_to_jpeg(dst)

```



As can be seen from the image, the image has moved to the lower right corner (200, 100)