Lab04

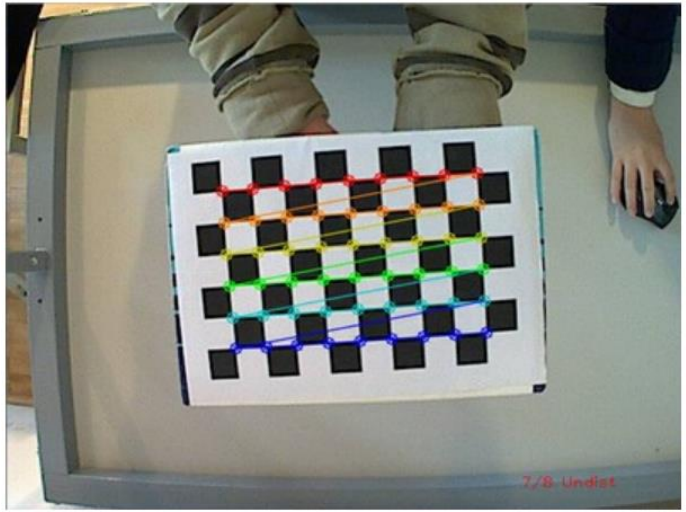
1. Camera Calibration (50%)
2. Warping practice (50%)

How to get image from webcam?

```
import cv2

cap = cv2.VideoCapture(1) #device

while(True):

  ret, frame = cap.read()

  #ret is True if read() successed

  cv2.imshow('frame', frame)

  cv2.waitKey(33)
```

1. Camera Calibration(50%)

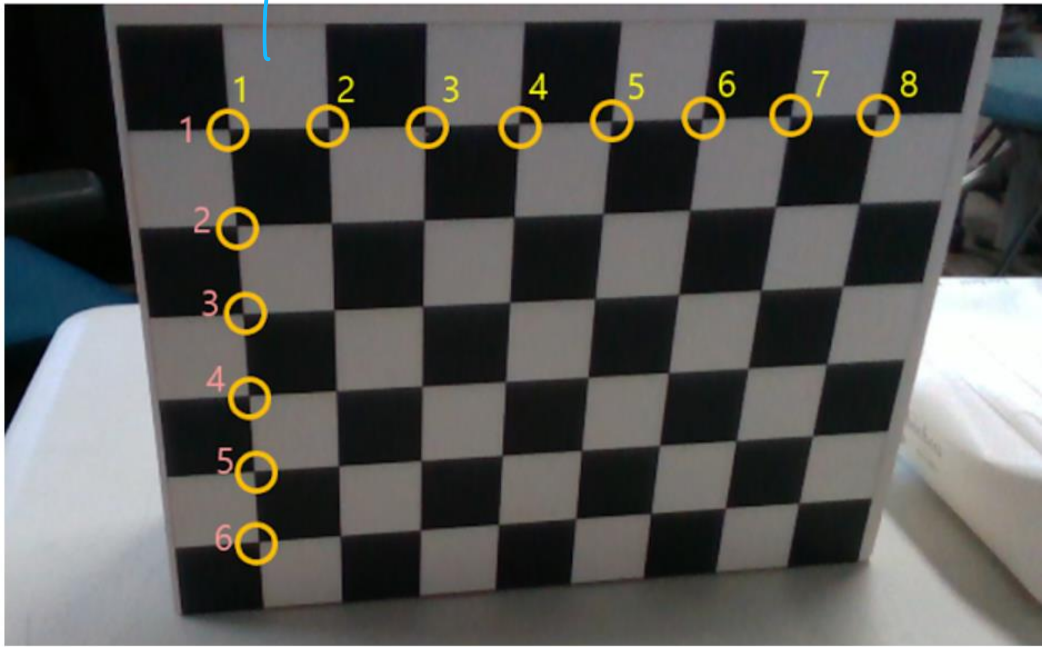
1. 假設好棋盤格的object point
2. 利用webcam讀取即時影像, 將影像轉成灰階
3. 拍攝棋盤格, 若有偵測到則儲存該影像中棋盤格的image point
4. 當儲存影像多於四張時, 開始計算參數
5. 得到參數並儲存於xml檔



1. Camera Calibration(50%)

即便長度不知道，只要知道相对位置等比例，就可以算内在参数（" 会除掉）

- 假設棋盤格的object point, z = 0
- Prepare object points, like (0,0,0), (1,0,0), (2,0,0) ....,(7,5,0)



1. Camera Calibration(50%)

- ret, corner = cv2.findChessboardCorners(image, patternSize, None)
  - patternSize – Number of inner corners per a chessboard row and column (patternSize = cvSize(points_per_row,points_per_colum) = cvSize(columns,rows)).
  - ret == True, chessboard detected

- cv2.cornerSubPix(image, corners, winSize, zeroZone, criteria)
  - image – Input image.
  - corners – Initial coordinates of the input corners and refined coordinates provided for output.
  - winSize - (11, 11)
  - zeroZone - (-1,-1)
  - criteria - criteria = (cv2.TERM_CRITERIA_EPS + cv2.TERM_CRITERIA_MAX_ITER, 30, 0.1)

1. Camera Calibration(50%)

- retval, cameraMatrix, distCoeffs, rvecs, tvecs = cv2.calibrateCamera(objectPoints, imagePoints, imageSize, None)
  - **cameraMatrix** – Output 3x3 floating-point camera matrix
  - **distCoeffs** – Output vector of distortion coefficients
  - rvecs, tvecs - rotation and translation matrix
  - 有多少組imagepoint就要有多少組objectpoint

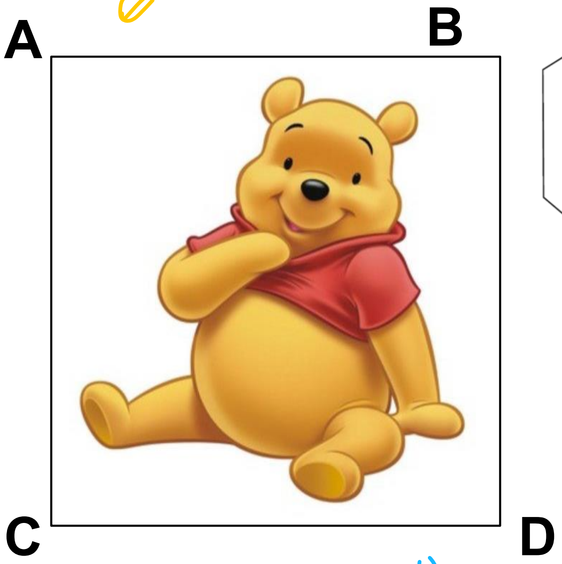
- f = cv2.FileStorage(filename, cv2.FILE_STORAGE_WRITE)
  - f.write("intrinsic", mtx)
  - f.write("distortion", dist)
  - f.release()

2. Warping (50%) (homography)

透視變換(Perspective Transformation)是將成像投影到一個新的視平面(Viewing Plane)，也稱作投影映射(Projective Mapping)

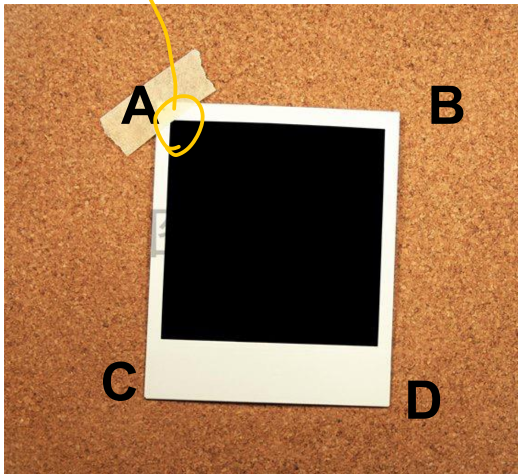
2. Warping (50%)

算回去那個點的值，不是整數的話
做內插



$$\begin{bmatrix} \text{Proj} \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = k^* \begin{bmatrix} i \\ j \\ 1 \end{bmatrix}$$

Projection

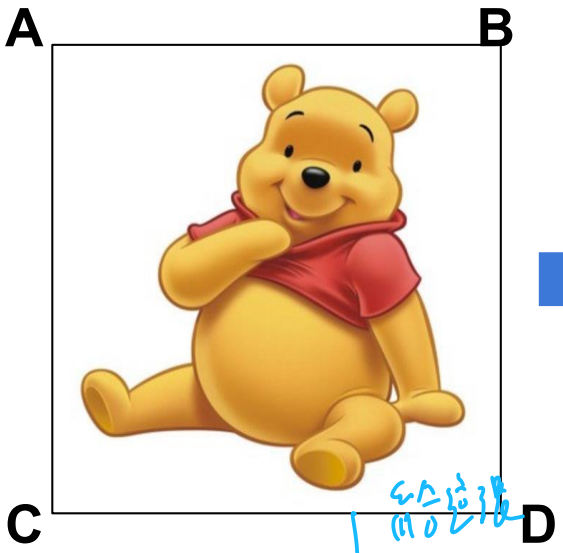


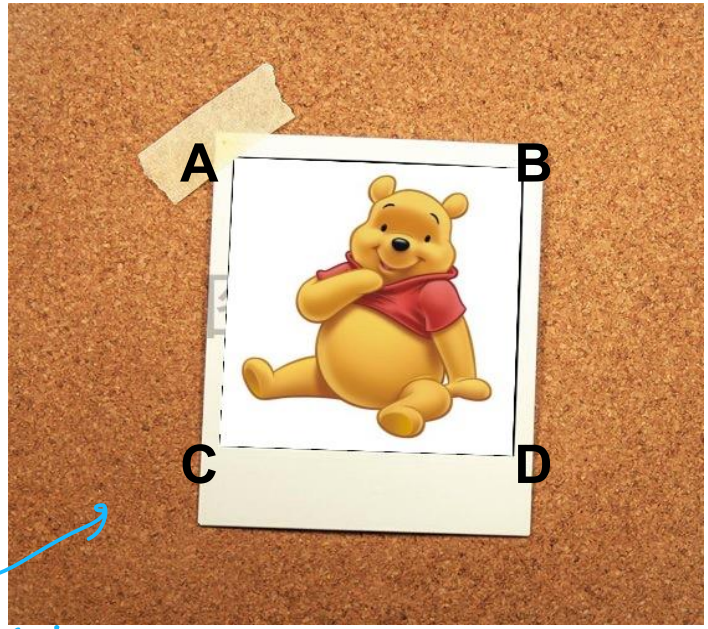
↓ 找 homography 的函式

cv2.getPerspectiveTransform(cap_corner, img_corner)

- cap_corner , img_corner 為四個點的陣列，順序需要兩兩相對
- 返回一個3x3的matrix

2. Warping (50%)





不能使用cv2.warpPerspective(src, M, dsize)

- 自己刻, 用bilinear interpolation將圖填上去

2. Warping (50%)

- 將webcam得到的**即時影像**warp到電視牆上

1. 得到兩張圖中對應的四個點
2. 利用cv2.getPerspectiveTransform得到轉換關係
3. 透過bilinear interpolation將圖適當的填上