Lab 03

Camera Calibration (50%)

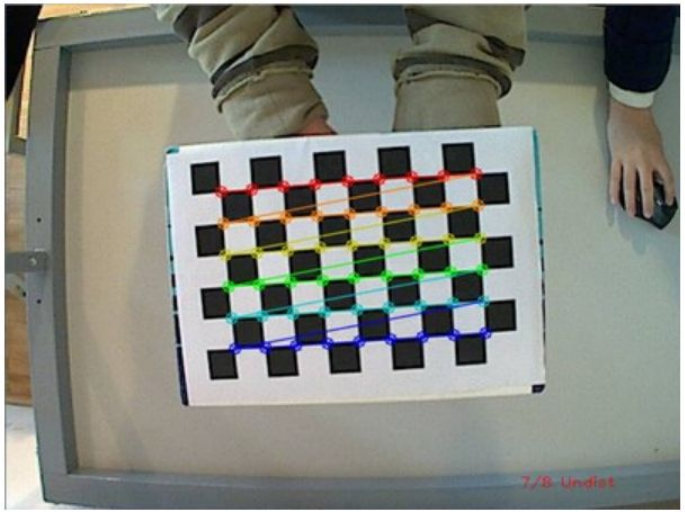
Warping Practice (50%)

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)
```

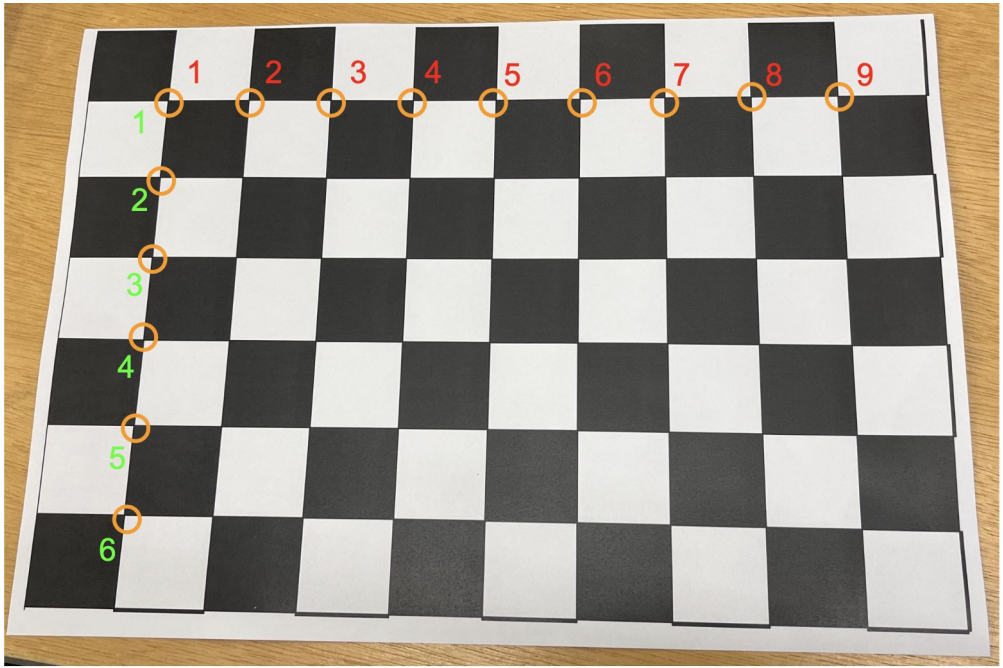
Camera Calibration (50%)

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



Camera Calibration (50%)

- 假設棋盤格的 object point (z = 0)
- 準備 object points (0,0,0), (1,0,0), (2,0,0) ....,(8,5,0)



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)

Camera Calibration (50%)

- ret, 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) //cameraMatrix
  - f.write("distortion", dist) //distCoeffs
  - f.release()

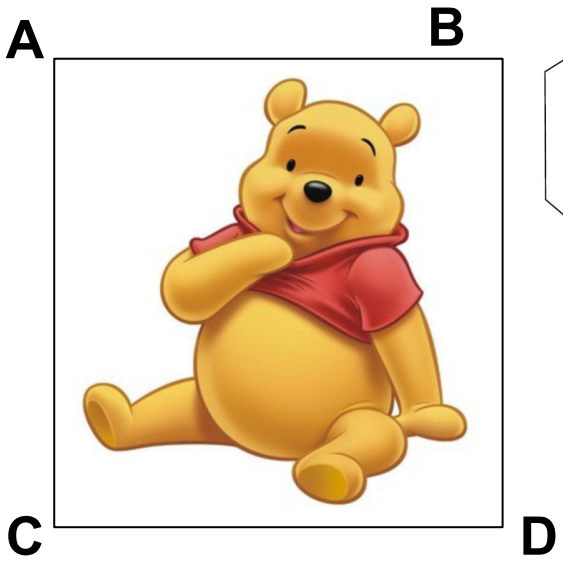
Warping Practice (50%)

Projection

透視變換 (Perspective Transformation) : 將成像投影到一個新的視平面(Viewing Plane),

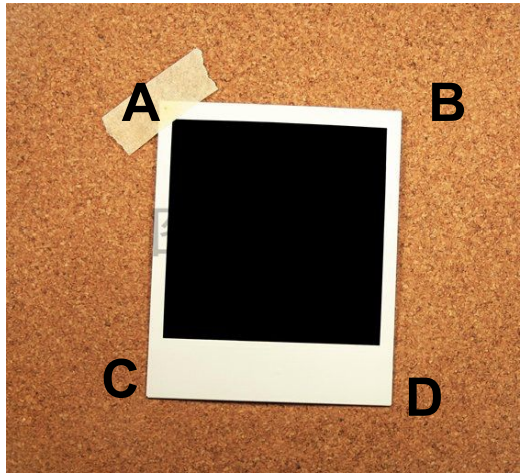
也稱作投影映射 (Projective Mapping)

Warping Practice (50%)



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

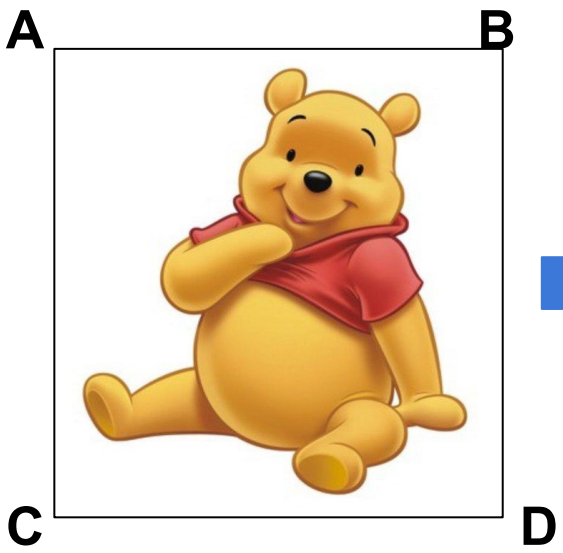
Projection

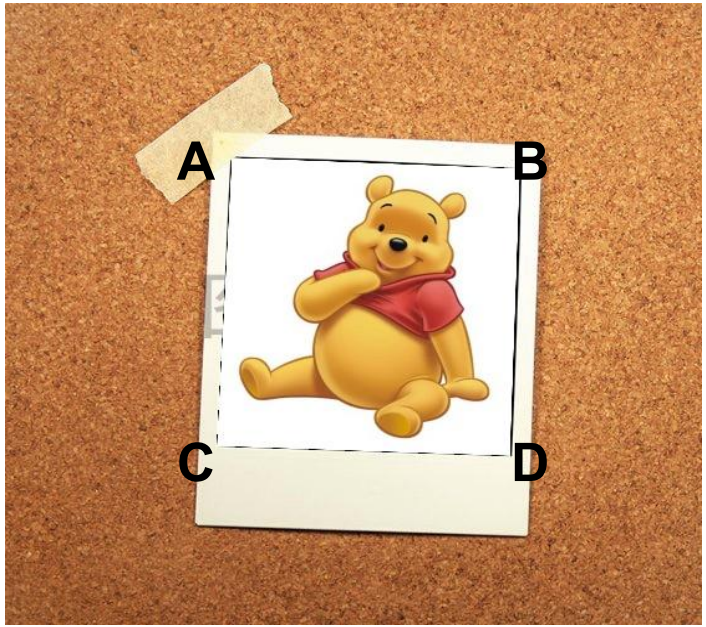


cv2.getPerspectiveTransform(cap_corner, img_corner)

- 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

Warping Practice (50%)





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

- 返回轉換後的圖後再將轉換圖貼上去
- 利用 bilinear interpolation 將圖填上去

Warping Practice (50%)

將 webcam 得到的**即時影像** warp 到看板上

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