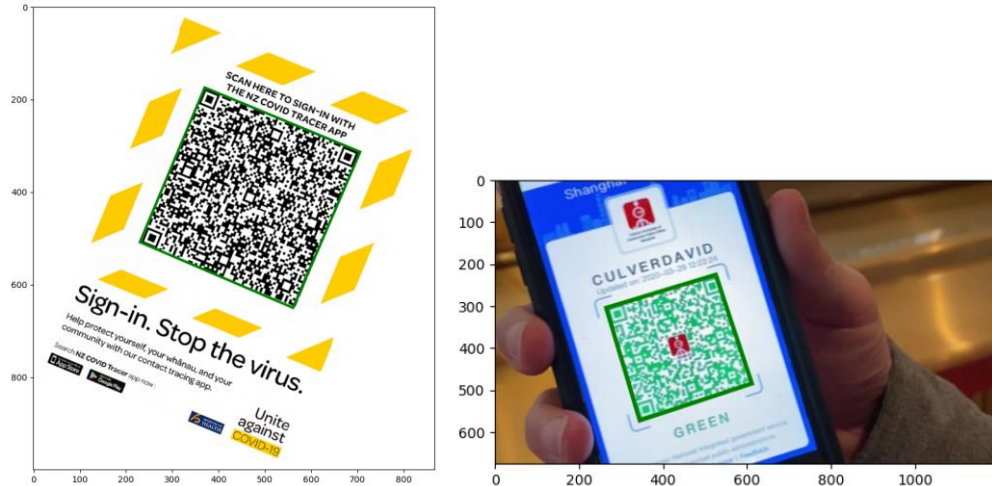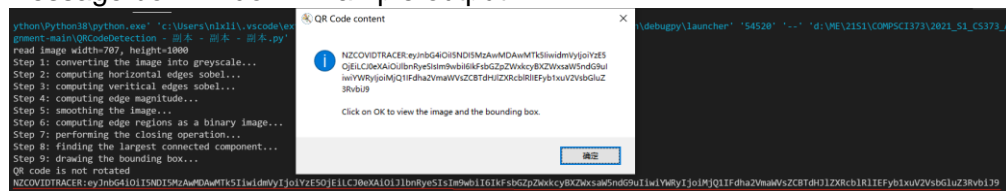# Report

1. Bounding box works for rotated images as well

To draw the bounding box around the QR code on a rotated image, I used Polygon instead of Rectangle. I imported Polygon from matplotlib.patches I implement it by writing the function
drawBoundingBox(pixel_array, image_height, image_width). A line will be printed indicating if the image is rotated. Example outputs:
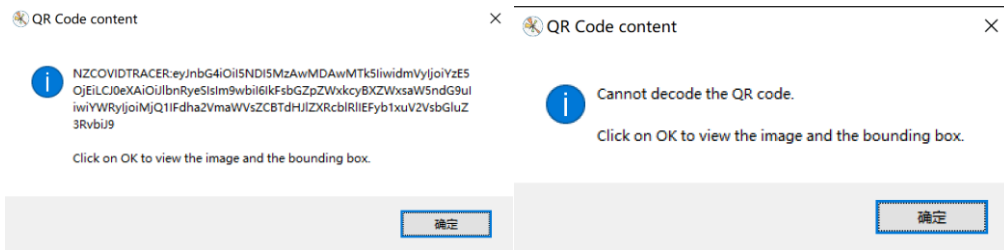

2. Combine with Python lib 'pyzbar' to actually decode the QR code

To decode the QR code, I imported pyzbar. In order to make the image readable by pyzbar, I converted it into a new greyscale png file in \images\covid19QRCode. I wrote the codes for decoding the QR code at the end of the main() function. To make sure the QR code can be recognized more clearly, I crop the image to have only the QR code part using cropImage(image, new_image, y_start, height, x_start, width), and save the new image as new_image.png in the \images\covid19QRCode file as well.
The content of the QR code is printed in the shell, and is displayed in a message box window. Example output:

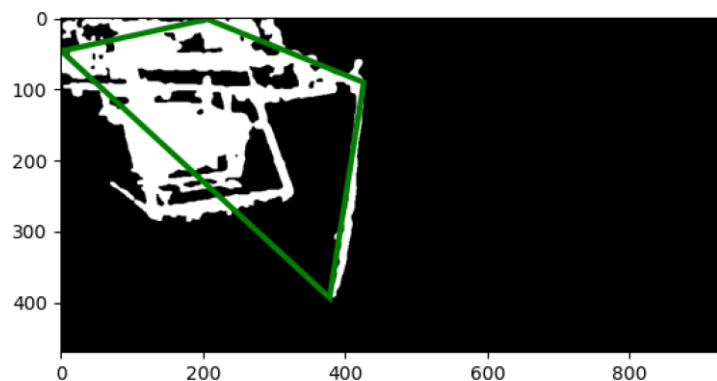### 3. The message box window displaying the content of the QR code

I wrote a message box displaying the content of the QR code. I imported tkinter and tkinter.messagebox. Once the code is running, the message box called "QR Code content" will first pop up. If the OK button is clicked, the matplotlib window will then show. If the QR code cannot be decoded, the message box will display 'Cannot decode the QR code'. Example outputs:

4. Code works for most of images in the 'challenging' file

File name	Can be correctly surrounded by the bounding box	QR code content can be decoded
bch.png	Yes	Yes
bloomfield.png	Yes	No
connecticut.png	Yes	Yes
playground.png	No	No
poster1smallrotated.png	Yes	Yes
shanghai.png	Yes	Yes

The bounding box on playground.png is not shown correctly because the code recognizes the benches part of the image as the largest connected component, instead of the QR code part.

This might be due to the number of dilations and erosions done, and the threshold value are not suitable for this image.
The QR code on bloomfield.png is too blurry, so it cannot not be decoded.
The QR code on playground.png is laminated therefore is too reflective, so it cannot be decoded as well.