

# How to Get Groundtruth

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To evaluate the performance of your EKF, you'll need to obtain the groundtruth of landmark positions. You can use the grid on the floor to get rough estimate of the positions (we've put down a grid on one of the tracks). Alternatively, the provided script *getGroundtruth.py* uses homography to estimate the landmark position from a single image. It's a Python script, and you need Numpy, OpenCV and Matplotlib.

To run the script, follow these steps:

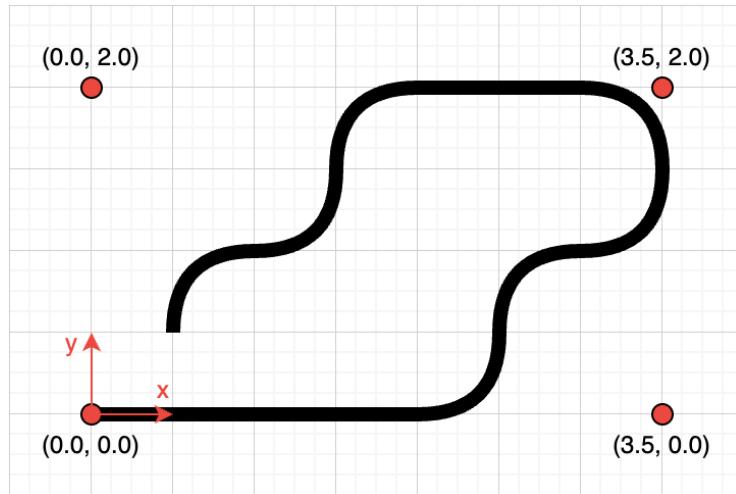


Figure 1: Coordinate for the track. You can find blue  $\oplus$  sign on the floor corresponding to the four corners with coordinates.

**1. Place landmarks** Place four landmarks at the four corners of the map, that is,  $(0,0)$   $(3.5,0)$   $(3.5,2.0)$  and  $(0, 2.0)$ , assuming the starting point of the track is  $(0,0)$ . You can find markers on the floor at these corners (see Fig. 1) Place the rest of landmarks along the track as you wish.

- 2. Take an image of the map** Use the camera on your phone, take an image of the whole track which includes all landmarks (including the landmarks on four corners). When taking the image, make sure you are using the normal mode (don't use wide range or fisheye mode). Send the image to your labtop. See Fig. 2 for an example.

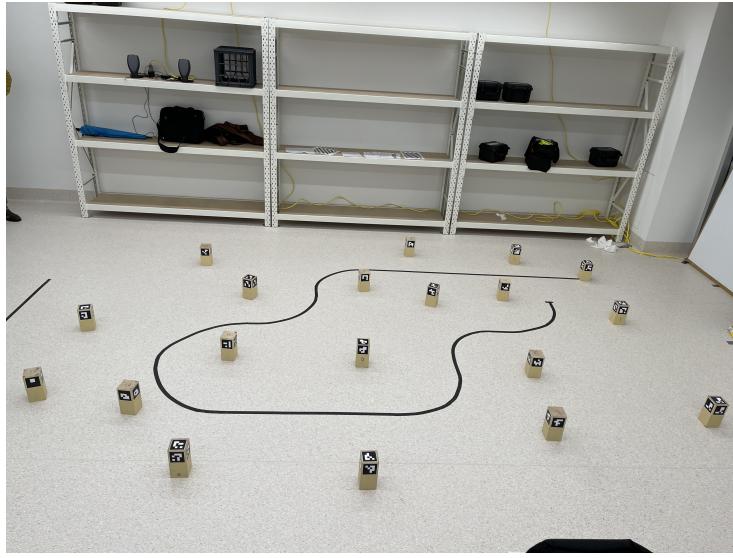


Figure 2: Example of the image

- 3. Run the script** Open a terminal or IDE or whatever tool you prefer to run a Python script, run the following commands:

```
python3 getGroundtruth.py —image_file [image.jpg]
```

and replace [image.jpg] with the file name of your image. I recommend you simply copy the image into the provided folder to avoid any potential problem with relative path. We provide a test image in the folder. You can run the script with this image to feel how it works.

- 4. Click the reference points for wrapping** When you run the script, you'll see a pop-up window as shown as Fig. 3. The interactive window allows clicking on the image. **You need to click on the centres of the top sides of four landmarks at each corner in the order (0,0) (3.5,0) (3.5,2.0) and (0, 2.0)**. After four clicks (each click will leave a red + on the image), the script will compute the homography matrix to rectify the image, and you will see the rectified image popping up (see Fig. 4)

- 5. Click the landmarks** Then you can click at the landmarks in the rectified image. **Make sure you are clicking on the top side of the landmark, not the**

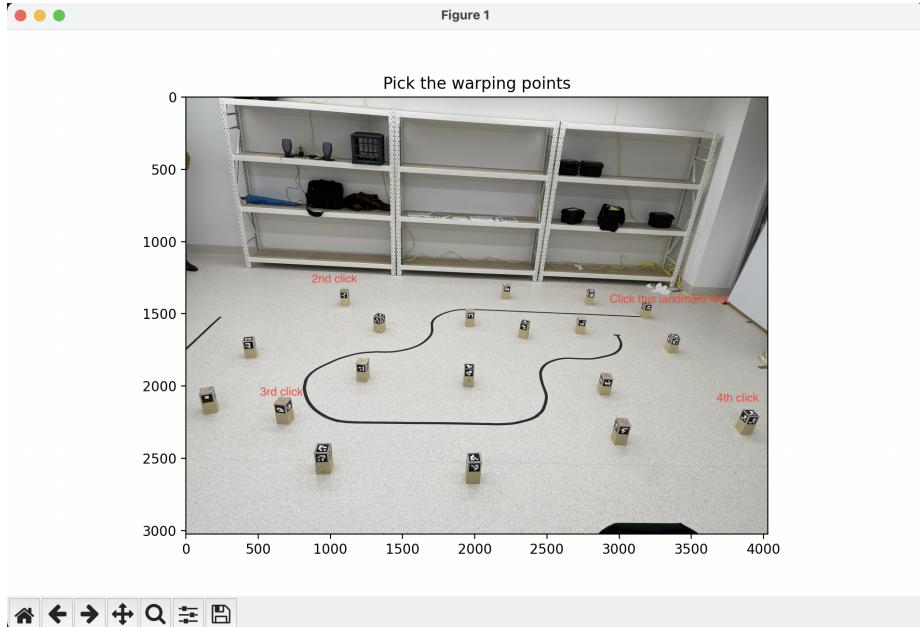


Figure 3: First step of picking the warpping points

**contacting point on the floor!** Also, the script doesn't know what the landmark ids are. So you need to record the order of landmark ids that you are clicking on. The script exits after 20 clicks, or you can hit ENTER to force it to quit. Then it will print out the coordinates of all the landmarks that you've clicked on. These coordinates are in the same frame as shown in Fig. 1.

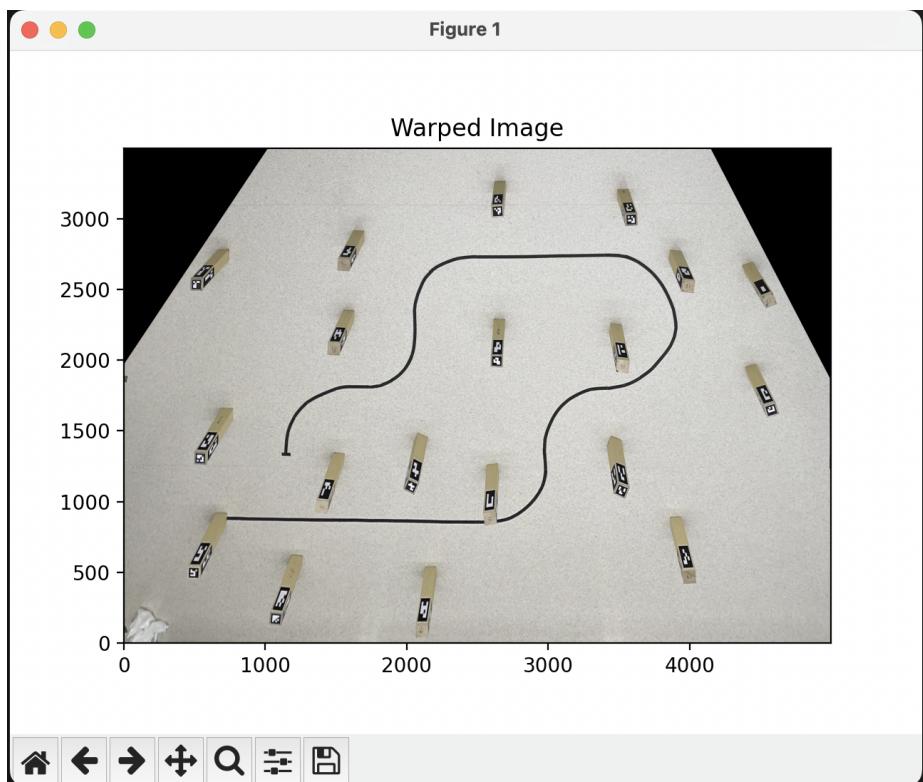


Figure 4: The rectified image