Introduction to My Projects

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Exploring my projects

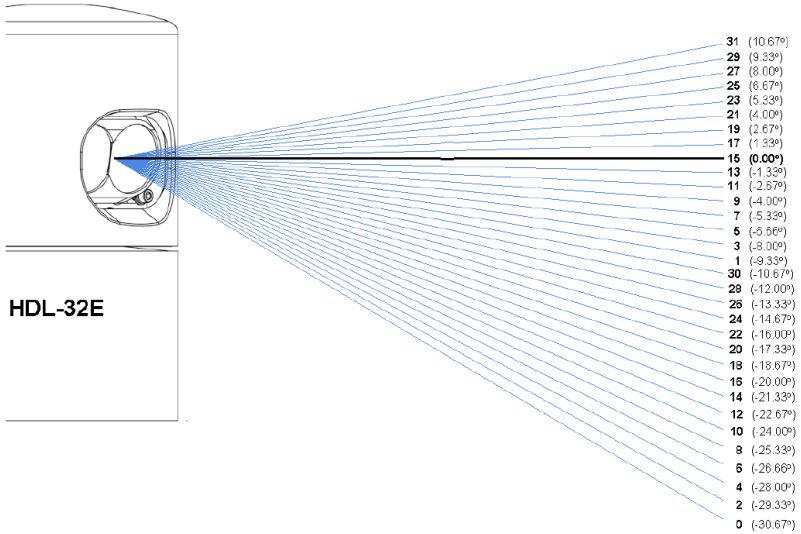
- Lidar object detection – 2019 ~2022 (NYCU), python, C++
- Localization using Point cloud map by ICP matching - 2020 (NYCU), C++
- Image stitching - 2021 (NYCU), python
- Localization using IMU and GPS by Kalman filter - 2023 (mobile drive), C++
- Bird eye view object tracking using Kalman filter - 2023 (mobile drive), C++

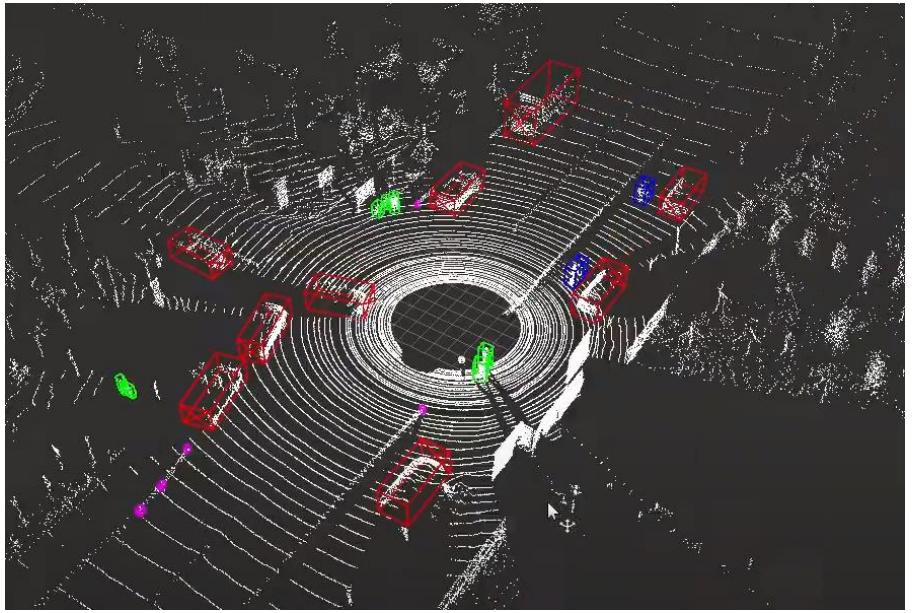
Lidar Object Detection

- Keyword: Python, C++, Point cloud(LiDAR), ROS(Robotic Operating System), Object Detection, Deep Learning

- 說明:
  1. 光達是一種測量距離的感測器，透過打出的雷射碰撞到物體，計算反射回來的時間得到與物體的距離，每一束雷射所收集到的資料可以點雲表示。
  2. 光達物件偵測即對點雲資料做物件種類的偵測。如右下圖，白色表示點雲、不同顏色的定界框表示不同物體。

- Example:



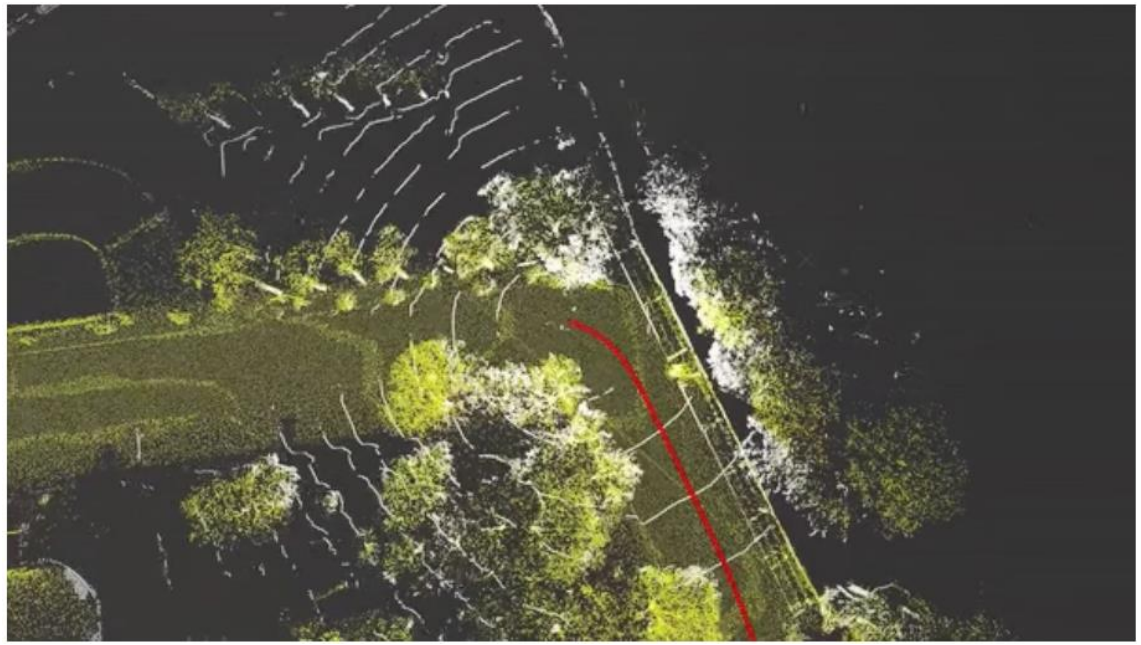


https://youtu.be/Afn1R8fXaxY

Localization using Point cloud map by ICP matching

- Keyword: C++, ROS(Robotic Operating System), ICP (Iterative Closest Point), Scan Matching

- 說明: 因現有GPS定位系統，常有公尺級的誤差，公尺級的誤差對需要精準定位的自駕車來說是不能使用的，因此我們透過預先建立的點雲地圖，並將實時取得的點雲與點雲地圖做匹配，取得自駕車在點雲地圖內的定位，做到公分級以內誤差
- Example :



Localization

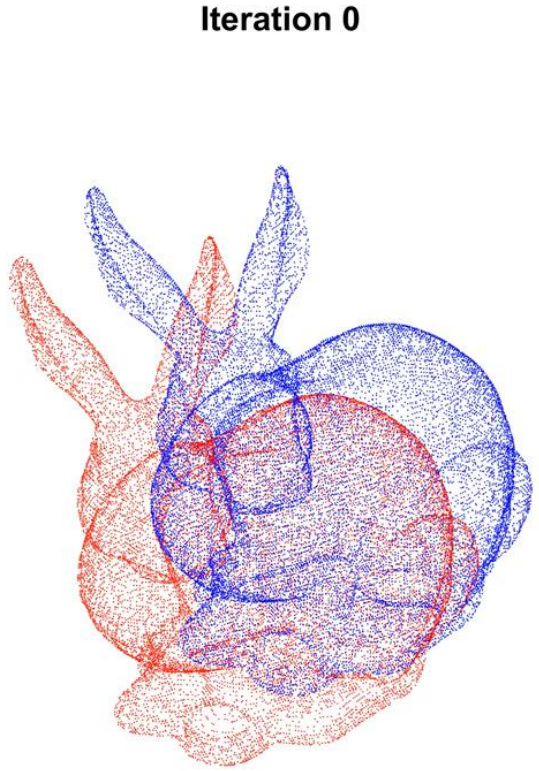
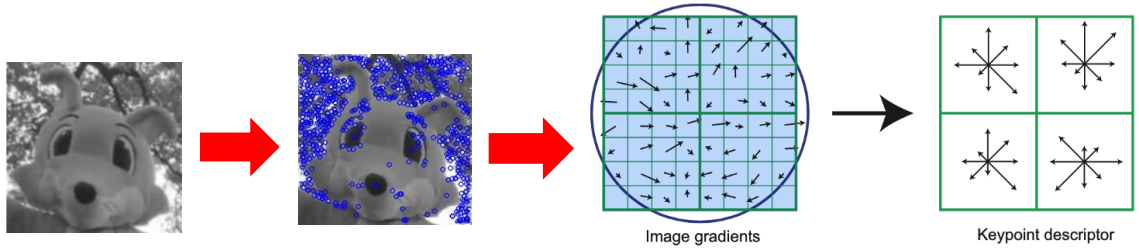


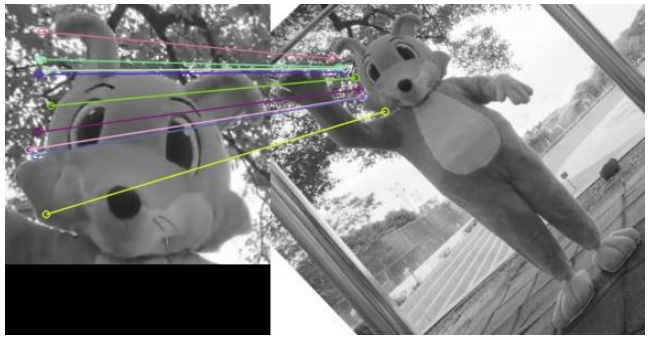
Image stitching

- Keyword: Python, SIFT (Scale-invariant feature transform), Matching, Image Processing

- 說明: 此項目希望將兩張有相似參考點的照片拼貼起來，形成類似全景圖的效果。我們採用SIFT特徵點(keypoints)搜尋，找出兩張圖象中的 keypoints，並比較兩張圖像中 keypoints 的descriptor，最後找出相似的 keypoints，完成匹配。

- Example:



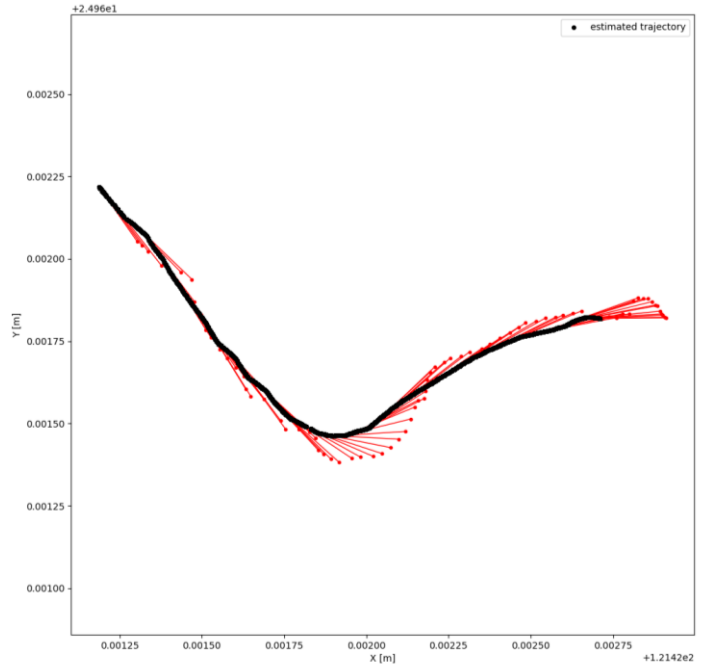


Localization using IMU and GPS by Kalman filter

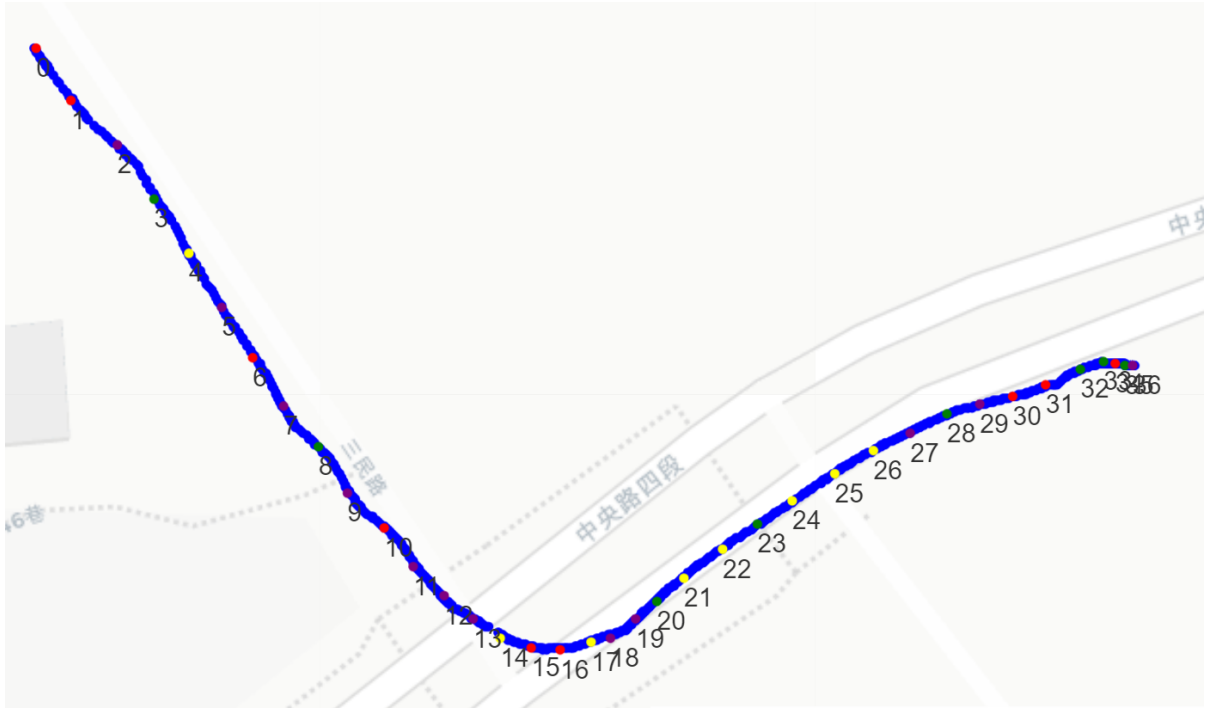
- Keyword: C++, Kalman Filter, Sensors Fusion, IMU, GPS

- 說明：透過IMU增加定位點密度並彌補GPS的不穩定性，達到更為穩定的定位效果，具體來說，以 IMU取得之yaw rate作為Kalman filter的prediction, GPS作為measurement，並融合兩種data

- Example:



IMU heading

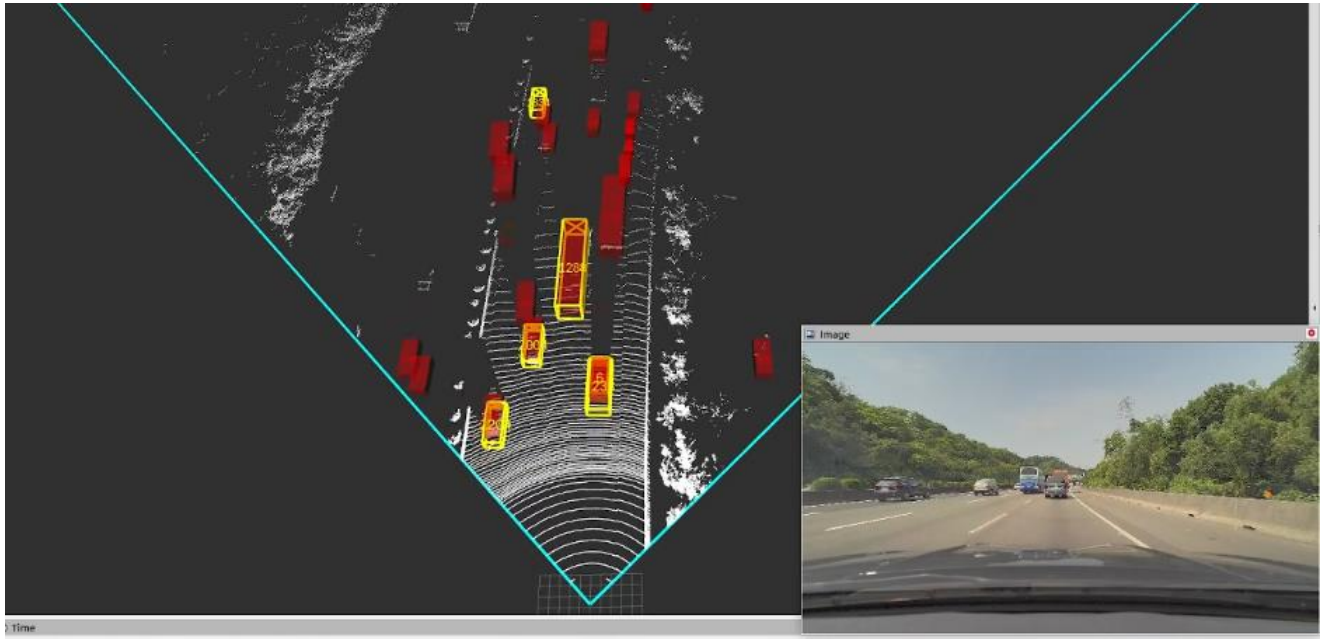


Localization

Bird eye view object tracking using Kalman filter

- Keyword: C++, Kalman Filter, Object tracking
- 說明：從3D物件偵測取得的3D物體, 將其投影至世界座標，以Kalman filter追蹤物體，讓物件偵測結果更加穩定
- Example:

3D 物件偵測(示意圖)



Bird eye view 物件追蹤

Thanks for Attention

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