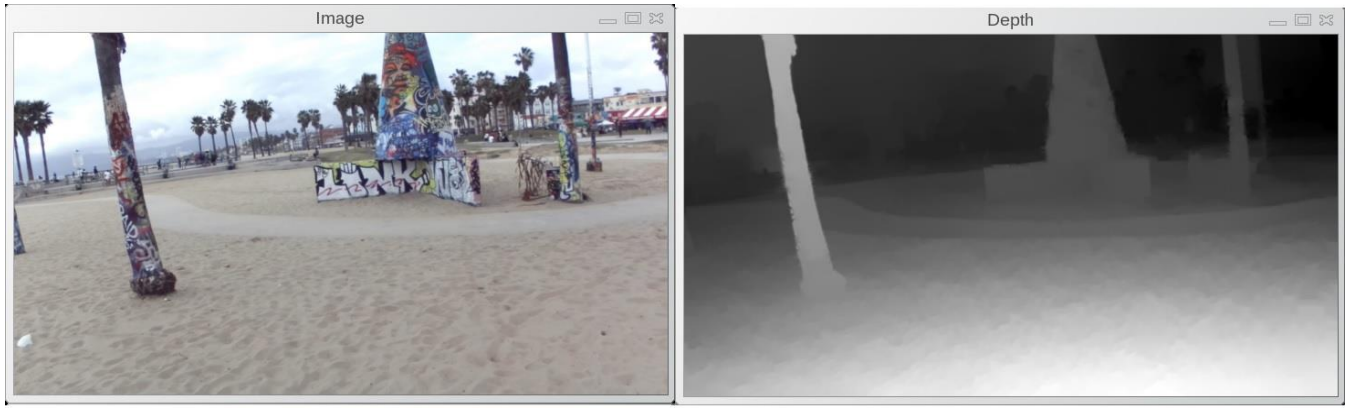
Perception

Mobile Robotics Crash Course

Sensors

Stereolabs ZED 2i Stereo camera

- Two eyes (cameras)
- Outputs color and depth images
- Reasonable depth estimates
- Rich semantic information
  - Color



Camera: https://cdn.stereolabs.com/assets/images/zed-2/zed-2-front.jpg Image/Depth: https://cdn.stereolabs.com/blog/wp-content/uploads/2015/05/depth_grab.jpg

Sensors

Velodyne VLP-16

- Light Detection and Ranging (LiDAR)
- Outputs point cloud
- Accurate depth estimates (+/- 2cm)
- No color information
  - Intensities

Point Cloud: https://upload.wikimedia.org/wikipedia/commons/b/bd/YandexLidarCloud.png LiDAR: https://eak2mvmpt4a.exactdn.com/wp-content/uploads/2019/08/Velodyne_Puck-1.png

What Does Perception DO?

Responsible for cone locations around the car

Involves:

- Looking at lots of data!
- Extracting cone locations from both sensors
- Training some models

How Do We Do Perception?

Stereo camera:

- Extract bounding boxes from the RGB images using YOLOv7
- Use segmentation within a bounding box to get cone pixels
- Calculate depth from corresponding cone depth pixels

LiDAR:

- Filter out LiDAR point cloud using various hand-tested algorithms
- Remaining points are (hopefully) due to cones

Fusion:

- Matching pairs of cones and calculate combined position estimate

What You'll Learn Today

How to:

- Use ROS 2 to subscribe to multiple topics simultaneously
- Process a depth image to extract depth information from bounding boxes
- Extract coordinates given depth values and pixel coordinates
- Visualize the cone locations extracted from the depth image