Recognizing and Tracking High-Level, Human-Meaningful Navigation Features of Occupancy Grid Maps

Payam Nikdel, Mo Chen, Richard Vaughan
{pnikdel, mochen, vaughan}@sfu.ca

Autonomay lab

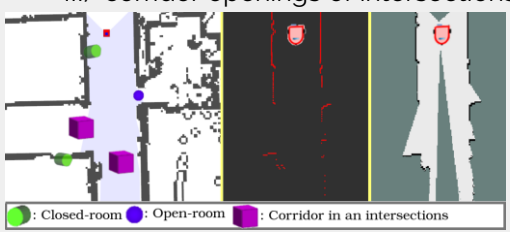
Motivation

Recognizing and Tracking Environmental features from
> 2D LiDAR data
> Local occupancy grid maps (Gmap)

Applications:
> Service-robot for visually impaired people
> Annotate Unknown maps

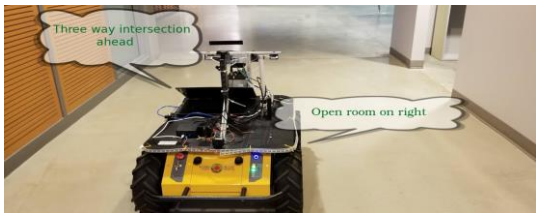
New Dataset

Generate a new dataset using Stage containing:
> 2D LiDAR data
> Local-map from SLAM GMapping
> Position of I) closed doors, II) open doors III) corridor openings of intersections

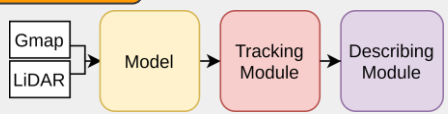


Stage with Annotations 2D LiDAR Gmap

Data augmentation:
I) Rotating II) Translating III) Re-sizing IV) Synthesizing partially-open doors



Method



Inputs:
> Local map from 2D LiDAR data
> Local map from Performing SLAM

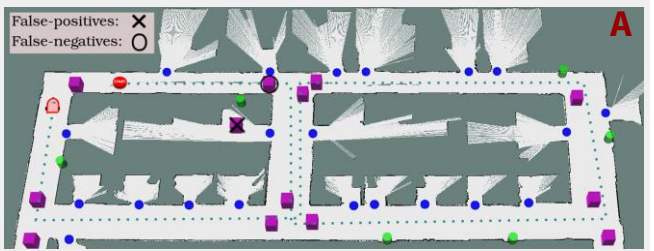
Models:
Define these three models:
> Laser model: uses LiDAR data only
> Map model: uses GMap data only
> Combined model: uses both

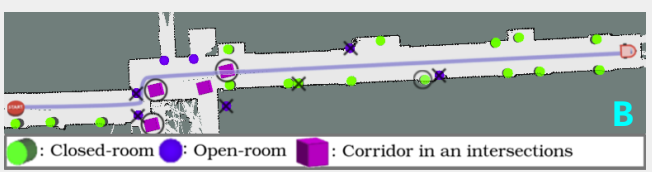
Tracking:
> Aggregates the predictions into clusters and locates the target classes more precisely

Describing:
> Describe the robot environment based on the position of the tracked clusters

Experiments

Conducted three experiments per models
1) Only the model with no tracking module
2) Full system in simulation (A)
3) Full system in real world (B)





	F1 Score Simulation			F1 Score Real world		
	Closed Room	Open Room	Corridor	Closed Room	Open Room	Corridor
Laser	0.84	0.90	**0.84**	**0.96**	0.43	**0.71**
Map	0.77	0.85	0.81	0.81	0.19	0.47
Combined	**0.86**	**0.91**	0.83	0.83	**0.50**	0.31

> Our results shows an increase in F1 score with the addition of our tracking module
> Unlike simulation, real world experiment achieves a relatively better F1-score with laser model