Perception and localization

Matteo Baiguera

November 21, 2020

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1 Introduction

Perception: detect the object, classify the object, estimate the object's trajectory.
The assumed sensor-suite is the following

	Sensor(s)	computing platform
Perception	LiDAR, Camera	
	Ultrasonic	
	Event camera	
Navigation	IMU,GPS	

2 Extended Kalman Filter

The purpose of extended kalman filter in AD problem is to track objects.

The assumed dynamic for all object is the following:

$$\vec{x}_{k+1} = A_k\vec{x}_k + B_k\vec{u}_k$$
$$\vec{x}_k = C_k\vec{z}_k$$

For each tracked object is assumed a state ($\vec{x}$) and an observation ($\vec{z}$).

$$\vec{x}_{k+1} = A_k\vec{x}_k + B_k\vec{u}_k$$
$$\vec{x}_k = C_k\vec{z}_k$$

The object state is defined as:

$$\vec{x} = \begin{bmatrix} x \\ y \\ v_x \\ v_y \end{bmatrix} \tag{1}$$

and
The object's motions is assumed to be a *"random walker"* process, such that:

$$A_k = \begin{pmatrix} 1 & 0 & \Delta t & 0 \\ 0 & 1 & 0 & \Delta t \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \tag{2}$$

Algorithm 1 Put your caption here

```
for o_j ∈ o1, o2, ...oN do                    ▷ track all objects
    Initialization:
    Update Step:
    Predict Step:
while something ≠ 0 do                        ▷ put some comments here
    var1 ← var2                               ▷ another comment
    var3 ← var4
```

3 Particle Filter

Vehicle ego-localization via particle filter