Bayes Filter

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Contents

1 Introduction

Bayes filter is an algorithm which is used for calculating belief distribution *bel* from the control given and the measurements collected by various sensors.

2 Algorithm

```
1   def Bayes_Filter(bel(x_{t-1}), u_t, z_t):
2       for x in x_t:
3           bel(x) = ∫ p(x_t|u_t, bel(x_{t-1}))
4           bel(x) = η p(z_t|x_t)bel(x)
```

2.1 Explanation

This is **one iteration** of the Bayes Filter algorithm at time step t. The filter takes as input the belief at time step $t-1$, $\mathrm{bel}(x_{t-1})$, the controls at time t, u_t and the measurements made at time t, z_t.

In the line 3. of the algorithm, it calculates $\overline{bel}(\mathrm{x}_t)$ using only the controls given at time t and the belief of previous time step. The line basically is calculating the probability of getting some state x in x_t given the believed state from the last time step and the controls given at this time step. It is just approximating how the controls might have changed the state of the system.

In the line 4. of the algorithm, It incorporates the measurements taken by the sensors. It calculates the belief based on the measurements and the $\overline{bel}$ calculated in line 3.

3   Proof