RoboSurgery

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Abstract

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Contents

1   Introduction

The goal of this project is to simulate a surgical robot for exploring lungs of patients.

2   Related Work

3   Probkem Statement

4   POMDP

Formal description of Partially Observable Markov Decision Process as in [3]

Formally, a POMDP is a 7-tuple $(S, A, T, R, \Omega, O, \gamma)$, where:

S is a set of states,

A is a set of actions,

T is a set of conditional transition probabilities between states,

$R : S \times A \to \mathbb{R}$ is the reward function.

Ω is a set of observations,

O is a set of conditional observation probabilities,

$\gamma \in [0, 1)$ is the discount factor.

5 Mathematical Formulation

5.1 State Space

From now on we're going to indicate as **State** the fully observable state of the system, which is the position of the robot, the deformation of the object and the

$$s = (\underline{\text{pos}}, \theta)$$

where $\underline{\text{pos}} = (x, y, \phi)$ is the position of the robot in the 2D space and θ represents the deformation parameters of the object.

5.2 Action Space

The action space is the set of all possible actions that the robot can take, Forwards, Backwards, Left, Right.

5.3 Observation Space

The observation space is the set of all possible observations that the robot can make, which is the presence of an obstacle in its field of view.

6 Results

6.1 QMDP

6.2 Thompson Sampling

6.3 Infotaxis

6.4 Information Directed Sampling

[2]

References

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[2] Daniel Russo and Benjamin Van Roy. Learning to optimize via information-directed sampling, 2017.

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