Using SOGBOFA algorithm in an OpenAI Environment

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Introduction

- Open AI provides a simulation environment where an agent can interact with an environment. In each step, the agent is taking an action, observing its outcome, and overall trying to maximize rewards while acting. The environment alone does not predict these actions, so we used an algorithm called SOGBOFA. SOGBOFA is a planning algorithm that uses an environment model to determine what actions to take in each step. If you would like to learn more about the planner, then you can scan the QR code below.

- My goal was to adapt a physics-based model of dynamics of a very simple car type, "Dubin's car model" to the Open AI interface to enable its use with SOGBOFA.

Paper for Algorithm

Creating the OpenAI Environment

Creating an Environment requires four main functions

- __init__()
  - When initializing the environment, we needed to set variables that will help us control the environment. For this environment, setting a random x,y position for our agent and goal were one of the key parts of the environment.

- Step()
  - The step function is what holds most of the functionality of the environment. This is where the SOGBOFA algorithm will choose its next action. For the SOGBOFA algorithm, the possible actions the algorithm can take are left, right, stop, or forward. A possible action that may be implemented in the future is reverse.

- Reset()
  - The reset function sets key variables back to the original state. This means our x,y position for our agent and our goal were randomized again.

- Render()
  - The render function is not an essential part of the program, its more for us to see program at work. If you plan on rendering your environment, I recommend using another library other than matplotlib.

Challenges

- I had not had a lot of experience with Python and the libraries that I needed to use.
- Creating the OpenAI environment was difficult at first since I had no experience with the OpenAI library and resources online were limited
- Matplotlib was not a suitable library for visualization

Results

- I was able to implement such an environment and SOGBOFA was runs successfully. Snapshots from a simple demo where SOGBOFA plans a path for the car to reach a goal position are shown below.