Homework 6

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Contents

List of Figures

1 Chapter 18

1.1 Problem 1.1

Code for this problem can be found here.

Figure 1 shows the field and obstacles integrated. From this I can take the partial derivatives of each and obtain the best gradient at every point in the field.

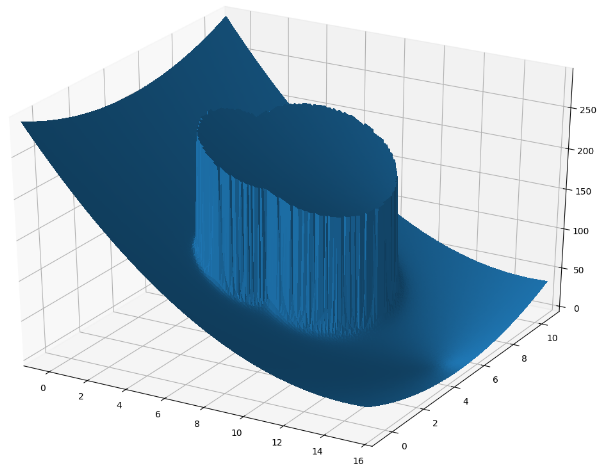

Figure 1: Potential Field with Obstacles

There was a **lot** of testing because I incorrectly entered an obstacle formula into a partial derivative calculator. After finally getting it working I had to tweak γ until it was able to make it through gradient decent. γ is sometimes called α or *step size*. Once I got it to descend to the goal I had to optimize it (of course). First I tried different static γ values with varrying degrees of success. The real breakthrough came with Figure 2, where I applied the following:

$$\gamma = \frac{1}{(x_0 - x_{goal})^2 + (y_0 - y_{goal})^2}$$

I realized that as the distance to goal decreased it would generate exceedingly large γ values. This was resolved with stepping the function:

$$D = (x_0 - x_{goal})^2 + (y_0 - y_{goal})^2$$

$$\gamma = \begin{cases} \frac{\eta}{D} & D > \eta \\ \gamma * 0.9 & 0.01 < D < \eta \\ 0 & D <= 0.01 \end{cases}$$

Where $\eta = 1$, but I played around with that variable as well. Using this combination for γ I was able to converge in a very reasonable 174 steps. Figure 3 shows the start and end points in green, the path in blue, and the obstacles in red.

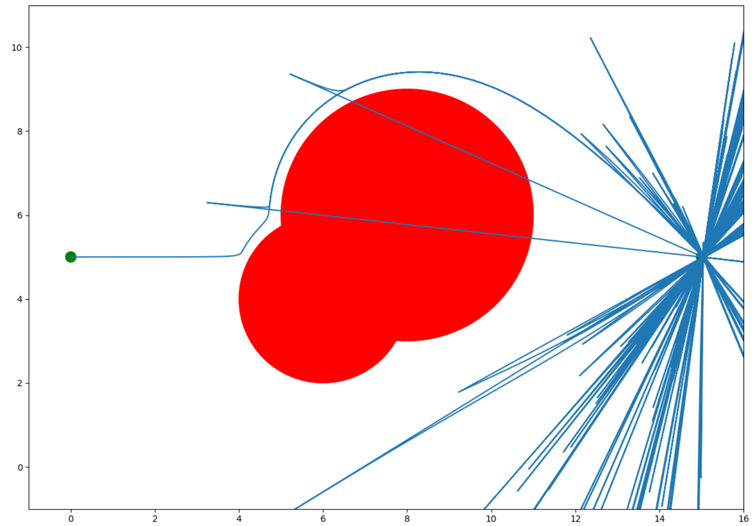

Figure 2: Explosion

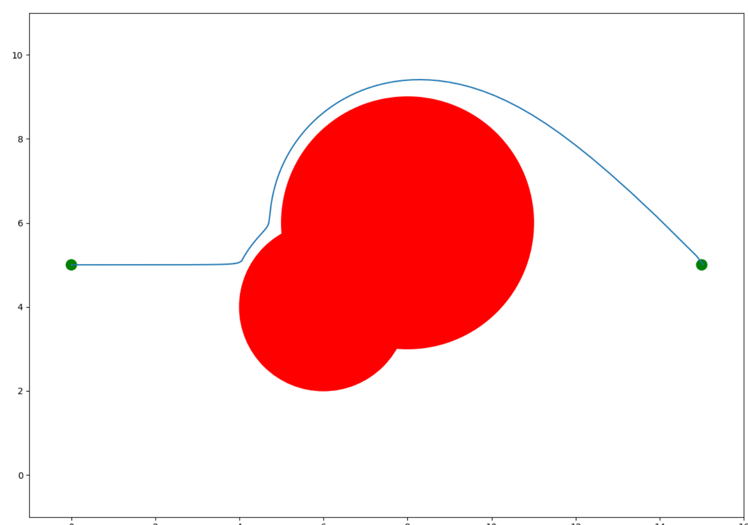

Figure 3: Proper Path Planned