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# Experiment 4: Potential Field Method

## Table of Contents

Theory .....	1
Outputs .....	1
Changed code output with repulsion factor = 0.05 and obstacles 40 .....	2
Conclusion: .....	5

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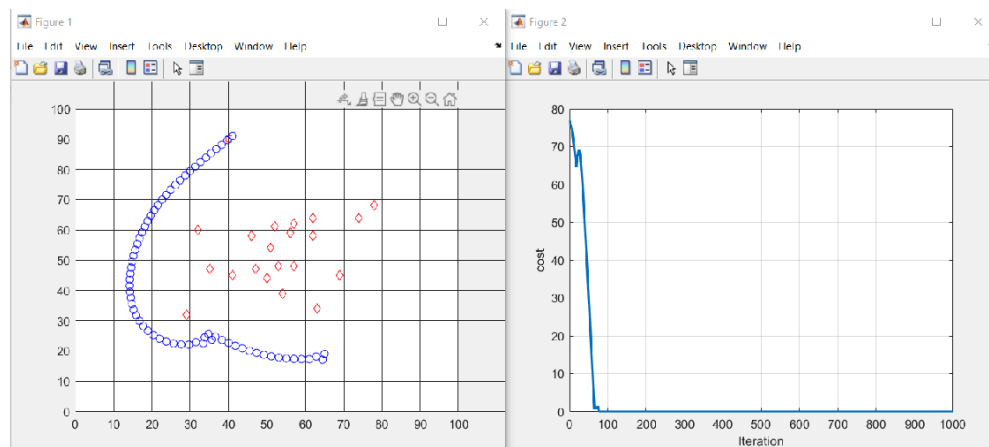
## Theory

Attractive-Repulsive Potential method is based on attractive potential field due to the target and repulsive potential field due to the obstacles of the world. The sum of these two potential gives us the current potential of the robot and the negative gradient of that sum gives us the replacement vector.

## Outputs

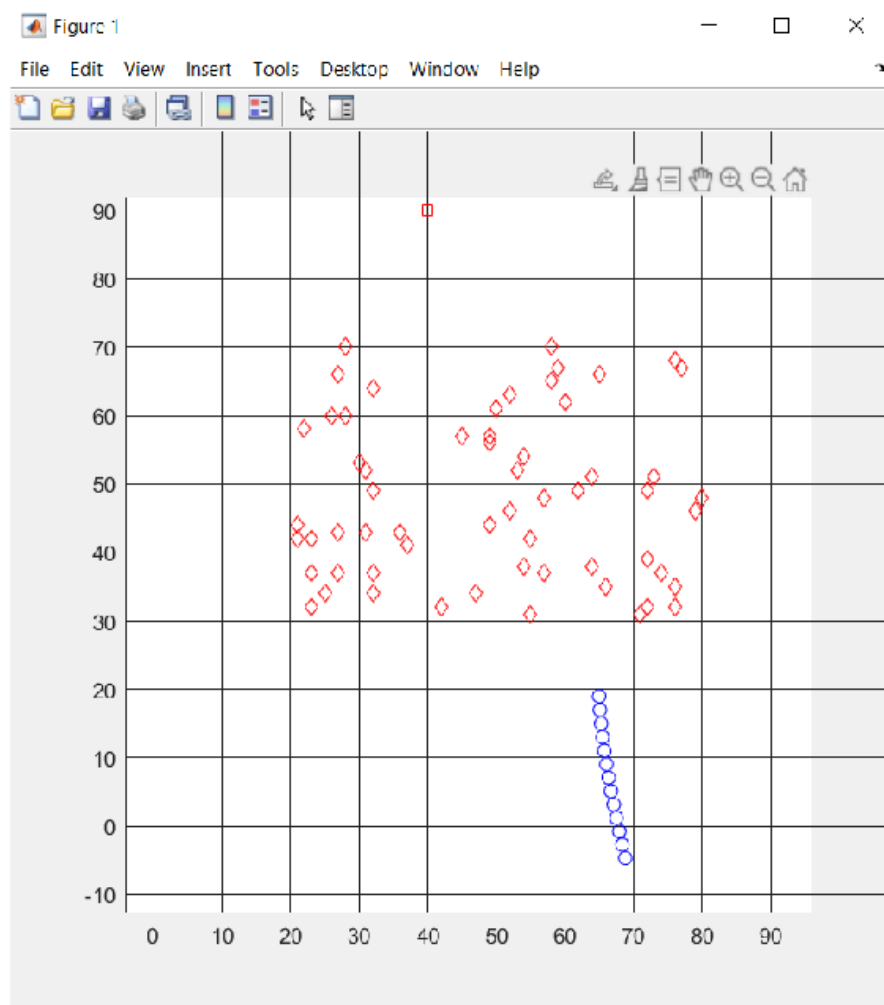
Initial input with 20 obstacles and repulsion factor =0.1

```
I = imread('initial.png');  
imshow(I)
```



Output with 60 Obstacles and repulsion factor =0.1

```
Img = imread('60.png');
imshow(Img)
```



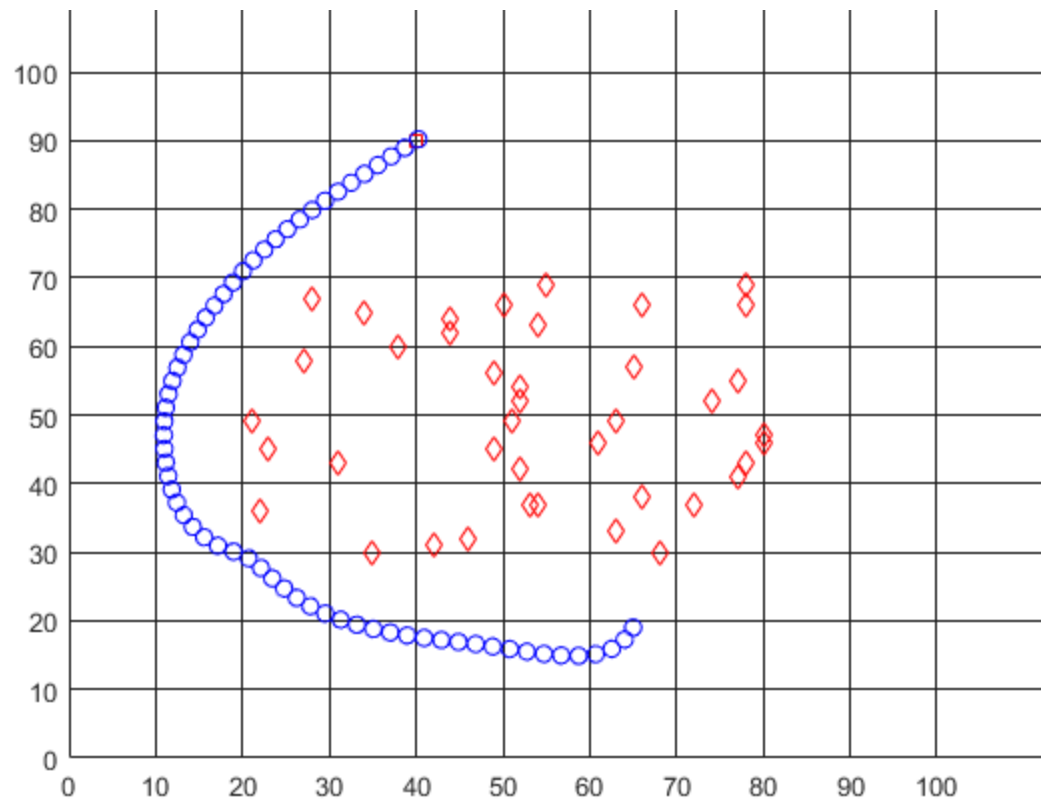
**Changed code output with repulsion factor = 0.05 and obstacles 40**

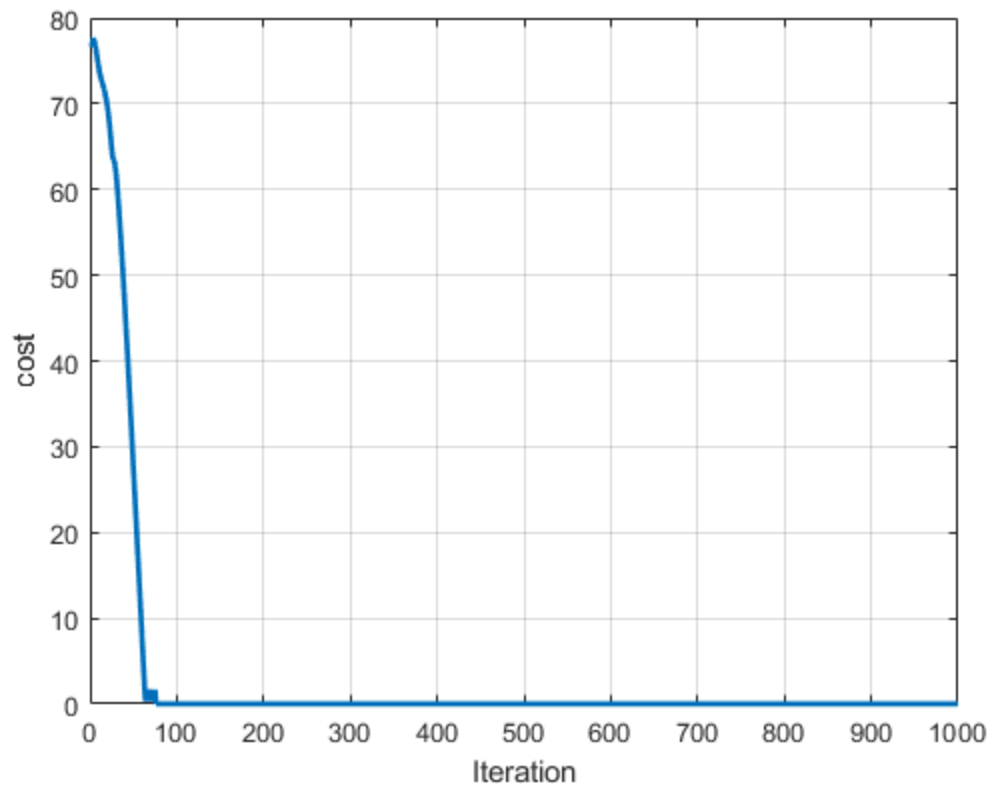
```
sm;
```

```
Iteration 2: Cost = 76.5963
Iteration 3: Cost = 77.4538
Iteration 4: Cost = 77.6712
Iteration 5: Cost = 77.4075
Iteration 6: Cost = 76.8948
```

Iteration 7: Cost = 76.2623  
Iteration 8: Cost = 75.5821  
Iteration 9: Cost = 74.9046  
Iteration 10: Cost = 74.2715  
Iteration 11: Cost = 73.7149  
Iteration 12: Cost = 73.2476  
Iteration 13: Cost = 72.8538  
Iteration 14: Cost = 72.4982  
Iteration 15: Cost = 72.1451  
Iteration 16: Cost = 71.7713  
Iteration 17: Cost = 71.3631  
Iteration 18: Cost = 70.9051  
Iteration 19: Cost = 70.372  
Iteration 20: Cost = 69.7328  
Iteration 21: Cost = 68.9648  
Iteration 22: Cost = 68.063  
Iteration 23: Cost = 67.0419  
Iteration 24: Cost = 65.9371  
Iteration 25: Cost = 64.8221  
Iteration 26: Cost = 63.882  
Iteration 27: Cost = 63.5078  
Iteration 28: Cost = 63.3127  
Iteration 29: Cost = 62.7762  
Iteration 30: Cost = 61.9241  
Iteration 31: Cost = 60.8249  
Iteration 32: Cost = 59.5433  
Iteration 33: Cost = 58.1335  
Iteration 34: Cost = 56.6367  
Iteration 35: Cost = 55.0811  
Iteration 36: Cost = 53.4829  
Iteration 37: Cost = 51.8476  
Iteration 38: Cost = 50.1735  
Iteration 39: Cost = 48.4558  
Iteration 40: Cost = 46.6917  
Iteration 41: Cost = 44.8831  
Iteration 42: Cost = 43.0359  
Iteration 43: Cost = 41.1582  
Iteration 44: Cost = 39.2572  
Iteration 45: Cost = 37.3388  
Iteration 46: Cost = 35.4072  
Iteration 47: Cost = 33.4653  
Iteration 48: Cost = 31.5151  
Iteration 49: Cost = 29.5579  
Iteration 50: Cost = 27.5945  
Iteration 51: Cost = 25.6243  
Iteration 52: Cost = 23.6468  
Iteration 53: Cost = 21.6622  
Iteration 54: Cost = 19.6719  
Iteration 55: Cost = 17.6776  
Iteration 56: Cost = 15.6809  
Iteration 57: Cost = 13.6827  
Iteration 58: Cost = 11.6836  
Iteration 59: Cost = 9.6841  
Iteration 60: Cost = 7.6843

Iteration 61: Cost = 5.6844  
Iteration 62: Cost = 3.6844  
Iteration 63: Cost = 1.6844  
Iteration 64: Cost = 0.31561  
Iteration 65: Cost = 1.6844  
Iteration 66: Cost = 0.31561  
Iteration 67: Cost = 1.6844  
Iteration 68: Cost = 0.31561  
Iteration 69: Cost = 1.6844  
Iteration 70: Cost = 0.31561  
Iteration 71: Cost = 1.6844  
Iteration 72: Cost = 0.31561  
Iteration 73: Cost = 1.6844  
Iteration 74: Cost = 0.31561  
Iteration 75: Cost = 1.6844  
Cost toggling. End reached. Stop it !!!





## Conclusion:

The model finds the shortest when 40 obstacles are provided and the algorithm does not converge when the obstacles are increased over 40 and this error occurs due to set parameters and therefore the repulsion force increases and therefore the bot tends to move into the negative axis. And by changing coefficient of repulsion to a lower value the coefficient of attraction increases and therefore the bot moves to the target.

*Published with MATLAB® R2020a*