Neha Kumar
Homework 11

Raw Data
Run 1:

```
    # Change these parameters to improve performance
    self.density_first_layer = 16
    self.density_second_layer = 16
    self.num_epochs = 2
    self.batch_size = 64
    self.epsilon_min = 0.01

    # epsilon will randomly choose the next action as either
    # a random action, or the highest scoring predicted action
    self.epsilon = 1.0
    self.epsilon_decay = 0.995
    self.gamma = 0.99

    # Learning rate
    self.lr = 0.001
```

Converged after 731 episodes
Starting Testing of the trained model...
0   : Episode || Reward: 293.8010292045742
1   : Episode || Reward: 219.74550921720743
2   : Episode || Reward: 216.4229169600062
3   : Episode || Reward: -39.33232636916901
4   : Episode || Reward: 103.54491854080857
5   : Episode || Reward: 203.1945327436853
6   : Episode || Reward: 101.40524639301337
7   : Episode || Reward: 207.25490038164838
8   : Episode || Reward: 242.6384676292013
9   : Episode || Reward: 220.422747799342
10   : Episode || Reward: 220.6111545514342
11   : Episode || Reward: 107.1506297432145
12   : Episode || Reward: 246.2436271575501
13   : Episode || Reward: 260.8480792446929
14   : Episode || Reward: 214.36691243904693
15   : Episode || Reward: 109.41657895766934
16   : Episode || Reward: 193.4992571368312
17   : Episode || Reward: 208.25917681208006
18   : Episode || Reward: 234.58436839359166

```
19      : Episode || Reward:  108.84665779309098
20      : Episode || Reward:  105.72184633036112
21      : Episode || Reward:  286.87394134977205
22      : Episode || Reward:  242.0001881568204
23      : Episode || Reward:  203.1841094558964
24      : Episode || Reward:  285.764021305992
25      : Episode || Reward:  129.9032003259337
26      : Episode || Reward:  206.09535016977077
27      : Episode || Reward:  211.62714308816356
28      : Episode || Reward:  259.6670070754303
29      : Episode || Reward:  212.48632299162935
30      : Episode || Reward:  -28.18247002193317
31      : Episode || Reward:  234.19786883754017
32      : Episode || Reward:  269.54652694366956
33      : Episode || Reward:  285.51966296524245
34      : Episode || Reward:  273.49591911515364
35      : Episode || Reward:  244.71722759325587
36      : Episode || Reward:  261.3784299361721
37      : Episode || Reward:  -37.622110743616105
38      : Episode || Reward:  197.44081927259018
39      : Episode || Reward:  198.25046156092606
40      : Episode || Reward:  12.665095022979969
41      : Episode || Reward:  214.59981647800868
42      : Episode || Reward:  297.5449702437611
43      : Episode || Reward:  273.505897654416
44      : Episode || Reward:  254.48622049211082
45      : Episode || Reward:  217.18913277365948
46      : Episode || Reward:  225.52508091486197
47      : Episode || Reward:  235.52925244353202
48      : Episode || Reward:  275.94705818337724
49      : Episode || Reward:  286.7856604643134
50      : Episode || Reward:  119.3029318177624
51      : Episode || Reward:  286.90481199567705
52      : Episode || Reward:  119.58343747168253
53      : Episode || Reward:  236.16107938273194
54      : Episode || Reward:  236.53628877973458
55      : Episode || Reward:  65.45514555508794
56      : Episode || Reward:  275.2691431475836
57      : Episode || Reward:  116.4308004117254
58      : Episode || Reward:  222.6257699202307
59      : Episode || Reward:  224.3804873605522
60      : Episode || Reward:  73.38844776240946
61      : Episode || Reward:  227.01034428021464
```

```
62      : Episode || Reward:  201.02245072484715
63      : Episode || Reward:  203.89825127651403
64      : Episode || Reward:  245.72354758901488
65      : Episode || Reward:  210.22908141857033
66      : Episode || Reward:  233.92555782899984
67      : Episode || Reward:  206.56898519908992
68      : Episode || Reward:  -21.44400741354211
69      : Episode || Reward:  242.5972100397087
70      : Episode || Reward:  -33.426150540891314
71      : Episode || Reward:  252.31514623418818
72      : Episode || Reward:  273.25317888687505
73      : Episode || Reward:  184.24034293817562
74      : Episode || Reward:  262.99839078183254
75      : Episode || Reward:  105.44740803380847
76      : Episode || Reward:  265.49857508558233
77      : Episode || Reward:  288.42593906661375
78      : Episode || Reward:  180.9649347855058
79      : Episode || Reward:  231.0043664280952
80      : Episode || Reward:  234.98131066829384
81      : Episode || Reward:  209.7144456550339
82      : Episode || Reward:  226.31868527386482
83      : Episode || Reward:  253.12351525919982
84      : Episode || Reward:  237.5656974873908
85      : Episode || Reward:  219.3773392914511
86      : Episode || Reward:  280.7765732813873
87      : Episode || Reward:  262.8026685846443
88      : Episode || Reward:  230.9476164791311
89      : Episode || Reward:  114.62500921396258
90      : Episode || Reward:  244.1262245883437
91      : Episode || Reward:  223.10257656591222
92      : Episode || Reward:  73.07362269218302
93      : Episode || Reward:  217.0190163440407
94      : Episode || Reward:  224.72041759781496
95      : Episode || Reward:  76.4412823963943
96      : Episode || Reward:  254.84931341446665
97      : Episode || Reward:  238.83688007705814
98      : Episode || Reward:  247.85511142393318
99      : Episode || Reward:  243.65639846944407
Average Reward:  200.58973636121647
```

Run 2: change density of first layer to 32
        # Change these parameters to improve performance

```
        self.density_first_layer = 32
        self.density_second_layer = 16
        self.num_epochs = 2
        self.batch_size = 64
        self.epsilon_min = 0.01

        # epsilon will randomly choose the next action as either
        # a random action, or the highest scoring predicted action
        self.epsilon = 1.0
        self.epsilon_decay = 0.995
        self.gamma = 0.99

        # Learning rate
        self.lr = 0.001
```

Converged after 778 episodes

```
0       : Episode || Reward:  234.32500516636983
1       : Episode || Reward:  201.4597129112627
2       : Episode || Reward:  121.06949890934258
3       : Episode || Reward:  231.58897960237397
4       : Episode || Reward:  263.7553418692693
5       : Episode || Reward:  265.50309958029493
6       : Episode || Reward:  232.14120675336386
7       : Episode || Reward:  221.4409774980162
8       : Episode || Reward:  204.63944966463703
9       : Episode || Reward:  218.29188153607947
10      : Episode || Reward:  227.67201402990008
c11     : Episode || Reward:  229.22290581611068
12      : Episode || Reward:  244.58649067684627
13      : Episode || Reward:  221.43700783605942
14      : Episode || Reward:  241.08672224368723
15      : Episode || Reward:  227.57835827468853
16      : Episode || Reward:  208.71631812834315
17      : Episode || Reward:  180.25480365015505
18      : Episode || Reward:  100.66390221704997
19      : Episode || Reward:  206.11757723625635
20      : Episode || Reward:  206.48534624986326
21      : Episode || Reward:  272.4345295768041
22      : Episode || Reward:  256.34716973411065
23      : Episode || Reward:  255.98380162060192
24      : Episode || Reward:  230.02829655005442
25      : Episode || Reward:  126.35665645911345
```

```
26       : Episode || Reward:  233.0881610207017
27       : Episode || Reward:  218.02988879969098
28       : Episode || Reward:  222.74229657681718
29       : Episode || Reward:  219.39343172944865
30       : Episode || Reward:  258.11025534872533
31       : Episode || Reward:  224.89988276249883
32       : Episode || Reward:  222.6642468104679
33       : Episode || Reward:  177.97844198643833
34       : Episode || Reward:  241.11825082706892
35       : Episode || Reward:  225.0373354352048
36       : Episode || Reward:  222.2156142340909
37       : Episode || Reward:  253.7472282763748
38       : Episode || Reward:  208.9489373866575
39       : Episode || Reward:  262.9109607019773
40       : Episode || Reward:  -3.194129758894391
41       : Episode || Reward:  112.17359926446801
42       : Episode || Reward:  266.3751682223838
43       : Episode || Reward:  204.6951763203803
44       : Episode || Reward:  259.95681919544325
45       : Episode || Reward:  191.66050577204317
46       : Episode || Reward:  -10.420611070547167
47       : Episode || Reward:  201.78941642055156
48       : Episode || Reward:  227.31370465369312
49       : Episode || Reward:  261.5451235682367
50       : Episode || Reward:  -3.508718310107838
51       : Episode || Reward:  204.68304403522802
52       : Episode || Reward:  224.56317962450538
53       : Episode || Reward:  120.01049459821255
54       : Episode || Reward:  175.88862528569064
55       : Episode || Reward:  204.59933554285465
56       : Episode || Reward:  252.5579698039501
57       : Episode || Reward:  229.21803128634286
58       : Episode || Reward:  217.92910871243532
59       : Episode || Reward:  240.58034255731067
60       : Episode || Reward:  230.16427153432912
61       : Episode || Reward:  214.87518850849392
62       : Episode || Reward:  256.88047875124005
63       : Episode || Reward:  265.10491534462835
64       : Episode || Reward:  240.35575013422525
65       : Episode || Reward:  209.4969633569247
66       : Episode || Reward:  206.58460673754024
67       : Episode || Reward:  261.5092973475226
68       : Episode || Reward:  209.9051160340287
```

```
69      : Episode || Reward:  264.3980550078196
70      : Episode || Reward:  211.32996984341034
71      : Episode || Reward:  264.90407716874483
72      : Episode || Reward:  225.33607765944362
73      : Episode || Reward:  198.74879778471697
74      : Episode || Reward:  262.3016070871922
75      : Episode || Reward:  254.04913912608282
76      : Episode || Reward:  235.01975430317847
77      : Episode || Reward:  224.2964176958576
78      : Episode || Reward:  186.03350205550566
79      : Episode || Reward:  239.87050917870374
80      : Episode || Reward:  249.8724506001776
81      : Episode || Reward:  256.31864551204785
82      : Episode || Reward:  212.76268040134363
83      : Episode || Reward:  223.51555204521452
84      : Episode || Reward:  259.8427780679928
85      : Episode || Reward:  215.34541827480246
86      : Episode || Reward:  180.3310637642217
87      : Episode || Reward:  122.61449916981739
88      : Episode || Reward:  235.58163794198416
89      : Episode || Reward:  204.91723577694086
90      : Episode || Reward:  207.1634770924615
91      : Episode || Reward:  252.83026662185114
92      : Episode || Reward:  237.59020745745144
93      : Episode || Reward:  244.0406527300769
94      : Episode || Reward:  240.7208208043475
95      : Episode || Reward:  213.7764752519768
96      : Episode || Reward:  214.625077193281
97      : Episode || Reward:  233.02042656749646
98      : Episode || Reward:  204.68015808274964
99      : Episode || Reward:  217.62210335431124
Average Reward:  214.8682429278113
```

Run 3: change density of first layer to 64
```
    # Change these parameters to improve performance
    self.density_first_layer = 64
    self.density_second_layer = 16
    self.num_epochs = 2
    self.batch_size = 64
    self.epsilon_min = 0.01

    # epsilon will randomly choose the next action as either
    # a random action, or the highest scoring predicted action
```

```
self.epsilon = 1.0
self.epsilon_decay = 0.995
self.gamma = 0.99

# Learning rate
self.lr = 0.001
```

Converged after 416 models

```
0       : Episode || Reward:  228.2882221189951
1       : Episode || Reward:  233.2207224728476
2       : Episode || Reward:  209.92976510837644
3       : Episode || Reward:  219.20802500135645
4       : Episode || Reward:  256.5465477138632
5       : Episode || Reward:  219.25114376271048
6       : Episode || Reward:  236.25374750727948
7       : Episode || Reward:  196.3217629031546
8       : Episode || Reward:  249.54843203835307
9       : Episode || Reward:  256.22344089755404
10      : Episode || Reward:  255.91259733305537
11      : Episode || Reward:  288.3630149858858
12      : Episode || Reward:  259.27927874437484
13      : Episode || Reward:  232.20701878482933
14      : Episode || Reward:  261.4686032133906
15      : Episode || Reward:  199.21027352751287
16      : Episode || Reward:  244.45248858599902
17      : Episode || Reward:  246.89708460822484
18      : Episode || Reward:  241.19825374947285
19      : Episode || Reward:  260.63504612640236
20      : Episode || Reward:  210.5726306146642
21      : Episode || Reward:  273.02892326596015
22      : Episode || Reward:  232.26534930936288
23      : Episode || Reward:  270.835791158341
24      : Episode || Reward:  249.27337341106588
25      : Episode || Reward:  205.93761191347375
26      : Episode || Reward:  279.59941386321407
27      : Episode || Reward:  259.5199482313967
28      : Episode || Reward:  224.29150590277567
29      : Episode || Reward:  251.6386801917195
30      : Episode || Reward:  271.86796518781887
31      : Episode || Reward:  246.6089765648788
32      : Episode || Reward:  244.65154742045124
33      : Episode || Reward:  236.16007280183103
34      : Episode || Reward:  273.49700748784295
```

```
35       : Episode || Reward:  206.70014969515455
36       : Episode || Reward:  265.170103983364
37       : Episode || Reward:  246.48999136152017
38       : Episode || Reward:  240.51770403172603
39       : Episode || Reward:  234.97254649989455
40       : Episode || Reward:  272.5740524603307
41       : Episode || Reward:  246.86250953312157
42       : Episode || Reward:  227.47730236570038
43       : Episode || Reward:  289.31010653205203
44       : Episode || Reward:  278.88095778320616
45       : Episode || Reward:  253.72281566742893
46       : Episode || Reward:  238.1970638671718
47       : Episode || Reward:  226.76642194527426
48       : Episode || Reward:  250.51652081030582
49       : Episode || Reward:  218.00364407867139
50       : Episode || Reward:  236.31172680101182
51       : Episode || Reward:  248.20444391274046
52       : Episode || Reward:  270.6272336322172
53       : Episode || Reward:  248.56058676669275
54       : Episode || Reward:  221.5481892760172
55       : Episode || Reward:  273.2308867600817
56       : Episode || Reward:  250.37404743217104
57       : Episode || Reward:  279.55135558436655
58       : Episode || Reward:  228.7281398674438
59       : Episode || Reward:  262.1642781810881
60       : Episode || Reward:  247.82069316335512
61       : Episode || Reward:  234.72717019796698
62       : Episode || Reward:  249.96845278534863
63       : Episode || Reward:  255.8780387362407
64       : Episode || Reward:  228.12965521817992
65       : Episode || Reward:  263.3772095942139
66       : Episode || Reward:  232.48824894502752
67       : Episode || Reward:  265.38159510816064
68       : Episode || Reward:  242.34724531233536
69       : Episode || Reward:  241.98186685680298
70       : Episode || Reward:  232.89639695978596
71       : Episode || Reward:  223.74112002351333
72       : Episode || Reward:  254.4293115137059
73       : Episode || Reward:  240.23594312749165
74       : Episode || Reward:  220.63474515597784
75       : Episode || Reward:  278.022036792107
76       : Episode || Reward:  212.12181911549493
77       : Episode || Reward:  247.34828742956864
```

```
78      : Episode || Reward:  275.05828324739923
79      : Episode || Reward:  266.441165247442
80      : Episode || Reward:  276.95174130236774
81      : Episode || Reward:  252.59085363991196
82      : Episode || Reward:  226.26091217191896
83      : Episode || Reward:  231.3903264662843
84      : Episode || Reward:  256.1980724508593
85      : Episode || Reward:  226.80590058608675
86      : Episode || Reward:  225.6622463963034
87      : Episode || Reward:  263.7070857797687
88      : Episode || Reward:  243.5799099021371
89      : Episode || Reward:  264.2413218700177
90      : Episode || Reward:  258.5276664980688
91      : Episode || Reward:  227.58628773426307
92      : Episode || Reward:  234.66126963843715
93      : Episode || Reward:  268.6905175487349
94      : Episode || Reward:  271.9508263746815
95      : Episode || Reward:  216.40550643828615
96      : Episode || Reward:  275.60510421857555
97      : Episode || Reward:  244.16690480999077
98      : Episode || Reward:  246.98074160632763
99      : Episode || Reward:  227.2860008211394
Average Reward:  245.91905526121462
```

Run 4: change num epochs to 1 and density of second layer to 32

```
    # Change these parameters to improve performance
    self.density_first_layer = 64
    self.density_second_layer = 32
    self.num_epochs = 1
    self.batch_size = 64
    self.epsilon_min = 0.01

    # epsilon will randomly choose the next action as either
    # a random action, or the highest scoring predicted action
    self.epsilon = 1.0
    self.epsilon_decay = 0.995
    self.gamma = 0.99

    # Learning rate
    self.lr = 0.001
```

Converged after 505 episodes

```
Starting Testing of the trained model...
0        : Episode || Reward:  260.10045026800344
1        : Episode || Reward:  176.9373866771526
2        : Episode || Reward:  272.2054644139637
3        : Episode || Reward:  260.43479977895026
4        : Episode || Reward:  256.3819848504734
5        : Episode || Reward:  228.04014730167916
6        : Episode || Reward:  257.0892926499679
7        : Episode || Reward:  255.74603355827568
8        : Episode || Reward:  248.4873117937571
9        : Episode || Reward:  214.9903529468902
10       : Episode || Reward:  228.1318904178763
11       : Episode || Reward:  272.4110685703518
12       : Episode || Reward:  254.34653429636572
13       : Episode || Reward:  191.74039640078223
14       : Episode || Reward:  265.3698202596904
15       : Episode || Reward:  190.20756237691987
16       : Episode || Reward:  216.55226717450932
17       : Episode || Reward:  159.25900599267493
18       : Episode || Reward:  244.27833835453907
19       : Episode || Reward:  257.0734645096045
20       : Episode || Reward:  226.63793013020359
21       : Episode || Reward:  252.18667313833978
22       : Episode || Reward:  252.02180694014137
23       : Episode || Reward:  263.1975405652827
24       : Episode || Reward:  257.7754555192055
25       : Episode || Reward:  196.24296914834594
26       : Episode || Reward:  248.18171780702568
27       : Episode || Reward:  246.1191244011765
28       : Episode || Reward:  215.2447409777032
29       : Episode || Reward:  237.43415164138813
30       : Episode || Reward:  244.57257961328645
31       : Episode || Reward:  227.7493218749982
32       : Episode || Reward:  177.9001547865984
33       : Episode || Reward:  208.6484354435776
34       : Episode || Reward:  228.91999366476645
35       : Episode || Reward:  215.39002081183423
36       : Episode || Reward:  255.75165910946254
37       : Episode || Reward:  228.99267807180286
38       : Episode || Reward:  222.17275759263296
39       : Episode || Reward:  234.10307887759248
40       : Episode || Reward:  211.1929623075869
```

```
41        : Episode || Reward:  254.19733860130262
42        : Episode || Reward:  266.84491939496206
43        : Episode || Reward:  233.88085604225486
44        : Episode || Reward:  202.2430494887523
45        : Episode || Reward:  231.31782108460322
46        : Episode || Reward:  232.0784883555333
47        : Episode || Reward:  246.4118283455229
48        : Episode || Reward:  248.295274642127
49        : Episode || Reward:  233.51023757396578
50        : Episode || Reward:  254.28194089789844
51        : Episode || Reward:  267.6633654507351
52        : Episode || Reward:  196.04002312215727
53        : Episode || Reward:  260.1608636051011
54        : Episode || Reward:  267.7584071430733
55        : Episode || Reward:  256.66450943873235
56        : Episode || Reward:  248.0597776945477
57        : Episode || Reward:  160.76921026940857
58        : Episode || Reward:  237.66519861584422
59        : Episode || Reward:  240.75754184583673
60        : Episode || Reward:  258.29866781448936
61        : Episode || Reward:  244.08368223613118
62        : Episode || Reward:  144.93459664356038
63        : Episode || Reward:  241.2780177037285
64        : Episode || Reward:  236.28072509659177
65        : Episode || Reward:  233.17968291571663
66        : Episode || Reward:  191.0946053706365
67        : Episode || Reward:  284.13321960539423
68        : Episode || Reward:  256.33629695905563
69        : Episode || Reward:  154.77062978751195
70        : Episode || Reward:  224.2016841099582
71        : Episode || Reward:  197.99553428351794
72        : Episode || Reward:  240.15533491946778
73        : Episode || Reward:  205.40240090355474
74        : Episode || Reward:  227.125316592254
75        : Episode || Reward:  241.399679108253
76        : Episode || Reward:  240.95514360373102
77        : Episode || Reward:  257.3323468951389
78        : Episode || Reward:  257.608826295311
79        : Episode || Reward:  229.95441913279248
80        : Episode || Reward:  145.4440245352292
81        : Episode || Reward:  248.73437361445798
82        : Episode || Reward:  161.8505418721096
83        : Episode || Reward:  218.94446309731393
```

84   : Episode || Reward: 241.6000649867164
85   : Episode || Reward: 211.8163706871349
86   : Episode || Reward: 255.94824708188094
87   : Episode || Reward: 242.64430442407192
88   : Episode || Reward: 187.12176056775147
89   : Episode || Reward: 216.46070374465373
90   : Episode || Reward: 221.13569985216998
91   : Episode || Reward: 197.80383526163047
92   : Episode || Reward: 217.53132725122225
93   : Episode || Reward: 176.07723674962878
94   : Episode || Reward: 251.13789461032601
95   : Episode || Reward: 217.75794868273346
96   : Episode || Reward: 236.36566137652125
97   : Episode || Reward: 248.22896793319566
98   : Episode || Reward: 250.36090778314264
99   : Episode || Reward: 262.00536448442654
Average Reward: 230.74310485200849

Run 5: change epsilon decay to 0.95 so we are more likely to use the last step

```
    # Change these parameters to improve performance
    self.density_first_layer = 64
    self.density_second_layer = 32
    self.num_epochs = 1
    self.batch_size = 64
    self.epsilon_min = 0.01

    # epsilon will randomly choose the next action as either
    # a random action, or the highest scoring predicted action
    self.epsilon = 1.0
    self.epsilon_decay = 0.95
    self.gamma = 0.99

    # Learning rate
    self.lr = 0.001
```

Converged after 696 episodes
0   : Episode || Reward: 179.89096153745578
1   : Episode || Reward: 204.73526971990412
2   : Episode || Reward: 259.60898465726353
3   : Episode || Reward: 224.22592626980196

```
4        : Episode || Reward:  195.3233993706755
5        : Episode || Reward:  185.11602429287552
6        : Episode || Reward:  222.64083232453677
7        : Episode || Reward:  256.056087599007
8        : Episode || Reward:  204.27175908690214
9        : Episode || Reward:  155.2196144863084
10       : Episode || Reward:  175.6832644545321
11       : Episode || Reward:  283.3622160595161
12       : Episode || Reward:  207.79984628702198
13       : Episode || Reward:  202.4775929134463
14       : Episode || Reward:  201.96777178800332
15       : Episode || Reward:  194.32057814392758
16       : Episode || Reward:  203.13490804763097
17       : Episode || Reward:  247.70438294647087
18       : Episode || Reward:  154.63214017521187
19       : Episode || Reward:  206.81038579526438
20       : Episode || Reward:  188.75651043354324
21       : Episode || Reward:  232.91120560640553
22       : Episode || Reward:  203.20165713827618
23       : Episode || Reward:  239.8073741388445
24       : Episode || Reward:  201.08296384631456
25       : Episode || Reward:  244.75507838944185
26       : Episode || Reward:  210.72291137716843
27       : Episode || Reward:  133.3064395307374
28       : Episode || Reward:  205.63230478547266
29       : Episode || Reward:  180.39077544981274
30       : Episode || Reward:  174.63113790400251
31       : Episode || Reward:  196.09874792077392
32       : Episode || Reward:  180.37714294940025
33       : Episode || Reward:  268.98062299644056
34       : Episode || Reward:  59.21446534530921
35       : Episode || Reward:  217.69517934414517
36       : Episode || Reward:  216.76799133597842
37       : Episode || Reward:  205.39128803991127
38       : Episode || Reward:  204.5419111866587
39       : Episode || Reward:  201.69236763383623
40       : Episode || Reward:  246.04902562538427
41       : Episode || Reward:  157.22377725755584
42       : Episode || Reward:  205.63268301138214
43       : Episode || Reward:  191.37231707754535
44       : Episode || Reward:  219.96680517273086
45       : Episode || Reward:  206.04644632305354
46       : Episode || Reward:  218.83058259994982
```

```
47        : Episode || Reward:  224.47269540696902
48        : Episode || Reward:  190.18882443177898
49        : Episode || Reward:  260.5851879916046
50        : Episode || Reward:  256.18312106885367
51        : Episode || Reward:  250.9812463818956
52        : Episode || Reward:  243.32721193689213
53        : Episode || Reward:  265.8914758444792
54        : Episode || Reward:  186.58296572696713
55        : Episode || Reward:  183.4688574241021
56        : Episode || Reward:  -122.59868444617615
57        : Episode || Reward:  227.94347876978912
58        : Episode || Reward:  233.76827013679733
59        : Episode || Reward:  193.6435663007979
60        : Episode || Reward:  206.07269505315853
61        : Episode || Reward:  215.4300730627603
62        : Episode || Reward:  203.28807223250524
63        : Episode || Reward:  230.04298191249737
64        : Episode || Reward:  198.7500353126833
65        : Episode || Reward:  230.27512241669262
66        : Episode || Reward:  240.01962534372862
67        : Episode || Reward:  203.11987560783575
68        : Episode || Reward:  205.1524127867707
69        : Episode || Reward:  179.57075192405028
70        : Episode || Reward:  222.80731821643752
71        : Episode || Reward:  215.07140684648715
72        : Episode || Reward:  169.02053506996066
73        : Episode || Reward:  177.17879131022426
74        : Episode || Reward:  223.03301689079268
75        : Episode || Reward:  181.79243065517886
76        : Episode || Reward:  256.0114054136337
77        : Episode || Reward:  192.9635998098745
78        : Episode || Reward:  196.97483768119469
79        : Episode || Reward:  248.6624335029141
80        : Episode || Reward:  218.93854016681132
81        : Episode || Reward:  175.16852248281498
82        : Episode || Reward:  218.5815603229531
83        : Episode || Reward:  194.62183521195504
84        : Episode || Reward:  188.19798676023254
85        : Episode || Reward:  244.85226275808344
86        : Episode || Reward:  218.18294518907737
87        : Episode || Reward:  222.25949172293872
88        : Episode || Reward:  210.59451997021313
89        : Episode || Reward:  247.09991514096515
```

```
90      : Episode || Reward:  247.41186029534424
91      : Episode || Reward:  262.4989812260701
92      : Episode || Reward:  234.1053840115254
93      : Episode || Reward:  209.17965341276442
94      : Episode || Reward:  189.80358184302423
95      : Episode || Reward:  241.63308796759335
96      : Episode || Reward:  142.12038607504672
97      : Episode || Reward:  191.64381330714832
98      : Episode || Reward:  192.94619443838621
99      : Episode || Reward:  246.68766794816548
Average Reward:  206.62265486651083
```

Run 6: Update epsilon decay to 0.99

```
        # Change these parameters to improve performance
        self.density_first_layer = 64
        self.density_second_layer = 32
        self.num_epochs = 1
        self.batch_size = 64
        self.epsilon_min = 0.01

        # epsilon will randomly choose the next action as either
        # a random action, or the highest scoring predicted action
        self.epsilon = 1.0
        self.epsilon_decay = 0.99
        self.gamma = 0.99

        # Learning rate
        self.lr = 0.001
```
Converged after 338 runs

```
Starting Testing of the trained model...
0       : Episode || Reward:  216.80758712168233
1       : Episode || Reward:  100.45218257163275
2       : Episode || Reward:  231.62111449122807
3       : Episode || Reward:  235.69074472777604
4       : Episode || Reward:  244.87321182283824
5       : Episode || Reward:  261.6289914863188
6       : Episode || Reward:  239.12714661937162
7       : Episode || Reward:  267.8954193621681
8       : Episode || Reward:  266.63424910198046
9       : Episode || Reward:  239.48963976757423
10      : Episode || Reward:  251.7954235424085
```

```
11      : Episode || Reward:  244.05682605455988
12      : Episode || Reward:  254.25975388014058
13      : Episode || Reward:  246.45348269283312
14      : Episode || Reward:  251.56069453893627
15      : Episode || Reward:  284.6038264820386
16      : Episode || Reward:  223.46267590882715
17      : Episode || Reward:  247.1647942422444
18      : Episode || Reward:  254.79555512089982
19      : Episode || Reward:  280.2798916301142
20      : Episode || Reward:  230.34843010049286
21      : Episode || Reward:  251.70215284107482
22      : Episode || Reward:  252.69597759573077
23      : Episode || Reward:  236.22124071602747
24      : Episode || Reward:  216.86683014998113
25      : Episode || Reward:  262.0224320786788
26      : Episode || Reward:  220.12535502946196
27      : Episode || Reward:  268.3850440165387
28      : Episode || Reward:  228.0380171956594
29      : Episode || Reward:  241.55703376063767
30      : Episode || Reward:  227.6920674213059
31      : Episode || Reward:  234.56493847576513
32      : Episode || Reward:  244.1423165025373
33      : Episode || Reward:  262.80268020379117
34      : Episode || Reward:  247.03673295650344
35      : Episode || Reward:  218.1262650218152
36      : Episode || Reward:  259.0437503475566
37      : Episode || Reward:  228.64492896807897
38      : Episode || Reward:  219.21804782495425
39      : Episode || Reward:  227.00563800330264
40      : Episode || Reward:  -183.99252347731743
41      : Episode || Reward:  239.39753391150168
42      : Episode || Reward:  236.2019358618381
43      : Episode || Reward:  245.7559680387819
44      : Episode || Reward:  256.32438002810846
45      : Episode || Reward:  243.7502428484642
46      : Episode || Reward:  210.73845929404462
47      : Episode || Reward:  228.26852352016869
48      : Episode || Reward:  259.72357857888744
49      : Episode || Reward:  267.2979195983214
50      : Episode || Reward:  205.40313512292352
51      : Episode || Reward:  262.6847968789457
52      : Episode || Reward:  204.74136731883516
53      : Episode || Reward:  245.4220200553416
```

```
54      : Episode || Reward:  258.21336477491866
55      : Episode || Reward:  206.38763844811348
56      : Episode || Reward:  258.5641216932069
57      : Episode || Reward:  202.18848406951875
58      : Episode || Reward:  205.84331402797292
59      : Episode || Reward:  139.4514971587339
60      : Episode || Reward:  250.72150588011652
61      : Episode || Reward:  254.16320387381307
62      : Episode || Reward:  243.03054078149307
63      : Episode || Reward:  233.78460270300292
64      : Episode || Reward:  246.10684475301278
65      : Episode || Reward:  237.714304087228
66      : Episode || Reward:  254.4637785762534
67      : Episode || Reward:  261.55979511824137
68      : Episode || Reward:  221.27986997853907
69      : Episode || Reward:  279.04148350350476
70      : Episode || Reward:  243.19864394344643
71      : Episode || Reward:  248.77246381478426
72      : Episode || Reward:  244.38053646944678
73      : Episode || Reward:  265.4871146702071
74      : Episode || Reward:  229.99883452065163
75      : Episode || Reward:  219.7411530910349
76      : Episode || Reward:  257.2779883364062
77      : Episode || Reward:  257.57902339012315
78      : Episode || Reward:  269.6663666887257
79      : Episode || Reward:  243.3161219274391
80      : Episode || Reward:  254.61532170748043
81      : Episode || Reward:  243.64407071993412
82      : Episode || Reward:  251.7949255074563
83      : Episode || Reward:  247.21493142139838
84      : Episode || Reward:  260.35106674648114
85      : Episode || Reward:  248.2552119569989
86      : Episode || Reward:  233.35542595321337
87      : Episode || Reward:  265.0155204164016
88      : Episode || Reward:  232.54547605525667
89      : Episode || Reward:  233.36955636588516
90      : Episode || Reward:  251.79323903507753
91      : Episode || Reward:  230.41058752995693
92      : Episode || Reward:  266.97799473697785
93      : Episode || Reward:  238.85007789229354
94      : Episode || Reward:  232.1136404245598
95      : Episode || Reward:  243.21311261703164
96      : Episode || Reward:  253.82919937283157
```

```
97       : Episode || Reward:  238.2841672157023
98       : Episode || Reward:  114.49843522190977
99       : Episode || Reward:  218.74925686806483
Average Reward:  235.31424241999156

real     190m1.302s
user     0m0.936s
sys      0m1.248s
```