

CS593  
Shivam Bhat  
bhat41@purdue.edu  
PUID:0033760929  
HW-3

### Q1.1

	NMP	NMP-w/o-Dropout	NMP-w/o-LVC
success rate	0.97	0.586	0.88
computation time	0.71 1.21	1.02 1.5	1.1 2.6

iTerm2 Shell Edit View Session Scripts Profiles Toolbelt Window Help

You are screen sharing

Stop Share

```
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.24s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.23s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.24s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.24s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.23s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.24s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.24s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.23s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.23s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.72/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.70/13.20/1.20s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.01/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.00/0.71/13.20/1.21s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.00/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.00/0.71/13.20/1.22s
cumulative: success rate=0.97, runtime (min/avg/max/stdev) = 0.00/0.71/13.20/1.21s
(/home/bhat41/.conda/envs/cent7/2020.11-py38/c5s953) bhat41@scholar-fe04:/PurduePrivate/Assignments/a3 $
```

I am using **Purdue scholar cluster -A GPU**

<https://www.rcac.purdue.edu/compute/scholar>

**name='Tesla V100-PCIE-16GB', major=7, minor=0, total\_memory=16160MB,  
multi\_processor\_count=80**

## Scholar Specifications

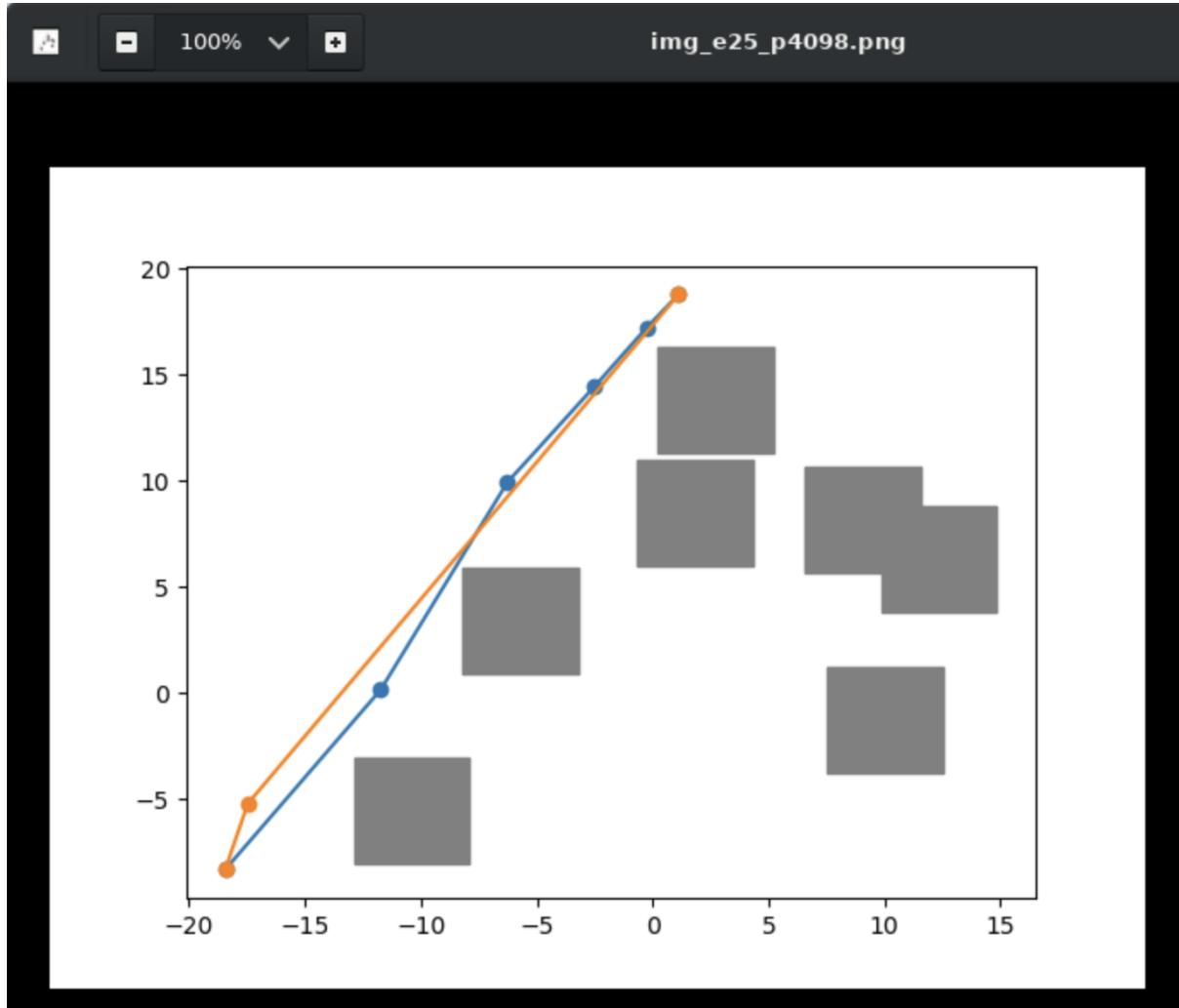
The Scholar A nodes have 128 processor cores, 256 GB RAM and 100 Gbps Infiniband interconnects.

Scholar Front-Ends					
Front-Ends	Number of Nodes	Processors per Node	Cores per Node	Memory per Node	Retires in
No GPU	4	Two Haswell CPUs @ 2.60GHz	20	512 GB	2023
With GPU	3	Two Sky Lake CPUs @ 2.60GHz with one NVIDIA Tesla V100	20	756 GB	2023

Scholar Sub-Clusters					
Sub-Cluster	Number of Nodes	Processors per Node	Cores per Node	Memory per Node	Retires in
A	4	Two AMD EPYC 7713 3rd generation ("Milan") 64-Core Processors	128	256 GB	2027
B	3	AMD EPYC 7702P 2nd generation ("Rome") 64-Core Processor	64	256 GB	2026
G	4	Two Skylake CPUs @ 2.10GHz with one NVIDIA Tesla V100 32GB GPUs	16	192 GB	2027
H	4	Two AMD EPYC 7543 3rd generation ("Milan") 32-Core Processors with two NVIDIA A30 24GB GPUs	64	512 GB	2027

## Q1.2

**E25 P4098**



```
● ● ● ssh
[12,32980192]
[[-11,490146 10,51437]
 [-17,423138 12,329802]]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer.py --data-path './data2/' --env-id 25 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data2/e25/path4098.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_25/path_4098.txt' --img "img_e25_p4098"
Namespace(data_path='./data2/', env_id=25, img_name='img_e25_p4098', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/data2/e25/path4098.dat', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_25/path_4098.txt'], point_cloud=False)
[1,81714613 8,45395752]
[-10,40256774 -5,51284829]
[ 2,68664437 13,81597603]
[10,00376795 -1,23701333]
[-5,68655938 3,43408723]
[9,03666372 8,15721595]
[12,35345815 6,29193443]
[-18,44469471 -8,30325179 -11,73474727 0,16570069 -6,2654255
 9,94036149 -2,5149733 14,44303187 -0,25699213 17,2239542
 1,11124308 18,77450072]
[[-18,44469471 -5,197492]
 [ 1,111243 18,7745 ]]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $
```

## RRT

[-18.44469471 -8.30325179 -11.73474727 0.16570069 -6.2654255  
 9.94036149 -2.5149733 14.44303187 -0.25699213 17.2239542  
 1.11124308 18.77450072]

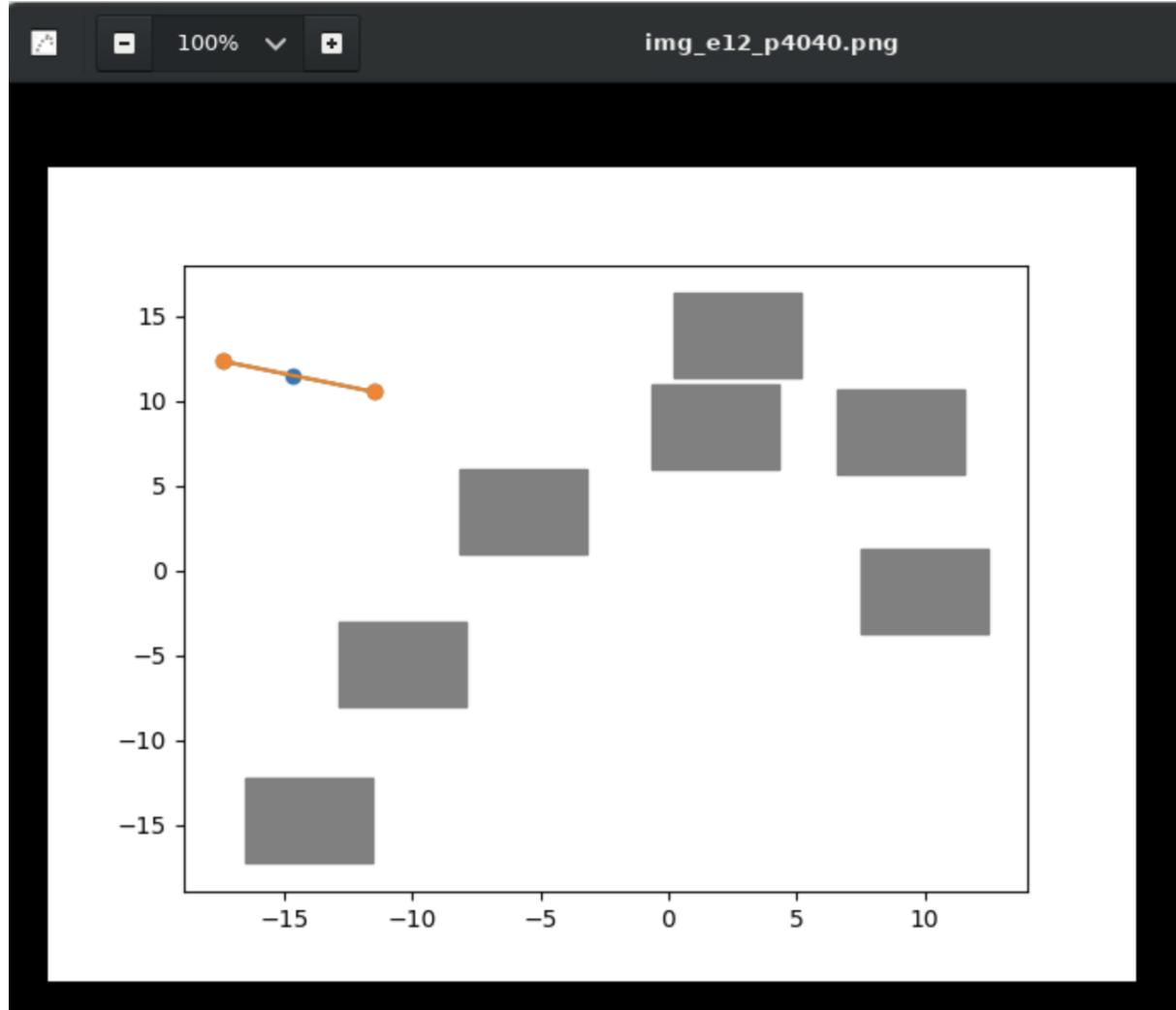
Distance = 22.46

## MPNET

[[-18.444695 -8.303252]  
 [-17.467018 -5.197492]  
 [ 1.111243 18.7745 ]]

Distance = 23.7777

## E12 P4040



```
● ● ● ▾SSH
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3$ python3.8 visualizer.py --data-path './data2/' --env-id 12 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data2/e12/path4040.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_12/path_4040.txt' --img "img_e12_p4040"
Namespace(data_path='./data2/', env_id=12, img_name='img_e12_p4040', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/data2/e12/path4040.dat', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_12/path_4040.txt'], point_cloud=False)
[1.81714613 8.45395752]
[-16.40256774 -5.51284829]
[ 2.68664437 13.81597603]
[-14.04902714 -14.7576826]
[10.00376795 -1.23701333]
[-5.68655938 3.43408723]
[9.03666372 8.15721595]
[-11.49014575 10.51437002 -14.66821903 11.48414362 -17.42313825
 12.32980192]
[[-11.49014575 10.51437002
  [-17.423138 12.329802]]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3$
```

## RRT

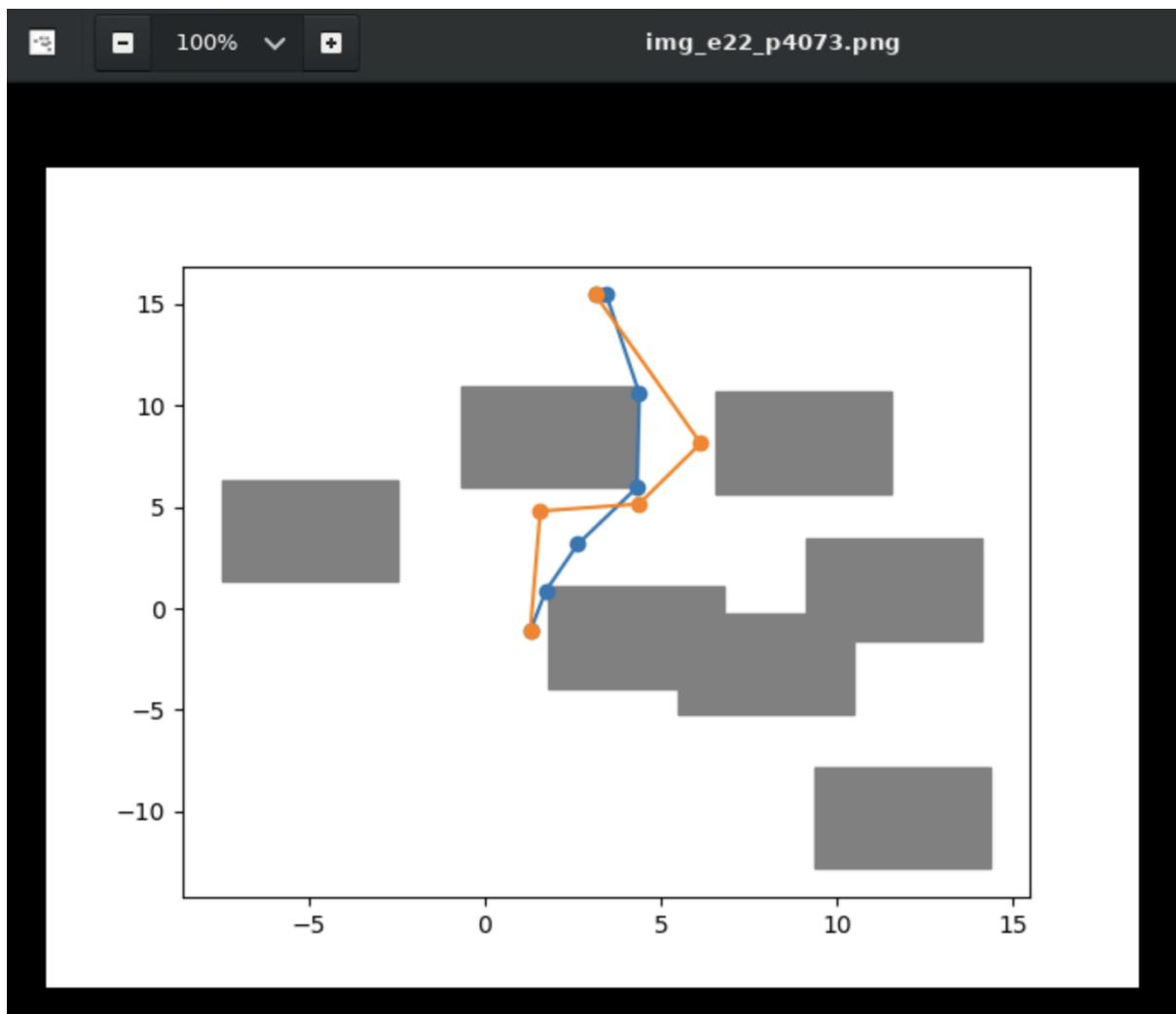
```
[  
-11.49014575 10.51437002
```

```
-14.66821903 11.48414362  
-17.42313825 12.32980192  
]  
6.2044
```

### **MPNET**

```
[-11.490146 10.51437 ]  
[-17.423138 12.329802]]  
6.20453
```

### **E22 P4073**



```

● ● ● ``#1
ssh
[ 1.26508 -0.625435]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer.py --data-path './data2/' --env-id 22 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data2/e22/path4073.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_22/path_4073.txt' --img "img_e22_p4073"
Namespace(data_path='./data2/', env_id=22, img_name='img_e22_p4073', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/data2/e22/path4073.dat', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_22/path_4073.txt'], point_cloud=False)
[1.81714613 8.45395752]
[ 7.98897886 -2.71691575]
[ 11.88709804 -10.32106688]
[11.60916676 0.91192107]
[ 4.31431767 -1.44092046]
[-4.98213066 3.80897935]
[9.03666372 8.15721595]
[ 1.29708899 -1.12114476 1.7346006 0.85562523 2.64535989 3.15942541
 4.32843684 5.95786079 4.39644465 10.56795541 3.45798934 15.44569676
 3.14305228 15.4494889 ]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ 

```

## RRT

```
[ 1.29708899 -1.12114476 1.7346006 0.85562523 2.64535989 3.15942541
 4.32843684 5.95786079 4.39644465 10.56795541 3.45798934 15.44569676
 3.14305228 15.4494889 ]
```

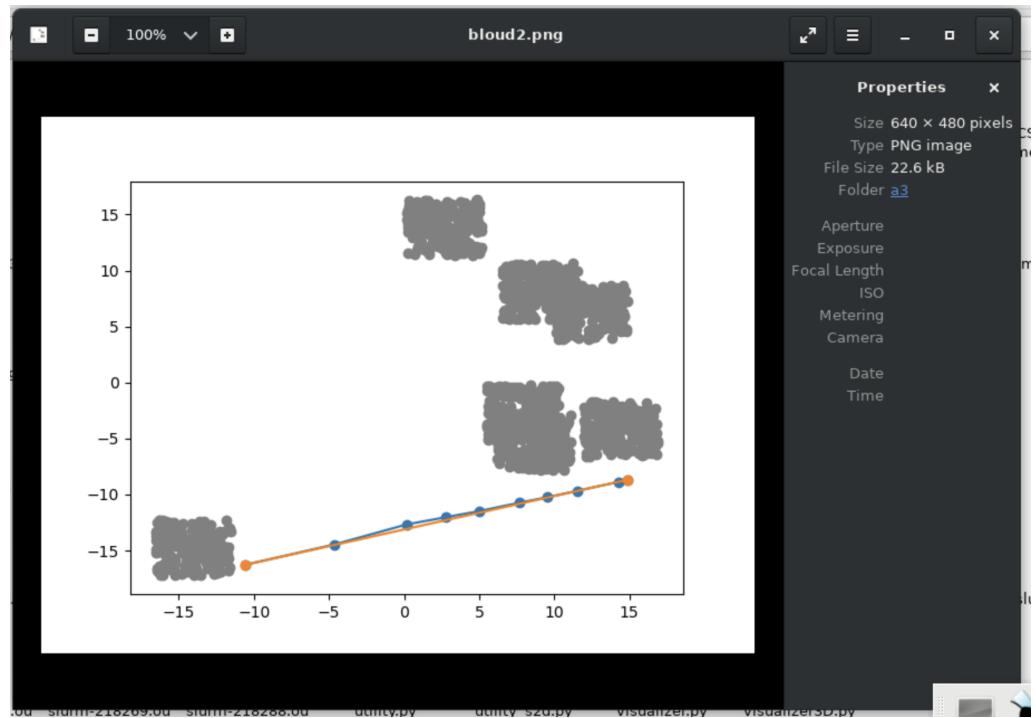
## 17.63

### MPNET

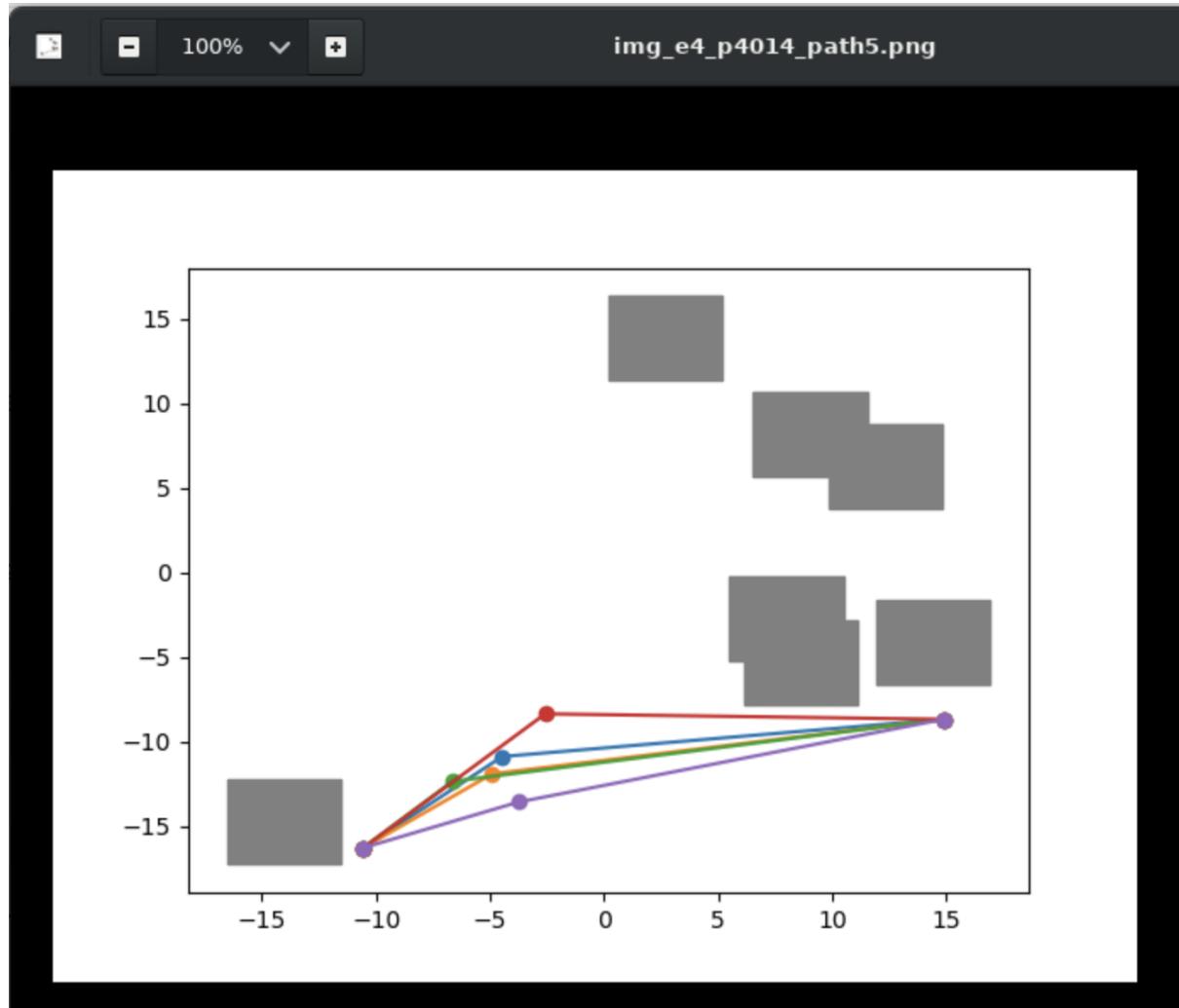
```
[[ 1.297089 -1.121145]
 [ 1.581615 4.794248]
 [ 4.384708 5.143425]
 [ 6.137797 8.131045]
 [ 3.143052 15.449489]]
```

## 20.116

## Cloud Image



**Q1.3**



```
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer.py --data-path './data2/' --env-id 4 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/1/path_4014.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/2/path_4014.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/3/path_4014.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/4/path_4014.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/5/path_4014.txt' --img "img_e4_p4014_path5"
Namespace(data_path='./data2/', env_id=4, img_name='img_e4_p4014_path5', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/1/path_4014.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/2/path_4014.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/3/path_4014.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/4/path_4014.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/path5/5/path_4014.txt'], point_cloud=False)
[ 2.68664437 13.81597663]
[-14.04902714 -14.75268826]
[ 8.64709888 -5.31794955]
[ 7.98897886 -2.71691575]
[14.44838772 -4.13622055]
```

## Q1.4

**Q2) Describe the significance of Dropout and lazy vertex contraction and their role in MPNet (max 100 words)**

**Dropout : Stochasticity**

The planning module used in the proposed approach leverages stochasticity, due to Dropout, that helps in recovery from failures. This is iterated in the paper as well [https://arxiv.org/pdf/1907.06013.pdf]. Dropout allows .Neurons in the layers with Dropout enabled to be randomly dropped with a probability  $p$   $[0, 1]$ . MPNet Hence receives a sliced or thinner model of the original planning network each time it calls Pnet, which results in stochastic behaviour.

## LVC

LVC technique allows us to speed up the process of constructing a graph representation of the environment presented to us (here a 2d and 3d env with square and cuboidal blocks as obstacles)

In order to reduce the number of nodes in the network generated initially by MPNET, lazy vertex contraction is employed to merge nodes that reflect similar configurations.

Lazy vertex contraction postpones the merger of two nodes when they are connected by an edge until the graph search algorithm requires that the two nodes be treated as the same. This prevents the graph from prematurely collapsing, which might lead to connection loss and potentially undesirable routes.

Hence it essentially improves the efficiency of the algorithm.

## Q2.1

**Ran on purdue scholar cluster A with Nvidia GPU as satiated in Q1.1 . Used same server with same configuration**

**Submitted Job using sbatch : 1 GPU with 1 Node**

**sbatch -A gpu --nodes=1 --gres=gpu:1 -t 00:180:00 job1\_1.sub**

	NMP	NMP-w/o-Dropout	NMP-w/o-LVC
success rate	0.99	0.76	0.92
computation time Std	0.81 1.41	1.59 2.78	1.102 2.45

```

● ● ● ~x1 ssh
planning: env=10, path=2082 || ( 01% complete) success rate = 0.988 planning time = 0.759sec
planning: env=10, path=2083 || ( 02% complete) success rate = 0.988 planning time = 0.164sec
planning: env=10, path=2084 || ( 03% complete) success rate = 0.988 planning time = 0.443sec
planning: env=10, path=2085 || ( 04% complete) success rate = 0.988 planning time = 0.112sec
planning: env=10, path=2086 || ( 05% complete) success rate = 0.988 planning time = 1.275sec
planning: env=10, path=2087 || ( 06% complete) success rate = 0.989 planning time = 0.977sec
planning: env=10, path=2088 || ( 07% complete) success rate = 0.989 planning time = 0.218sec
planning: env=10, path=2089 || ( 08% complete) success rate = 0.989 planning time = 2.076sec
planning: env=10, path=2090 || ( 09% complete) success rate = 0.989 planning time = 0.762sec
planning: env=10, path=2091 || ( 10% complete) success rate = 0.989 planning time = 0.375sec
planning: env=10, path=2092 || ( 11% complete) success rate = 0.989 planning time = 0.294sec
planning: env=10, path=2093 || ( 92% complete) success rate = 0.989 planning time = 0.267sec
planning: env=10, path=2094 || ( 93% complete) success rate = 0.989 planning time = 0.403sec
planning: env=10, path=2095 || ( 94% complete) success rate = 0.989 planning time = 0.249sec
planning: env=10, path=2096 || ( 95% complete) success rate = 0.99 planning time = 0.269sec
planning: env=10, path=2097 || ( 96% complete) success rate = 0.99 planning time = 0.391sec
planning: env=10, path=2098 || ( 97% complete) success rate = 0.99 planning time = 0.363sec
planning: env=10, path=2099 || ( 98% complete) success rate = 0.99 planning time = 0.139sec
planning: env=10, path=2100 || ( 99% complete) success rate = 0.99 planning time = 0.155sec
planning: env=10, path=2100 || (100% complete) success rate = 0.99 planning time = 0.155sec
Namespace(N=11, NP=100, data_path='./data3/', device=0, dropout='True', env_type='c3d', epoch=500, lvc='True', model_path='./models/', reproducible=False, result_path='./results/res3/d/res1/', s=0, sp=7001, world_size=20.0)
** Cuda Ava and Set **

picked c3d args
using deep encoder
shivam->34

** Picked existing model mpnet_c3d_epoch_500.pkl**

** MPNet Cuda Set **

loading..
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.04/0.82/10.98/1.61s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.04/0.73/10.98/1.47s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.04/0.78/10.98/1.44s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.04/0.76/10.98/1.39s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.04/0.81/11.08/1.46s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.03/0.78/11.08/1.38s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.03/0.73/11.08/1.30s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.03/0.76/11.08/1.34s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.03/0.76/11.08/1.32s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.03/0.74/12.25/1.34s
cumulative: success rate=0.99, runtime (min/avg/max/stddev) = 0.03/0.74/12.25/1.32s
(/home/bhat41/.conda/envs/cent7/2020.11-py38/c593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ █

```

```

● ● ● ~x1 ssh
planning: env=10, path=2081 || ( 00% complete) success rate = 0.667 planning time = 2.22sec
planning: env=10, path=2082 || ( 01% complete) success rate = 0.667 planning time = 2.22sec
planning: env=10, path=2083 || ( 02% complete) success rate = 0.663 planning time = 0.172sec
planning: env=10, path=2084 || ( 03% complete) success rate = 0.667 planning time = 0.368sec
planning: env=10, path=2085 || ( 04% complete) success rate = 0.671 planning time = 0.103sec
planning: env=10, path=2086 || ( 05% complete) success rate = 0.671 planning time = 0.103sec
planning: env=10, path=2087 || ( 06% complete) success rate = 0.671 planning time = 0.103sec
planning: env=10, path=2088 || ( 07% complete) success rate = 0.671 planning time = 0.103sec
planning: env=10, path=2089 || ( 08% complete) success rate = 0.644 planning time = 0.699sec
planning: env=10, path=2090 || ( 09% complete) success rate = 0.648 planning time = 0.361sec
planning: env=10, path=2091 || ( 10% complete) success rate = 0.652 planning time = 0.395sec
planning: env=10, path=2092 || ( 11% complete) success rate = 0.656 planning time = 0.263sec
planning: env=10, path=2093 || ( 12% complete) success rate = 0.66 planning time = 0.339sec
planning: env=10, path=2094 || ( 13% complete) success rate = 0.66 planning time = 0.267sec
planning: env=10, path=2095 || ( 14% complete) success rate = 0.663 planning time = 0.268sec
planning: env=10, path=2096 || ( 15% complete) success rate = 0.667 planning time = 0.277sec
planning: env=10, path=2097 || ( 16% complete) success rate = 0.673 planning time = 0.243sec
planning: env=10, path=2098 || ( 17% complete) success rate = 0.677 planning time = 0.142sec
planning: env=10, path=2099 || ( 18% complete) success rate = 0.68 planning time = 0.918sec
planning: env=10, path=2100 || ( 19% complete) success rate = 0.68 planning time = 0.918sec
Namespace(N=11, NP=100, data_path='./data3/', device=0, dropout='False', env_type='c3d', epoch=500, lvc='True', model_path='./models/', reproducible=False, result_path='./results/res3/d/res2/', s=0, sp=2001, world_size=20.0)
** Cuda Ava and Set **

picked c3d args
using deep encoder
Shivam->34

** Picked existing model mpnet_c3d_epoch_500.pkl**

** MPNet Cuda Set **

loading..
cumulative: success rate=0.73, runtime (min/avg/max/stddev) = 0.06/2.12/22.55/3.82s
cumulative: success rate=0.78, runtime (min/avg/max/stddev) = 0.06/1.76/22.55/3.36s
cumulative: success rate=0.77, runtime (min/avg/max/stddev) = 0.05/1.65/22.55/3.00s
cumulative: success rate=0.78, runtime (min/avg/max/stddev) = 0.05/1.63/22.55/2.90s
cumulative: success rate=0.74, runtime (min/avg/max/stddev) = 0.04/1.74/22.55/2.92s
cumulative: success rate=0.75, runtime (min/avg/max/stddev) = 0.04/1.62/22.55/2.78s
cumulative: success rate=0.76, runtime (min/avg/max/stddev) = 0.04/1.57/22.55/2.79s
cumulative: success rate=0.75, runtime (min/avg/max/stddev) = 0.04/1.68/22.55/2.92s
cumulative: success rate=0.76, runtime (min/avg/max/stddev) = 0.04/1.60/22.55/2.82s
cumulative: success rate=0.77, runtime (min/avg/max/stddev) = 0.04/1.55/22.55/2.76s
cumulative: success rate=0.76, runtime (min/avg/max/stddev) = 0.04/1.59/22.55/2.78s
(/home/bhat41/.conda/envs/cent7/2020.11-py38/c593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ █

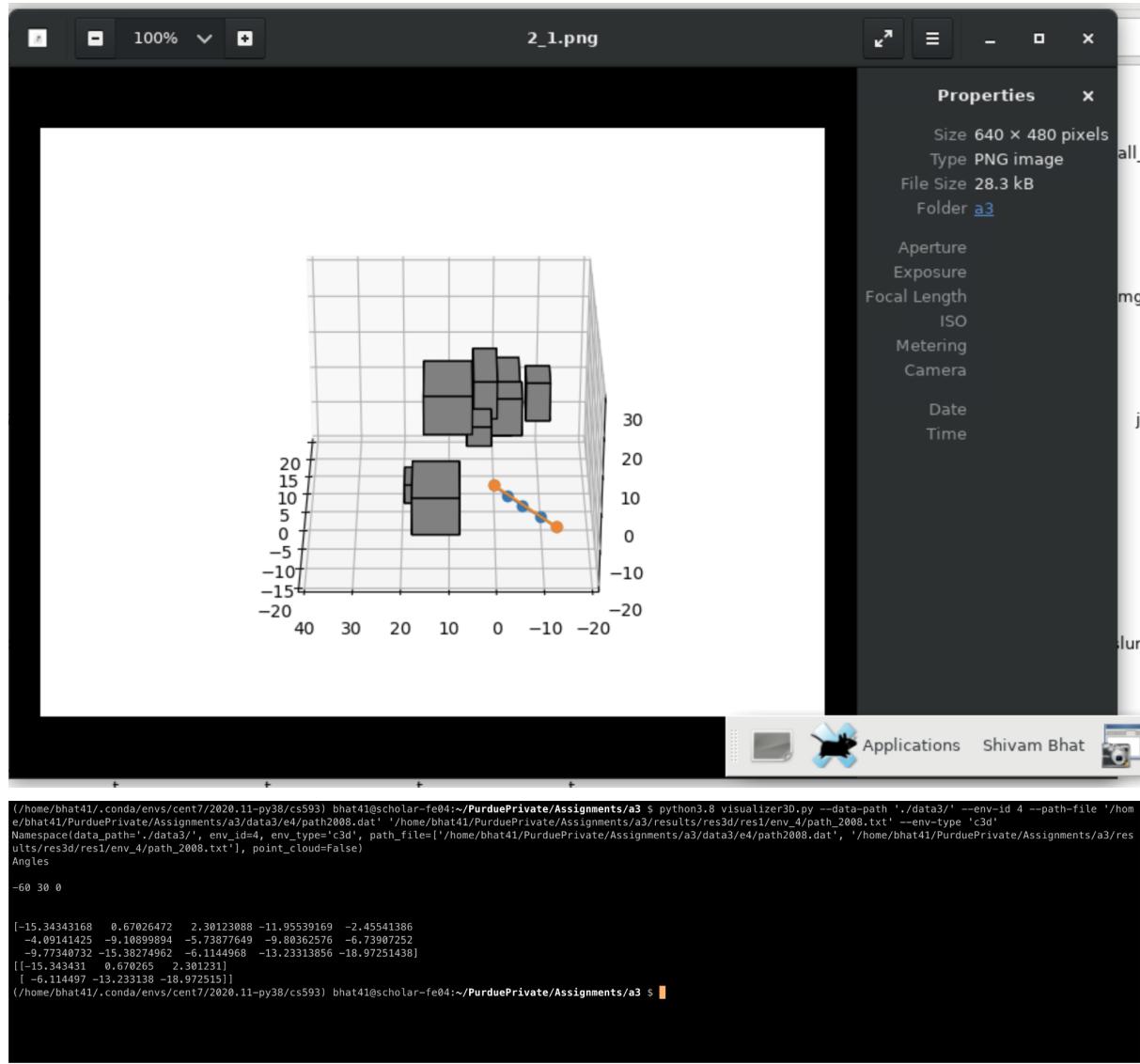
```

## Q2.2

**E: Environment**

**P: Path**

**E4 P 2008**



## RTT

**[-15.34343168 0.67026472 2.30123088 -11.95539169 -2.45541386  
-4.09141425 -9.10899894 -5.73877649 -9.80362576 -6.73907252  
-9.77340732 -15.38274962 -6.1144968 -13.23313856 -18.97251438]**

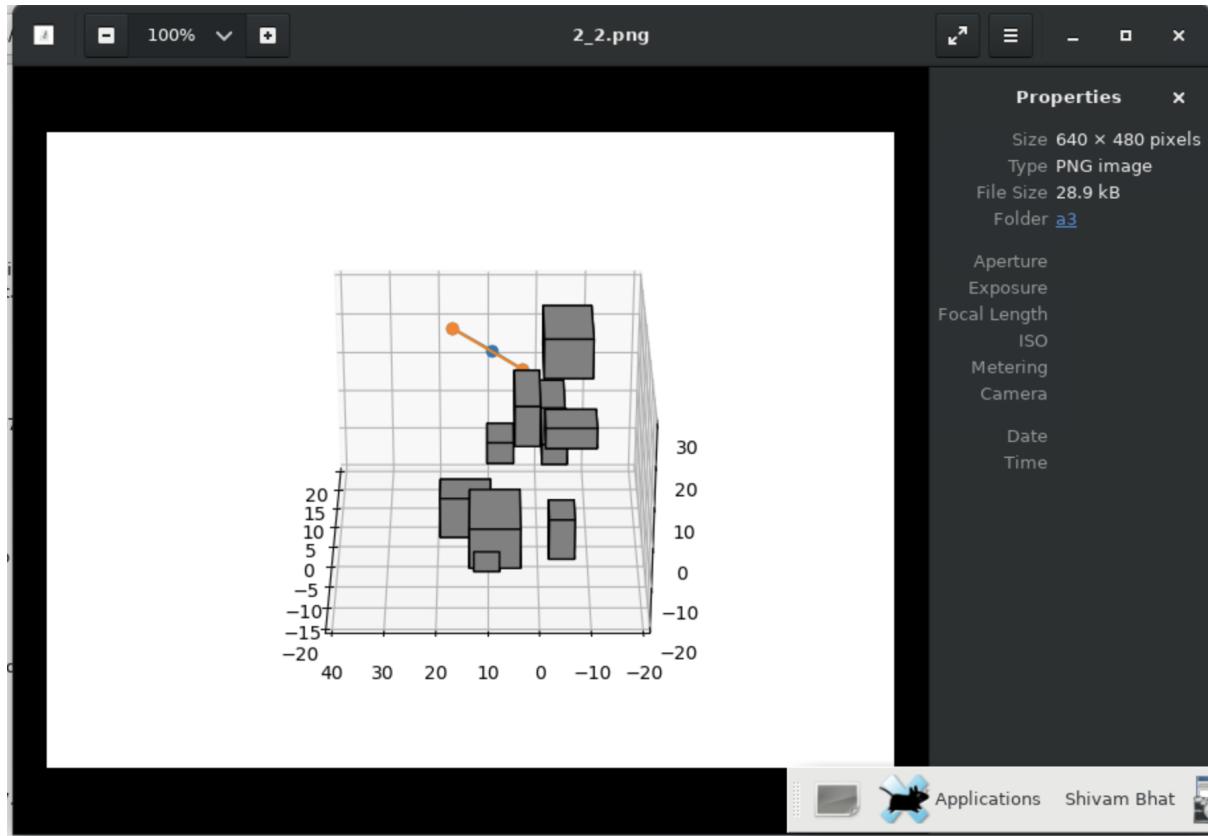
**27.35**

## MPNET

**[[-15.343431 0.670265 2.301231]  
[-6.114497 -13.233138 -18.972515]]**

**27.03794**

## E5 P2005



```
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer3d.py --data-path './data3/' --env-id 5 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data3/e5/path2005.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/res1/env_5/path_2005.txt' --env-type '3d'
Namespace(data_path='./data3/', env_id=5, env_type='3d', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/data3/e5/path2005.dat', '/home/bhat41/PurduePrivate/Assignments/a3/res3d/res1/env_5/path_2005.txt'], point_cloud=False)
Angles
-60 30 0

[17.79426925 17.3309768 19.00764264 18.62843568 9.20723906 12.49123655
 19.69395221 2.74163139 6.58486561]
[[17.79427 17.330976 19.007643]
 [19.693953 2.741632 6.584866]]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $
```

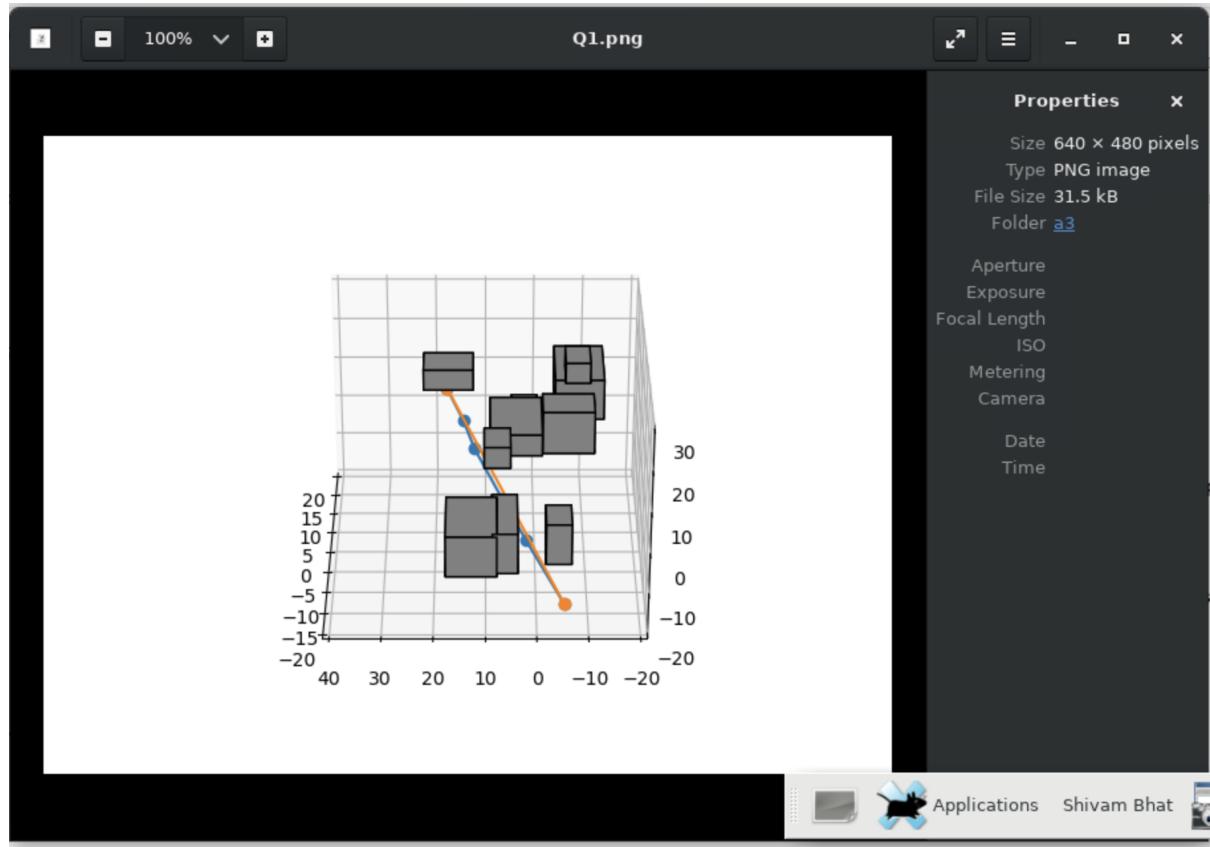
## RTT

**[17.79426925 17.3309768 19.00764264 18.62843568 9.20723906 12.49123655  
19.69395221 2.74163139 6.58486561]  
19.268**

## MPNET

**[[17.79427 17.330976 19.007643]  
[19.693953 2.741632 6.584866]]  
19.25573**

## E6 P2007



```
[ 7.271902  -1.370238 -14.700228]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer3D.py --data-path './data3/' --env-id 6 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data3/e6/path2007.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/res1/env_6/path_2007.txt' --env-type 'c3d'
Namespace(data_path='./data3/', env_id=6, env_type='c3d', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/data3/e6/path2007.dat', '/home/bhat41/PurduePrivate/Assignments/a3/res3d/res1/env_6/path_2007.txt'], point_cloud=False)
Angles
-60 30 0

[-19.37369663 -5.21899177 -13.77794305 -14.58504302  2.11517097
 -2.80319626 -10.78865856  6.64964816  3.6380229  -5.22654172
 12.06020411 10.82856018 -1.26301594 14.19363653 13.92864786
 3.19342908 17.50610098 17.8924802 ]
[[-19.373697 -5.218992 -13.777943]
 [ 3.193429 17.506102 17.892481]
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 -
```

## RTT

```
[-19.37369663 -5.21899177 -13.77794305 -14.58504302  2.11517097
 -2.80319626 -10.78865856  6.64964816  3.6380229  -5.22654172
 12.06020411 10.82856018 -1.26301594 14.19363653 13.92864786
 3.19342908 17.50610098 17.8924802 ]
```

## MPNET

**[[ -19.373697 -5.218992 -13.777943]  
[ 3.193429 17.506102 17.892481]]  
45.0413**

## Q2.3

**Printed same path in different angles for better visibility**

**In test -> generate paths then print them**

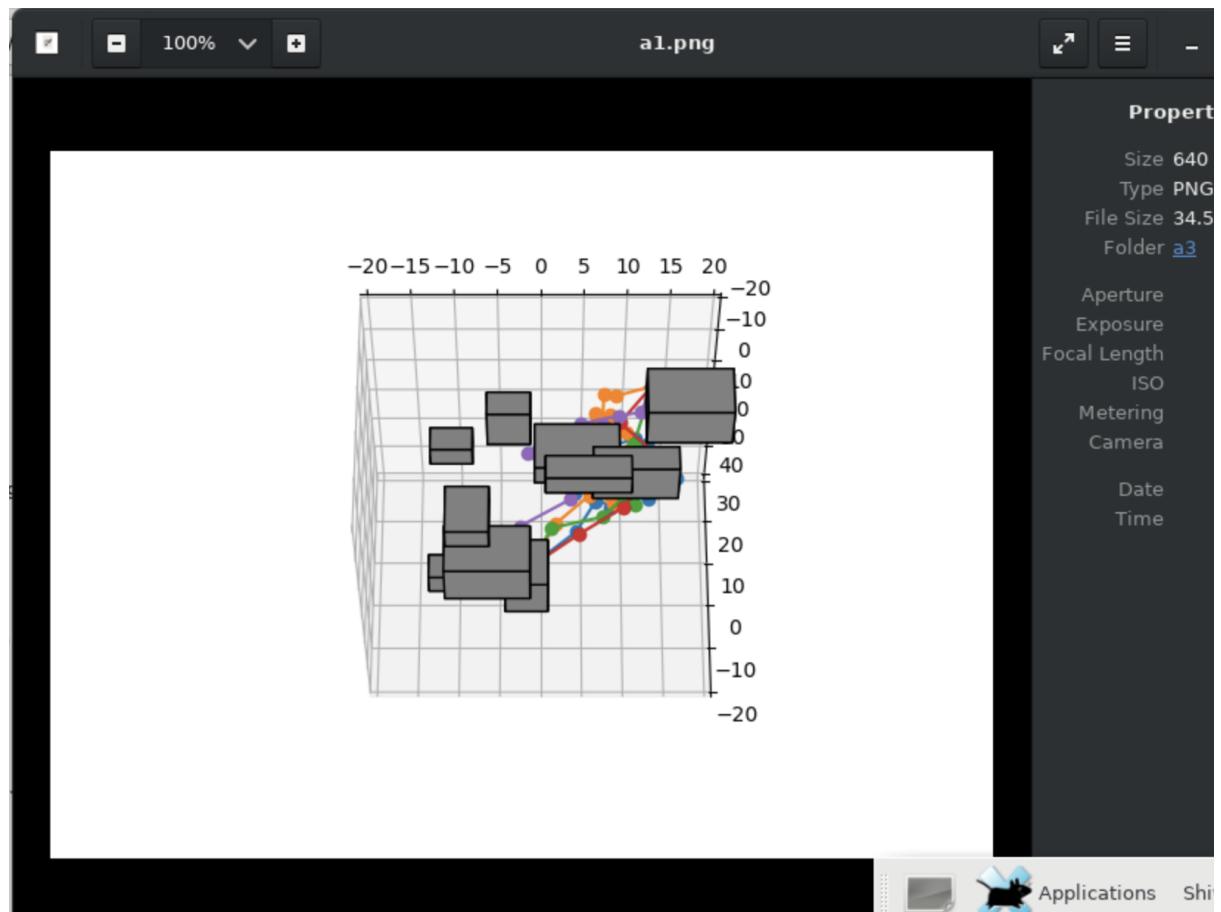
```
1154 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/1/' --env-type 'c3d'  
1155 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/2/' --env-type 'c3d'  
1156 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/3/' --env-type 'c3d'  
1157 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/4/' --env-type 'c3d'  
1158 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/5/' --env-type 'c3d'  
1161 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/4/' --env-type 'c3d'  
1163 python3.8 mpnet_test.py --N 1 --NP 1 --s 5 --sp 2002 --data-path './data3/' --result-path './results/res3d/path5/5/' --env-type 'c3d'
```

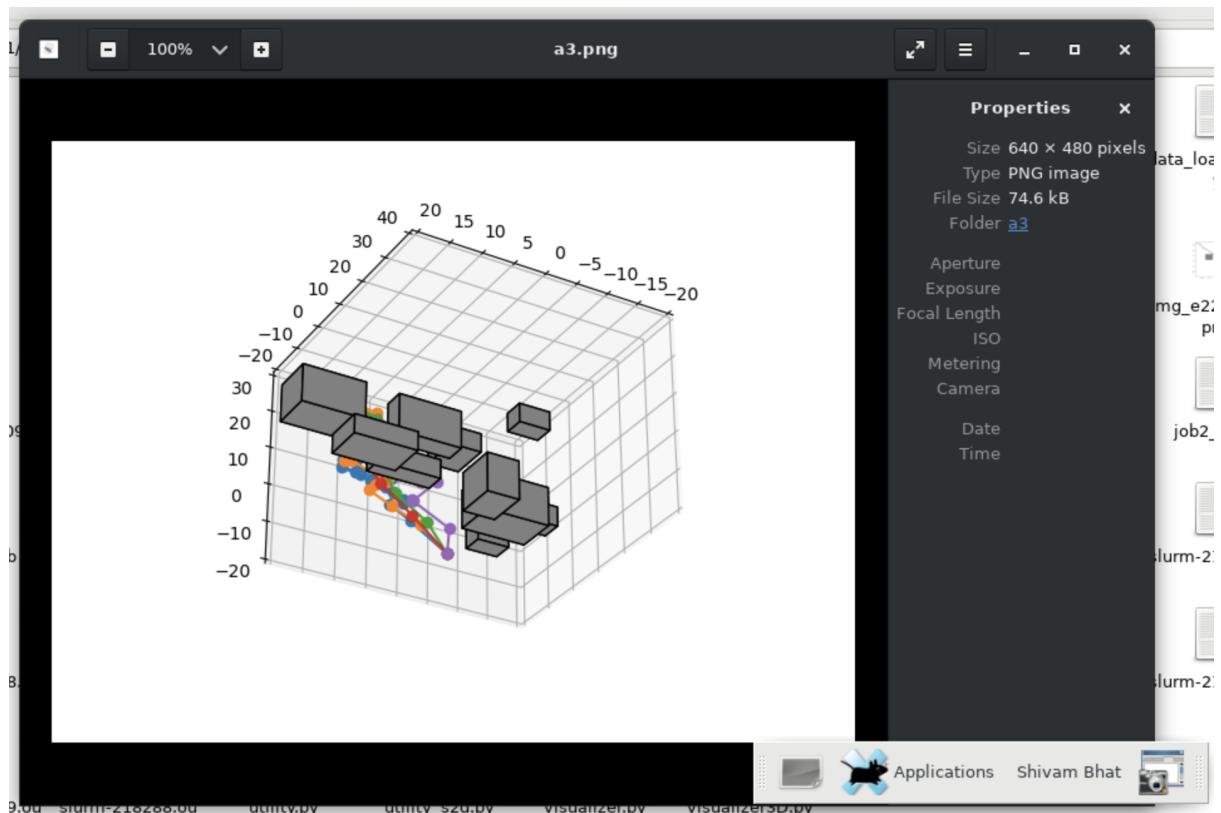
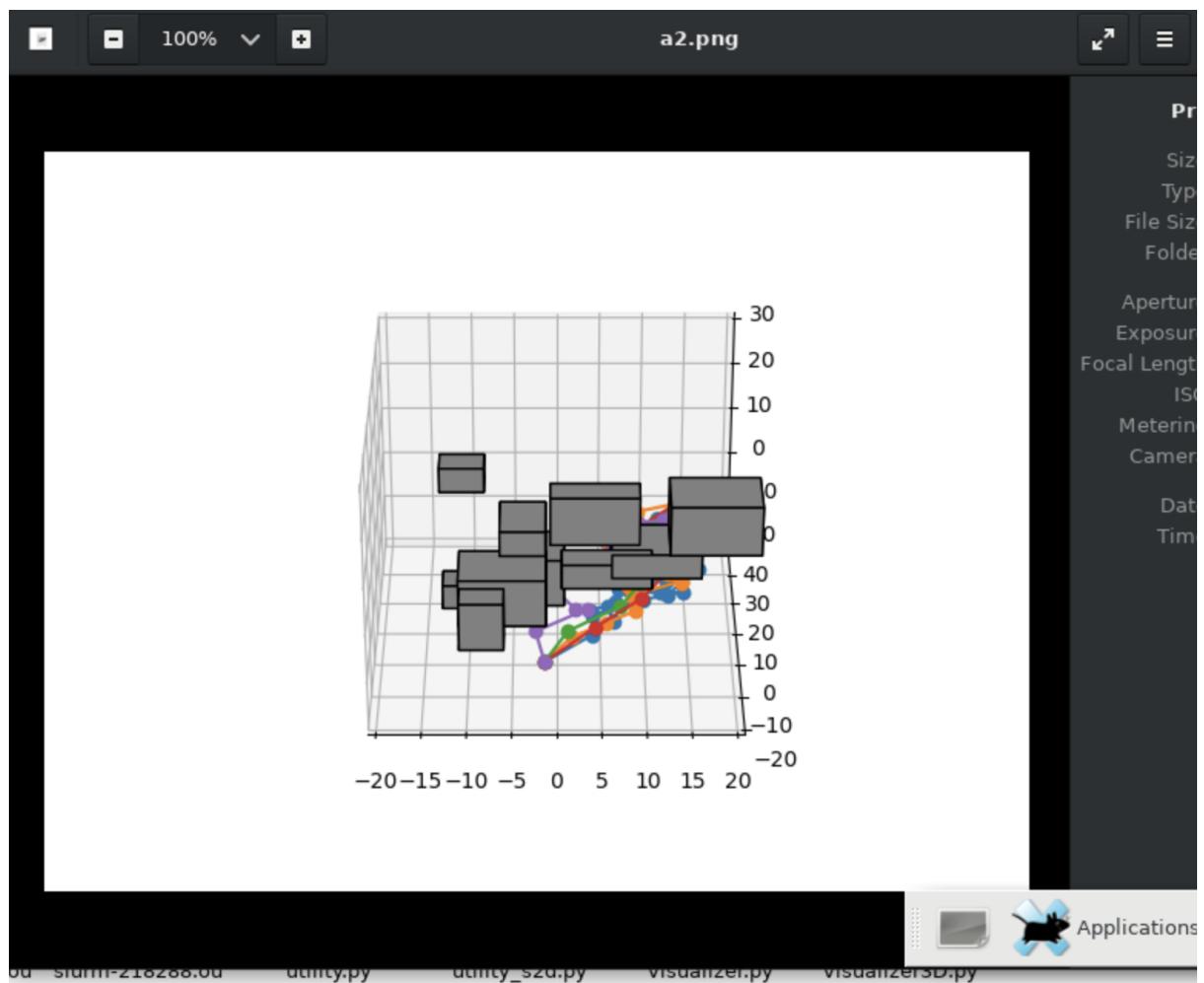
**Print Paths**

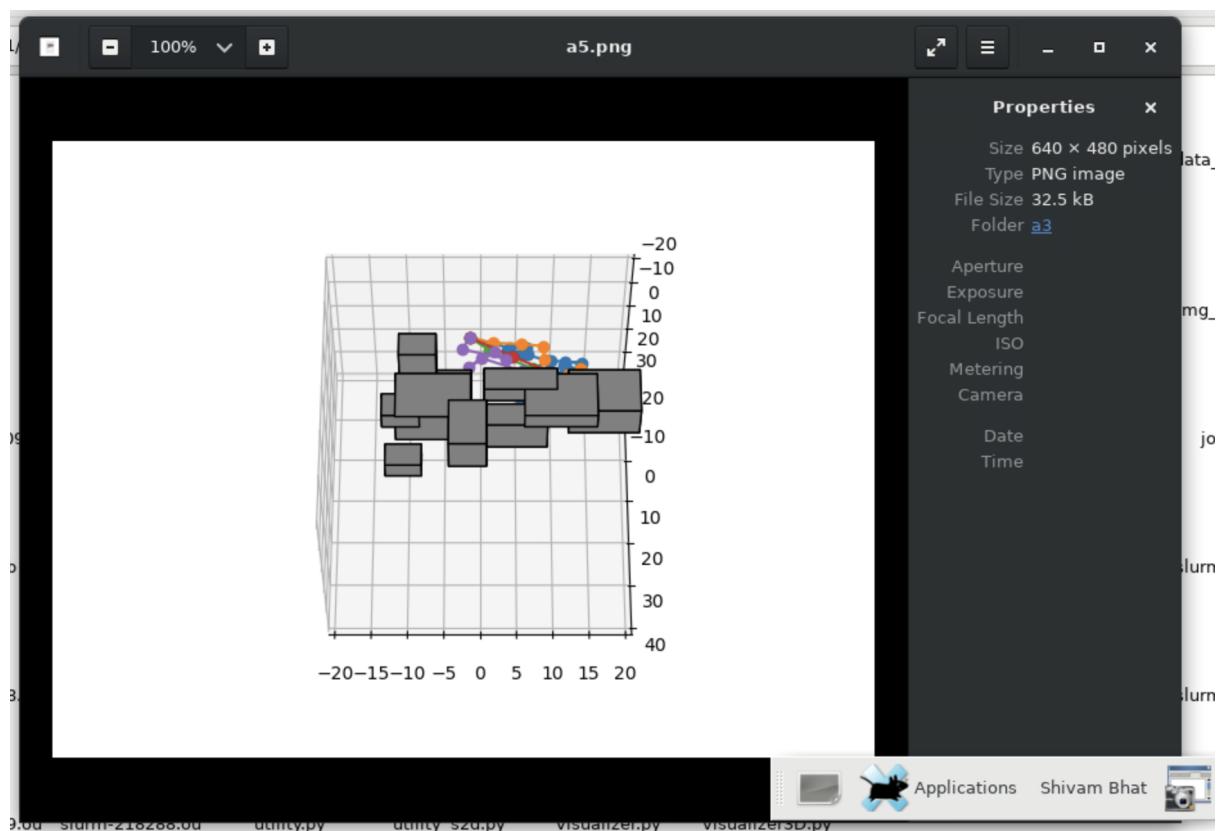
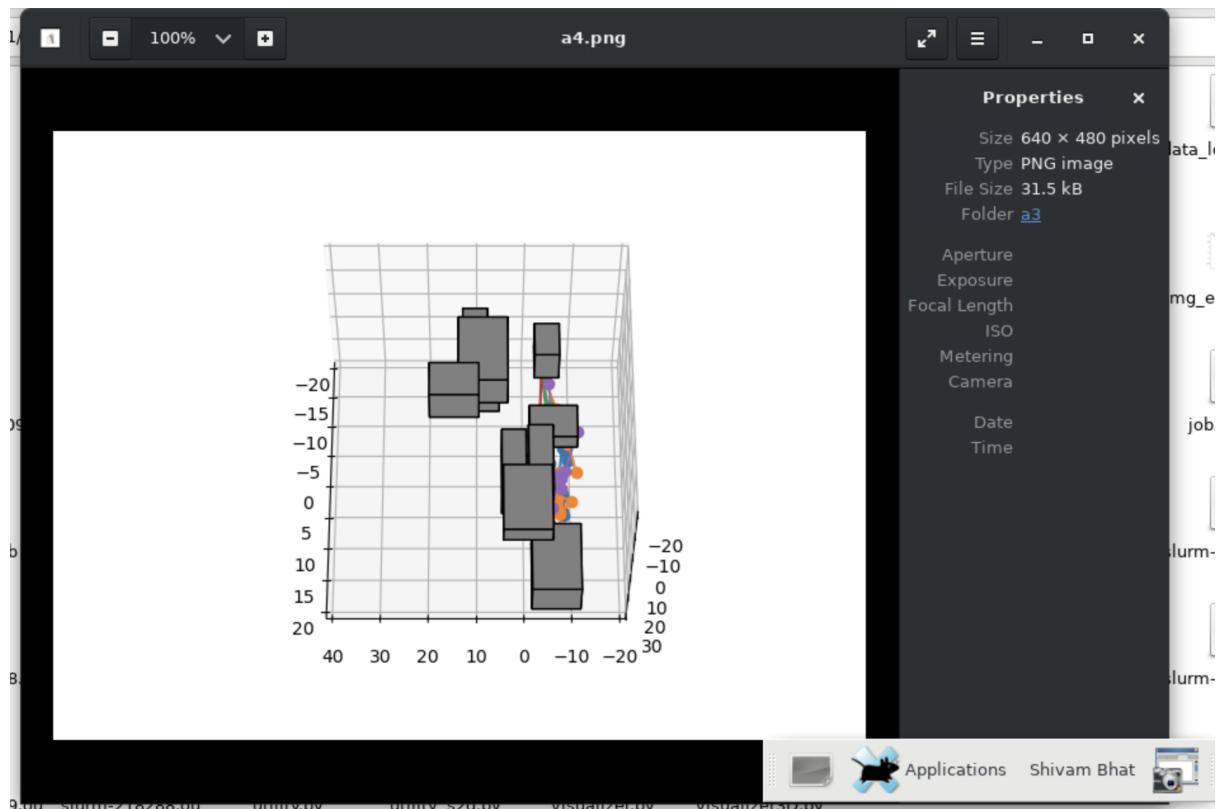
```
1206 vi visualizer3D.py  
1207 python3.8 visualizer3D.py --data-path './data3/' --env-id 5 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/1/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/2/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/3/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/4/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/5/env_5/path_2002.txt'  
1221 python3.8 visualizer3D.py --point-cloud True --data-path './data3/' --env-id 5 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data3/e5/path2005.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/res1/env_5/path_2005.txt' --env-type 'c3d'  
1251 history | grep "visualizer3D"  
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ █
```

## E5 P2002

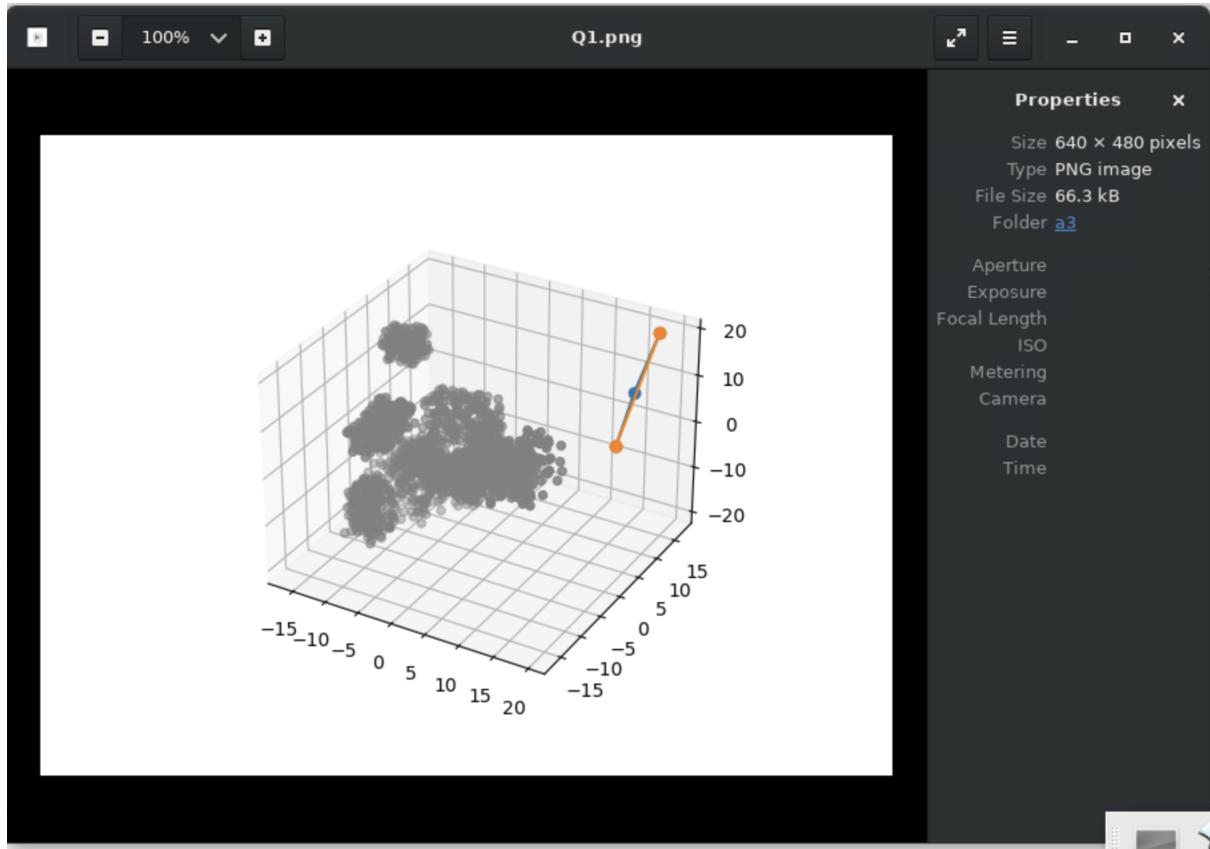
```
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ vi visualizer3D.py  
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer3D.py --data-path './data3/' --env-id 5 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/1/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/2/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/3/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/4/env_5/path_2002.txt' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/5/env_5/path_2002.txt'  
Namespace(data_path='./data3/', env_id=5, env_type='c3d', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/1/env_5/path_2002.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/2/env_5/path_2002.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/3/env_5/path_2002.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/4/env_5/path_2002.txt', '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/path5/5/env_5/path_2002.txt'], point_cloud=False)  
Angles  
-60 30 0  
  
[[ -1.399653 -3.073404 -18.108061]  
[ 4.028075 -4.493902 -11.110248]  
[ 6.294404 -7.3148 -6.153913]  
[ 5.67078 -7.915918 -2.430224]  
[ 6.546516 -8.582876 -1.16194 ]
```







## E5 2005 - Point cloud



```
[14.890153 -8.678407])  
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $ python3.8 visualizer3D.py --point-cloud True --data-path './data3/' --env-id  
5 --path-file '/home/bhat41/PurduePrivate/Assignments/a3/data3/e5/path2005.dat' '/home/bhat41/PurduePrivate/Assignments/a3/results/res3d/res1/env_5/path_2005.txt' --env-type 'c3d'  
Namespace(data_path='./data3/', env_id=5, env_type='c3d', path_file=['/home/bhat41/PurduePrivate/Assignments/a3/data3/e5/path2005.dat', '/home/bhat41/PurduePrivate/Assignments/a3/res  
ults/res3d/res1/env_5/path_2005.txt'], point_cloud=True)  
[17.79426925 17.3309768 19.00764264 18.62843568 9.20723906 12.49123655  
[19.69395221 2.74163139 6.58486561]  
[[17.79427 17.330976 19.007643]  
[19.693953 2.741632 6.584866]]  
(/home/bhat41/.conda/envs/cent7/2020.11-py38/cs593) bhat41@scholar-fe04:~/PurduePrivate/Assignments/a3 $
```

```
python3.8 visualizer3D.py --data-path './data2/' --env-id 4 --path-file  
'/home/bhat41/PurduePrivate/Assignments/a3/data2/e4/path4014.dat'  
'/home/bhat41/PurduePrivate/Assignments/a3/results/res2d/res1/env_4/path_4014.txt'  
--env-type 's2d' —point-cloud
```

## Details

Used Purdue scholar :'[ssh bhat41@gpu.scholar.rcac.purdue.edu](mailto:bhat41@gpu.scholar.rcac.purdue.edu)'

Loaded conda >> module load anaconda

Switch conda env :: conda activate cs593

I had to install some packages like torch vision and

>> conda install torchvision -c pytorch

>> install -c conda-forge tensorboardx

**Submitted CUDA GPU job using sbatch :**

**sbatch -A gpu --nodes=1 --gres=gpu:1 -t 00:180:00 job1\_1.sub**

**Where job is a batch file . Followed instruction given on rcac website ::**

**<https://www.rcac.purdue.edu/knowledge/scholar/run/slurm/submit>**

**In Q1 I have printed paths for both cloud and solid rigid obstacles . same for ‘c3d’ (complex 3d environment) as well.**

### **FOR 3D**

**For collision checking in 3d I created a new file ‘plan\_c3d.py’.**

**For CAE I created CAE3D.py since the layer input size is different.**

**For running the env-type will be ‘c3d’**

**All commands are shown in terminal screenshots but I am adding them here as well.**