

1.1-1

$$\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \theta = 0^\circ$$

1.1.2

$$\begin{bmatrix} \cos 45 & -\sin 45 \\ \sin 45 & \cos 45 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \end{bmatrix}, \theta = 45^\circ$$

1.1.3

$$\begin{bmatrix} d\cos\alpha & d\sin\alpha \end{bmatrix}, \theta = \alpha^\circ$$

1.2

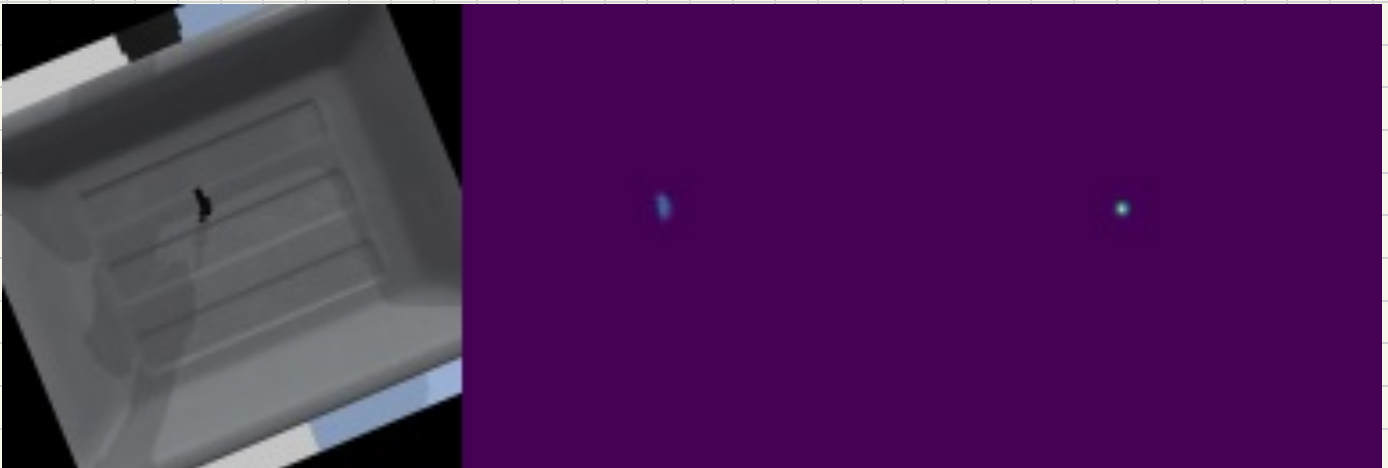
rotate image -45°

2.2.3

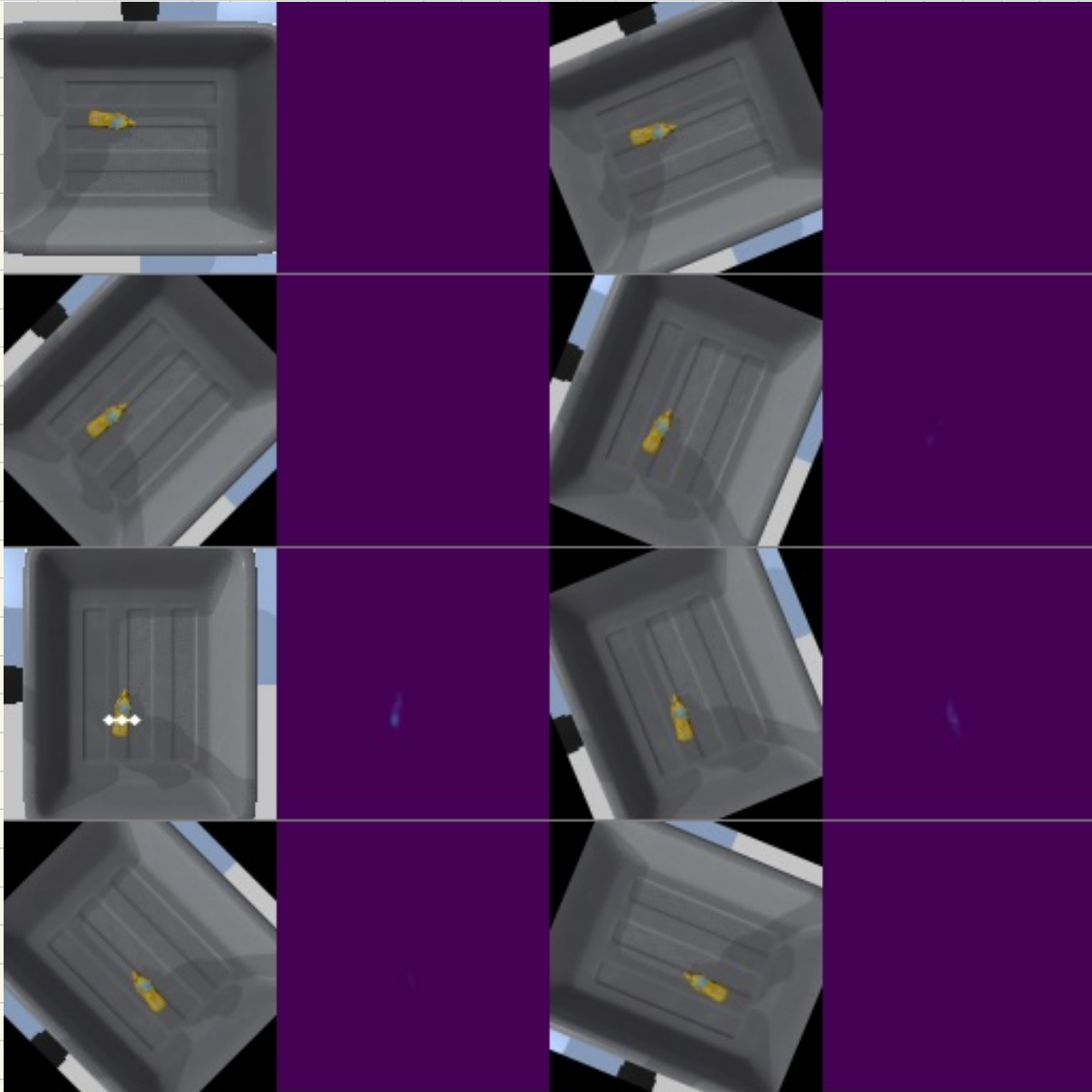
```
-----  
Start epoch 30  
step# 203 training loss 0.0015196383465081453  
Epoch ( 30 / 101 )  
-----  
Train loss: 0.0015  
Test loss: 0.0017  
-----  
checkpoint saved at epoch 30  
Saving predictions in directory data/affordance/training_vis
```

```
-----  
Start epoch 10  
step# 63 training loss 0.0011516002705320716  
Epoch ( 10 / 101 )  
-----  
Train loss: 0.0012  
Test loss: 0.0011  
-----  
checkpoint saved at epoch 10  
Saving predictions in directory data/affordance/training_vis
```

continue
training



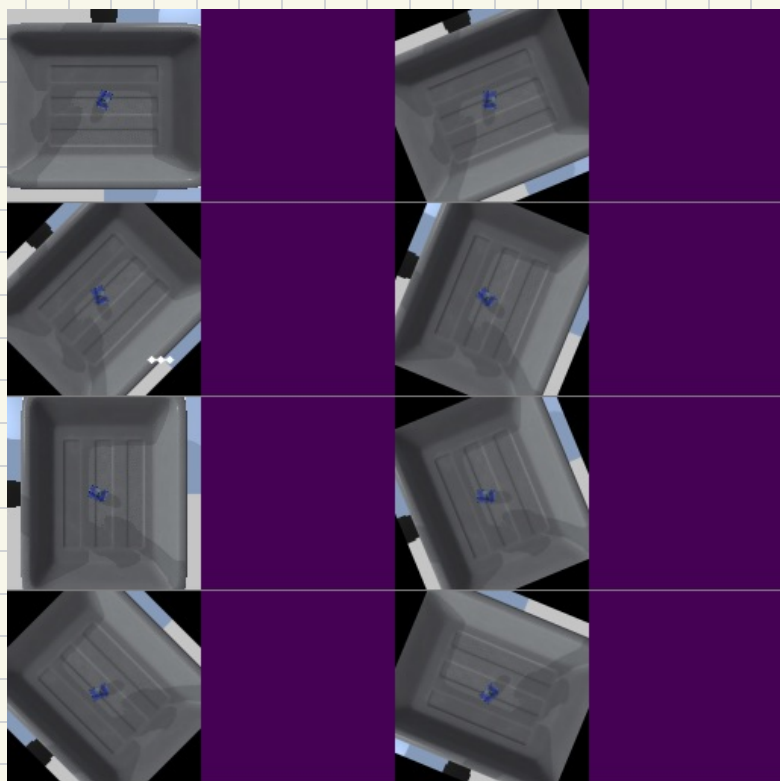
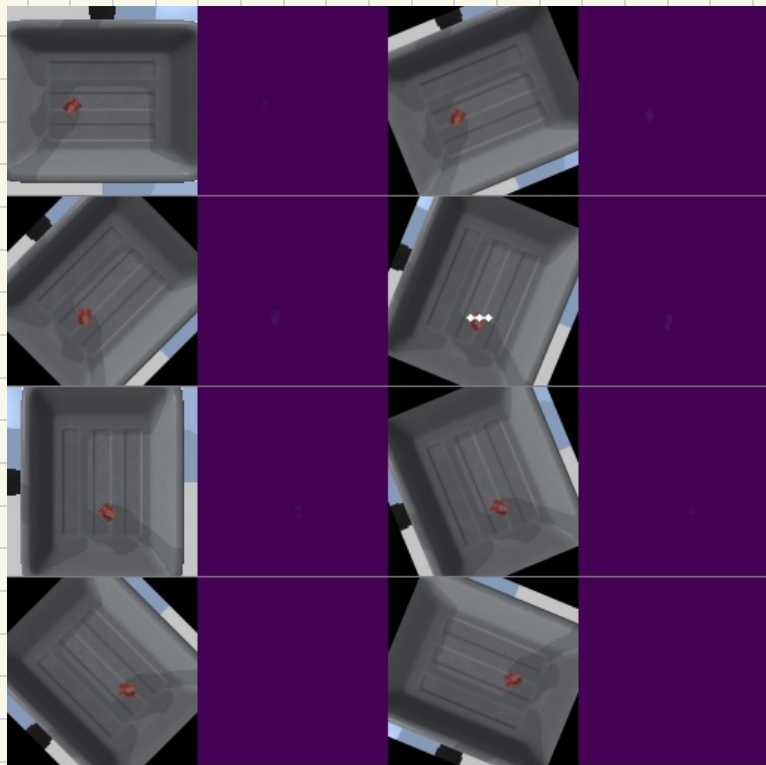
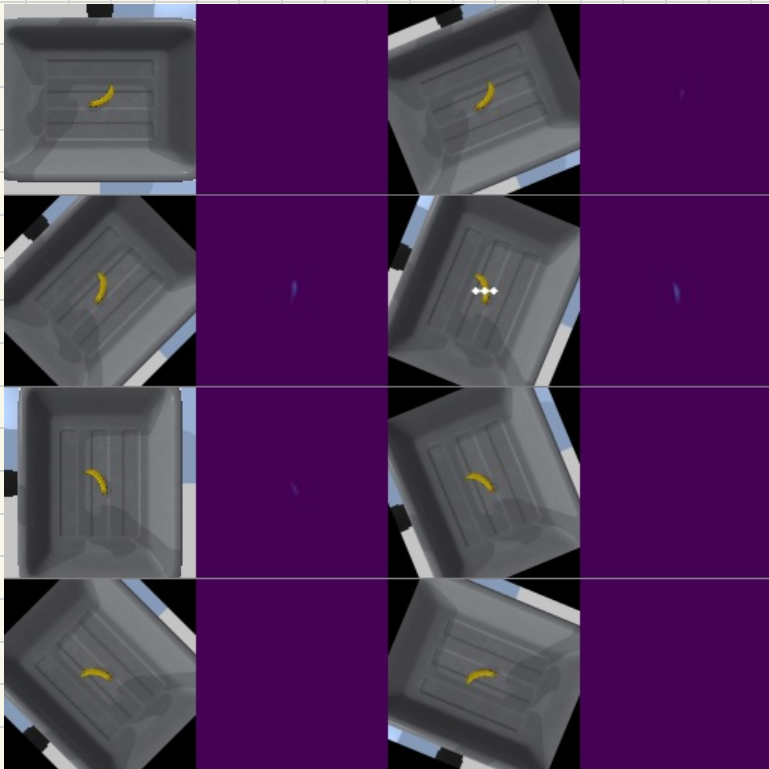
2.2.5



Success rate: 1.0

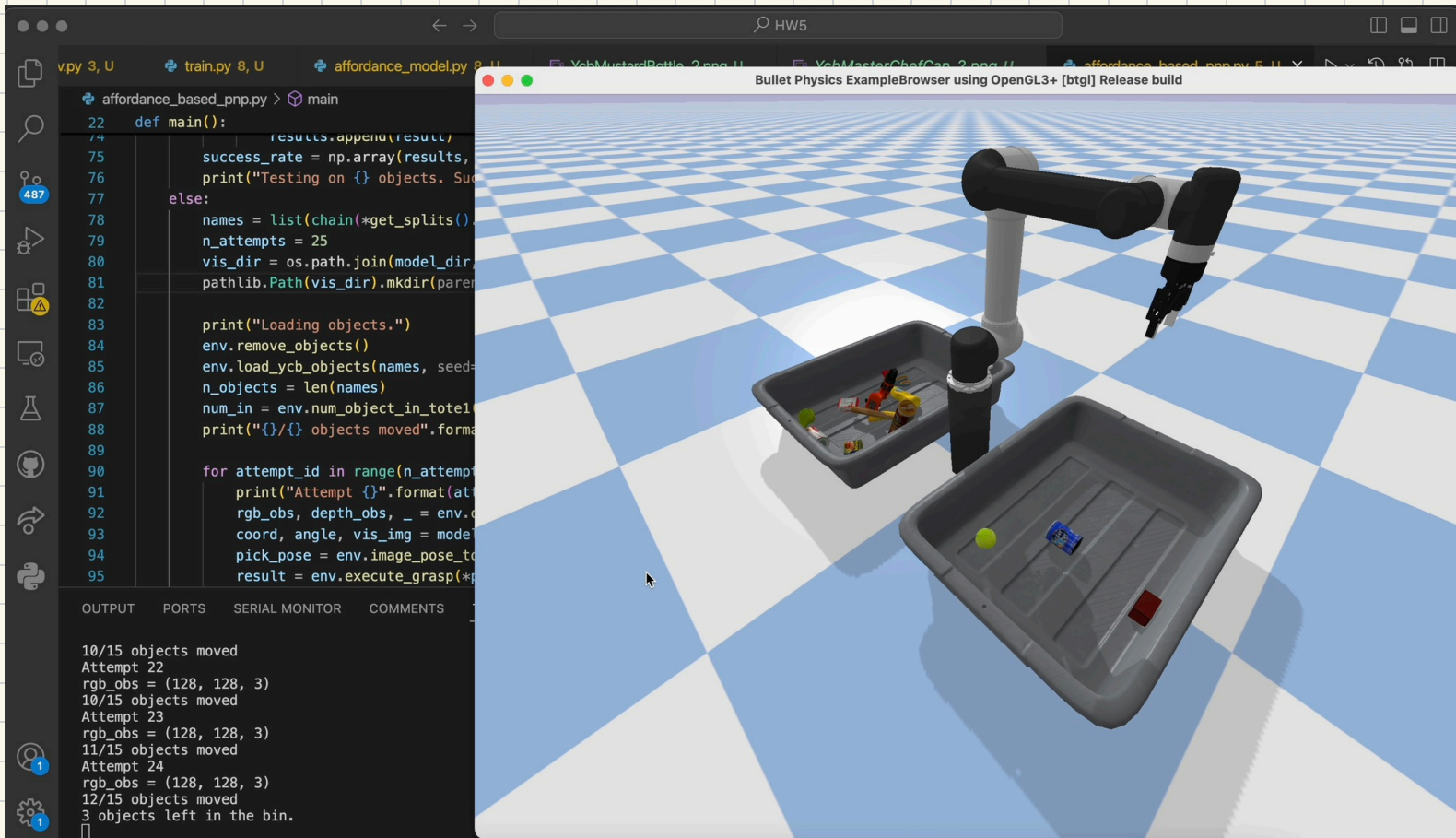
2-2-6

Success rate: 0.5



2.2-7

12 objects are moved

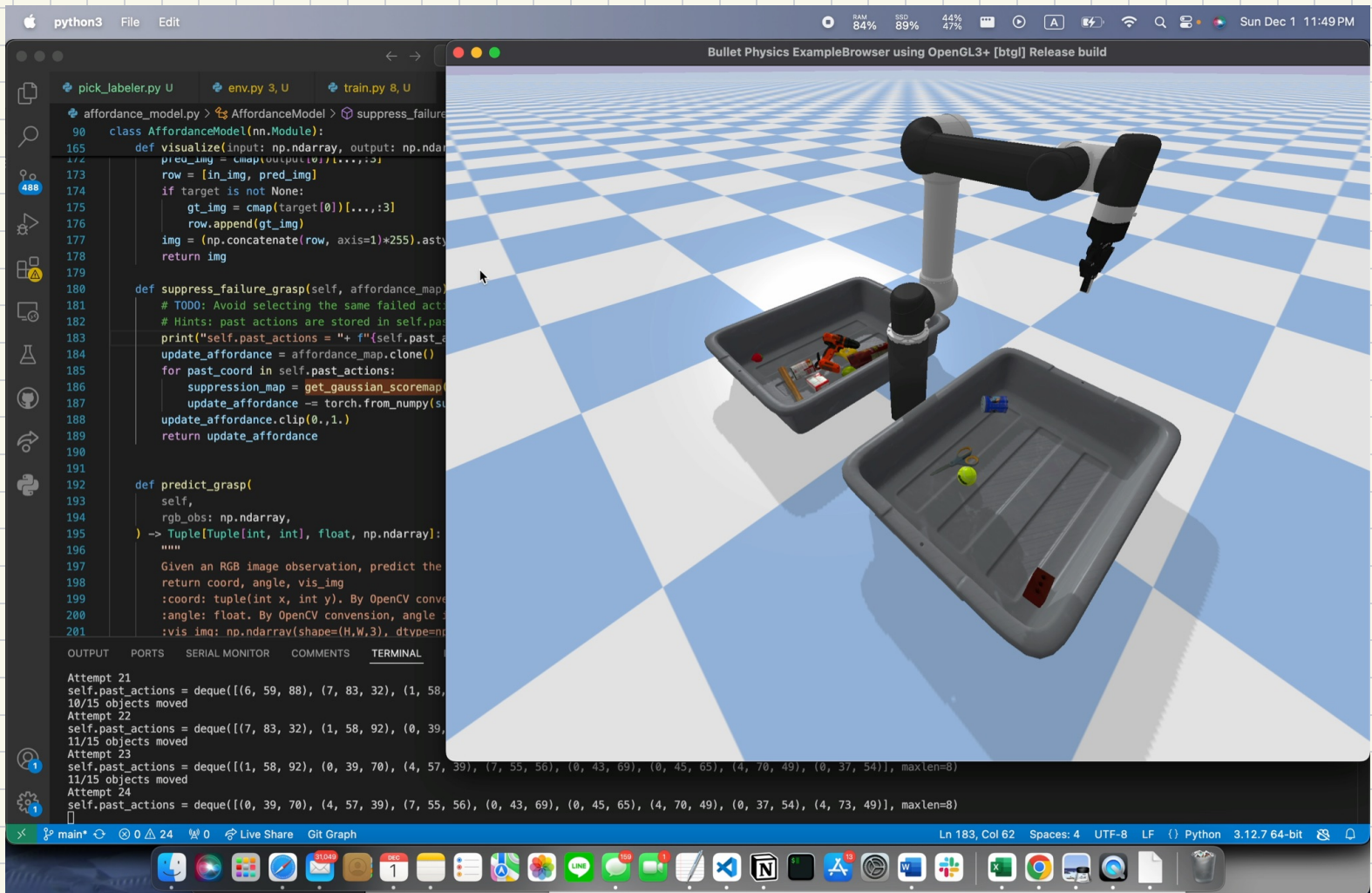


Video Link:

https://drive.google.com/file/d/1T6hrBxsO4uWuFGQ5H6HtUNxkMx575XF_/view?usp=sharing

2.2.8

11 objects are moved, the gripper keep adjusting to grab the scissor but it is unlucky that scissor was next to two other objects that make failure.



Video Link:

https://drive.google.com/file/d/1j0JuDKO9wRJs7CDR8o8cSB_z4gVIhHDu/view?usp=sharing

Pb3

- 3.1 This method works for both seen and unseen data because the end-to-end affordance model only takes images as input to generate grasp action. Hence, the network may learn action based on object shape or other geometry feature which can expand to unseen object. Also, the data augmentation step of rotating image 8 times generates more training data for different grasping angle, which leads to better performance on different aspect of view.
- 3.2 The test-time improvement of suppressing failure grasp prevent the gripper from taking same action as before, which in general should improve grasping efficiency. However, in my case of simulation, the gripper keep adjust to grasp scissor but the scissor is blocked by other two objects, thus lead to fewer objects be moved in the end. In this case I would say randomization affects a lot in limited (25) test. In the long-term I believe the performance should increase, since I do see the gripper trying different pose to grasp scissors. There may be also some potential issues from handmade label, or unsufficient model training process.