

Reinforcement Learning with Self-Supervised 3D Representation for Motor Control

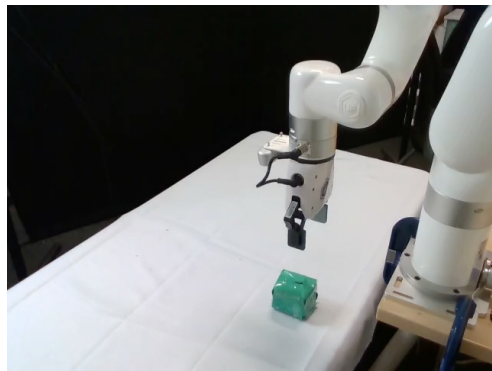
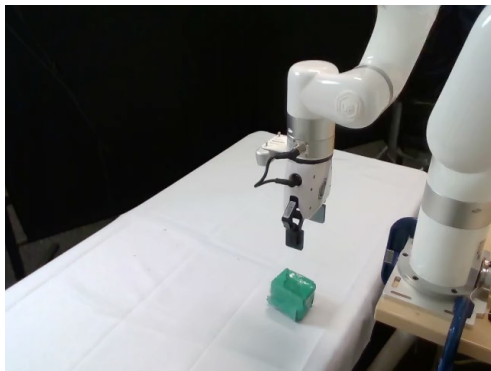
Anonymous Authors

Our 3D method trained in **simulation**
could transfer zero-shot to the **real** robot setup.

Lift



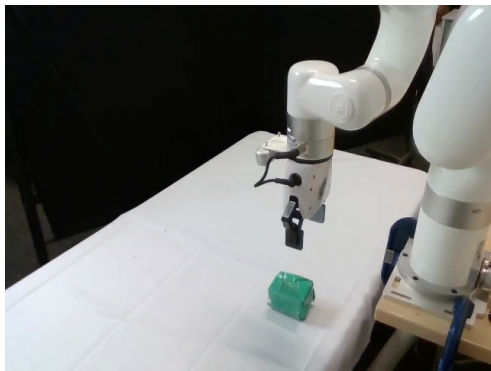
Ours (3D Pretrain)



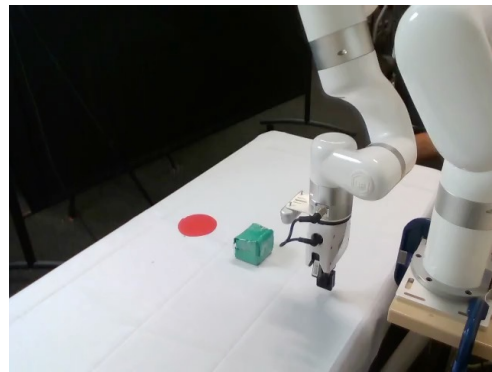
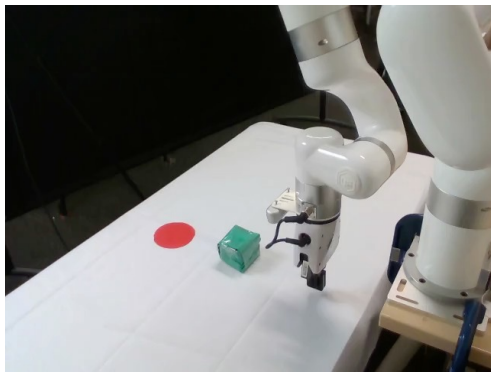
Lift



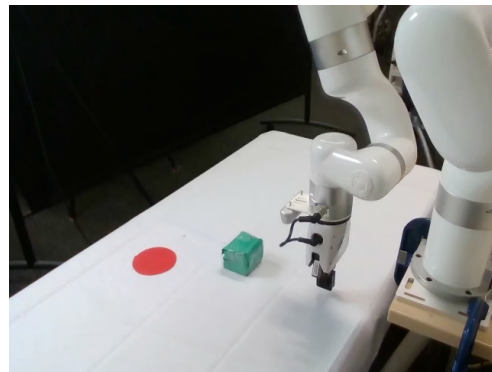
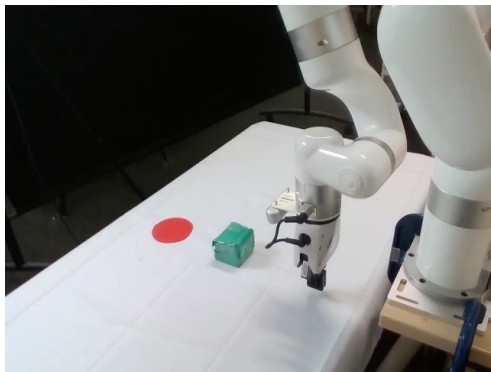
MoCo Pretrain



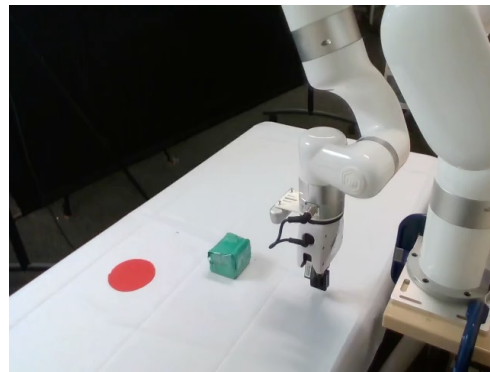
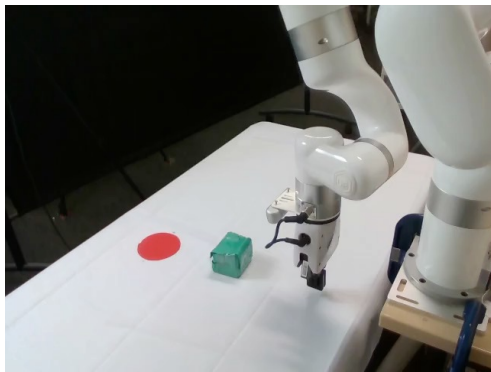
Push



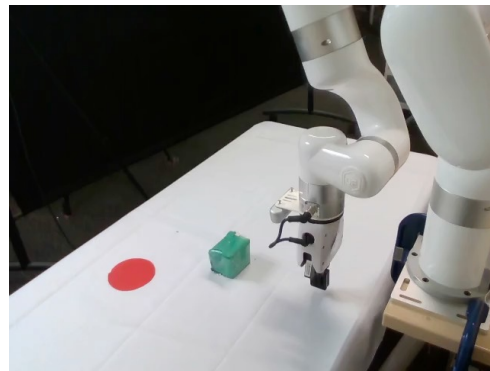
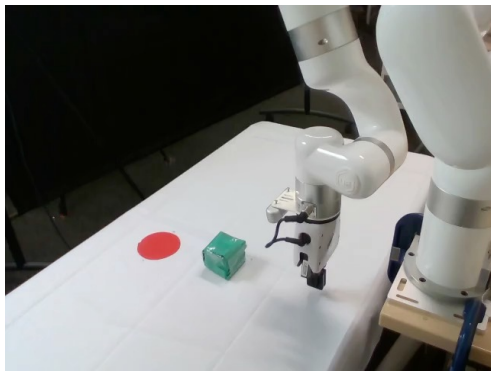
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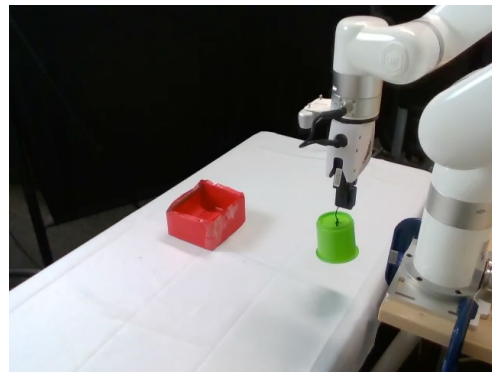
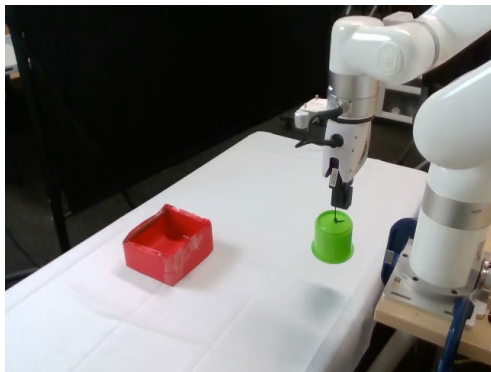
Push



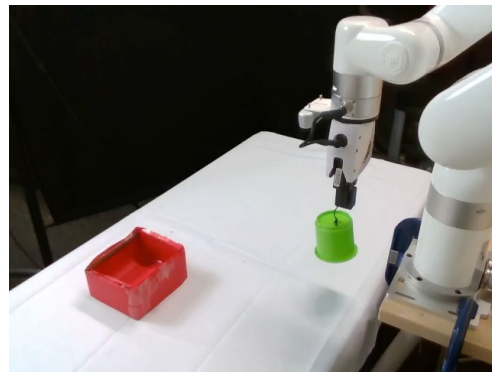
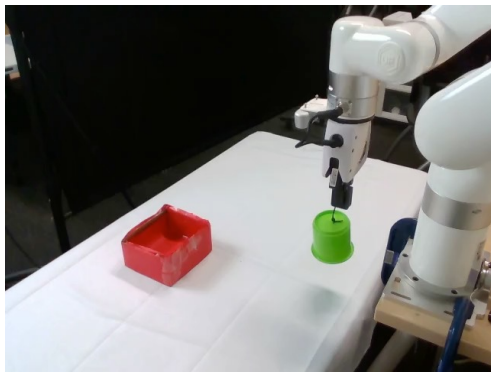
MoCo Pretrain



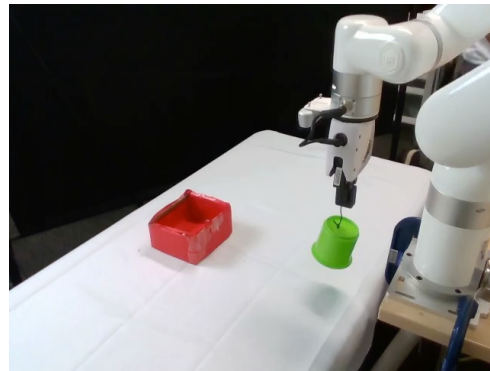
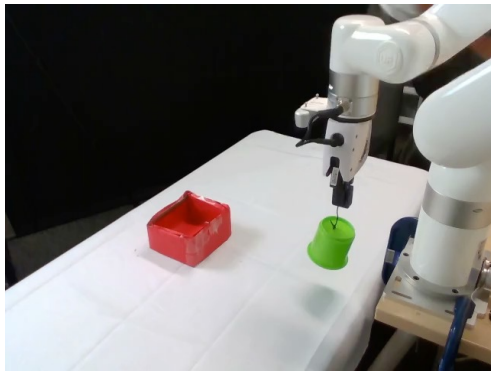
Peg in Box



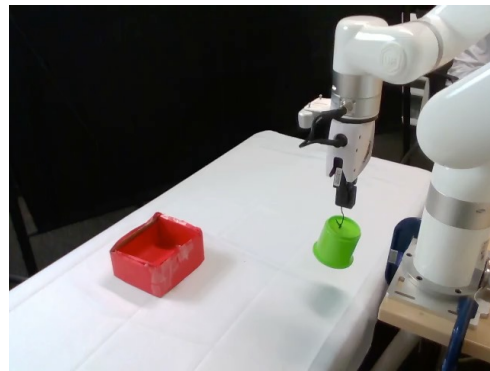
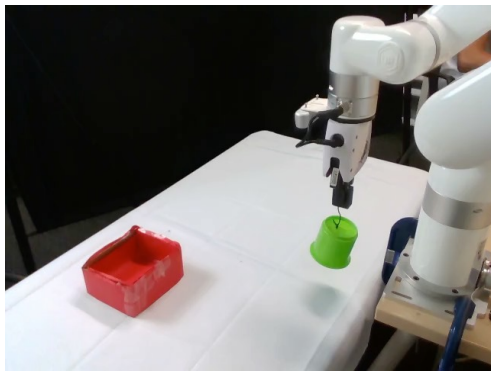
Ours (3D Pretrain)



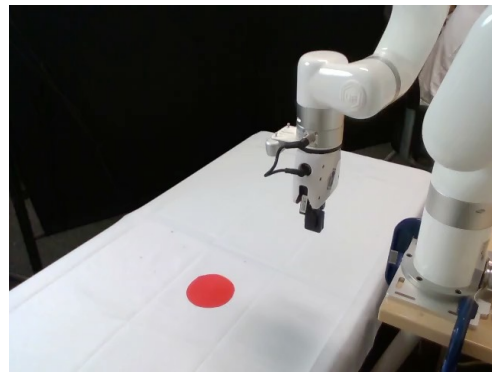
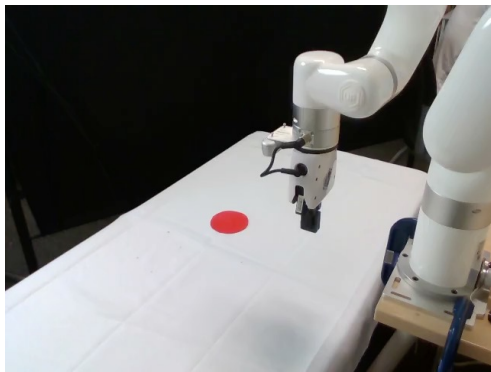
Peg in Box



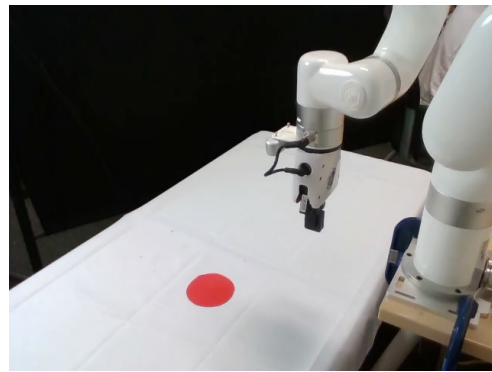
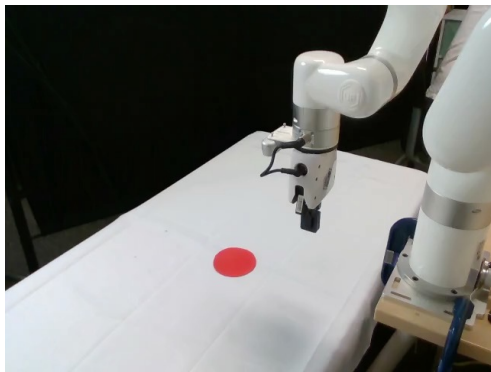
MoCo Pretrain



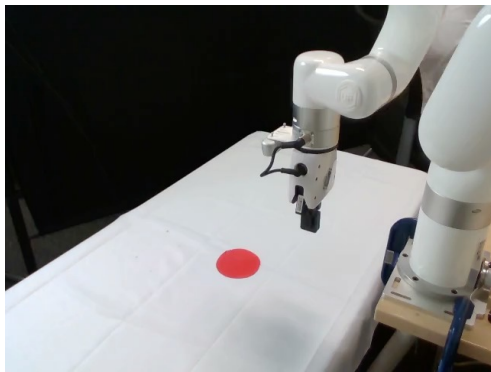
Reach



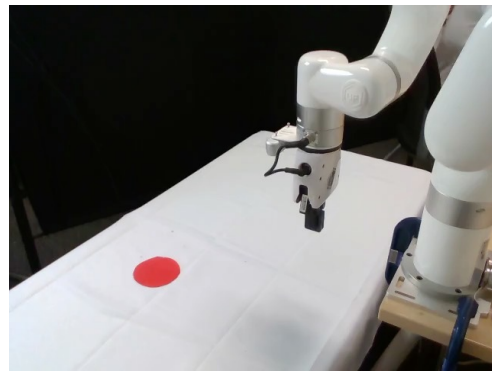
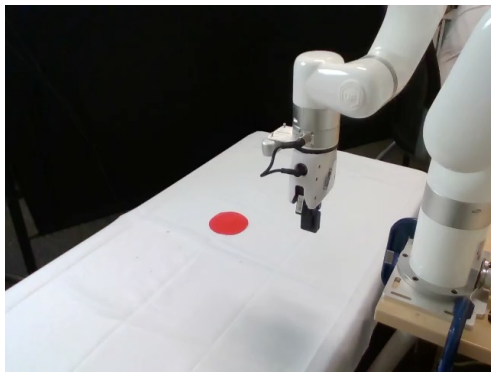
Ours (3D Pretrain)



Reach

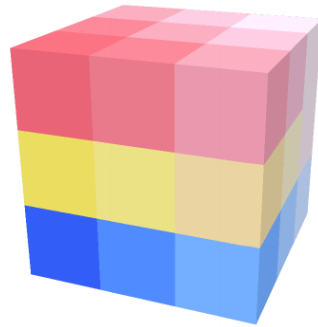


MoCo Pretrain



Our Method

We use a voxel-based 3D scene representation.

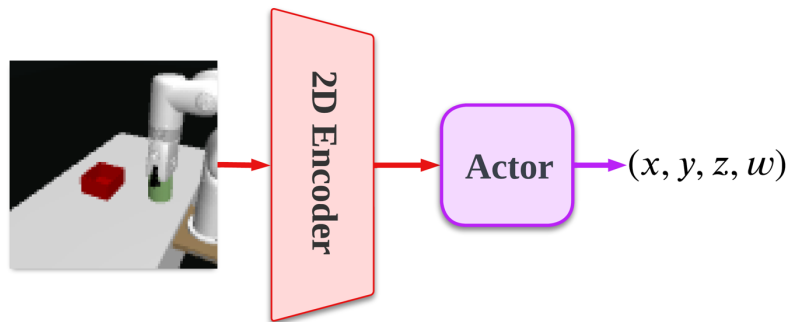


We first pretrain our visual representation on CO3D dataset, using a view synthesis task with autoencoder.



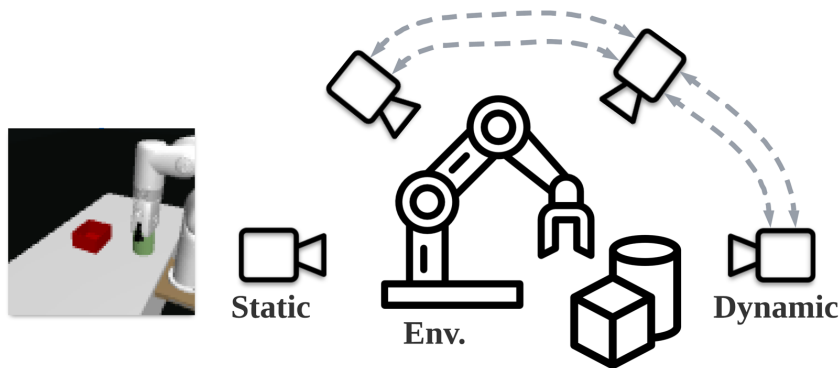
Then we train the RL policy and the 3D representation jointly,
with a shared 2D encoder.

RL

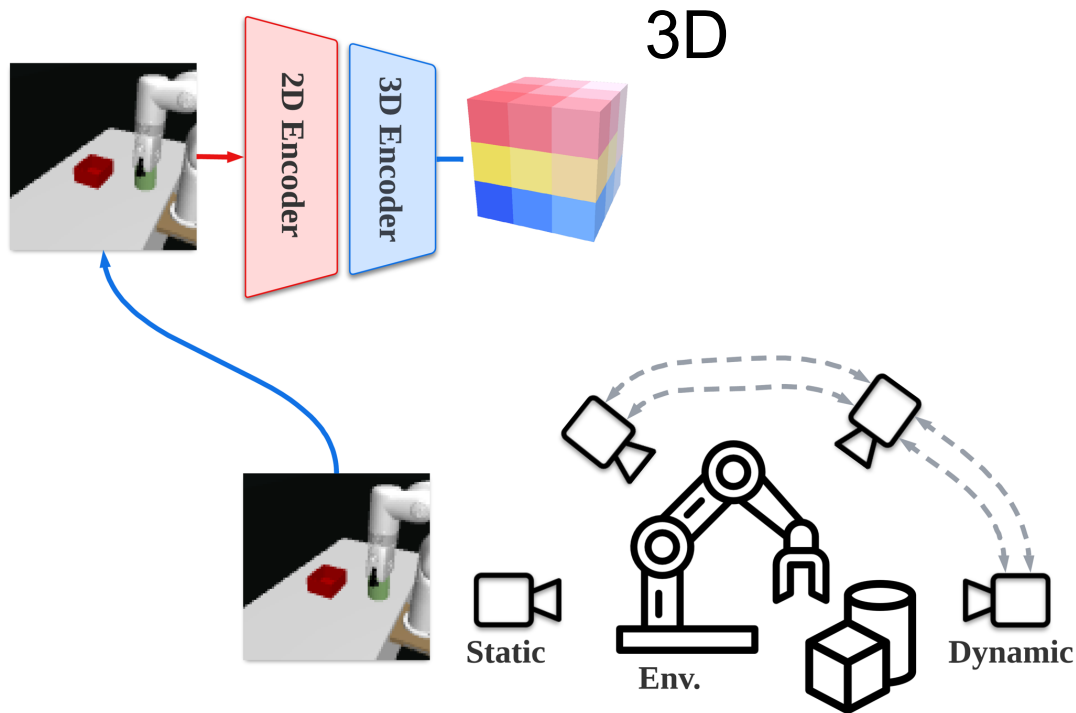


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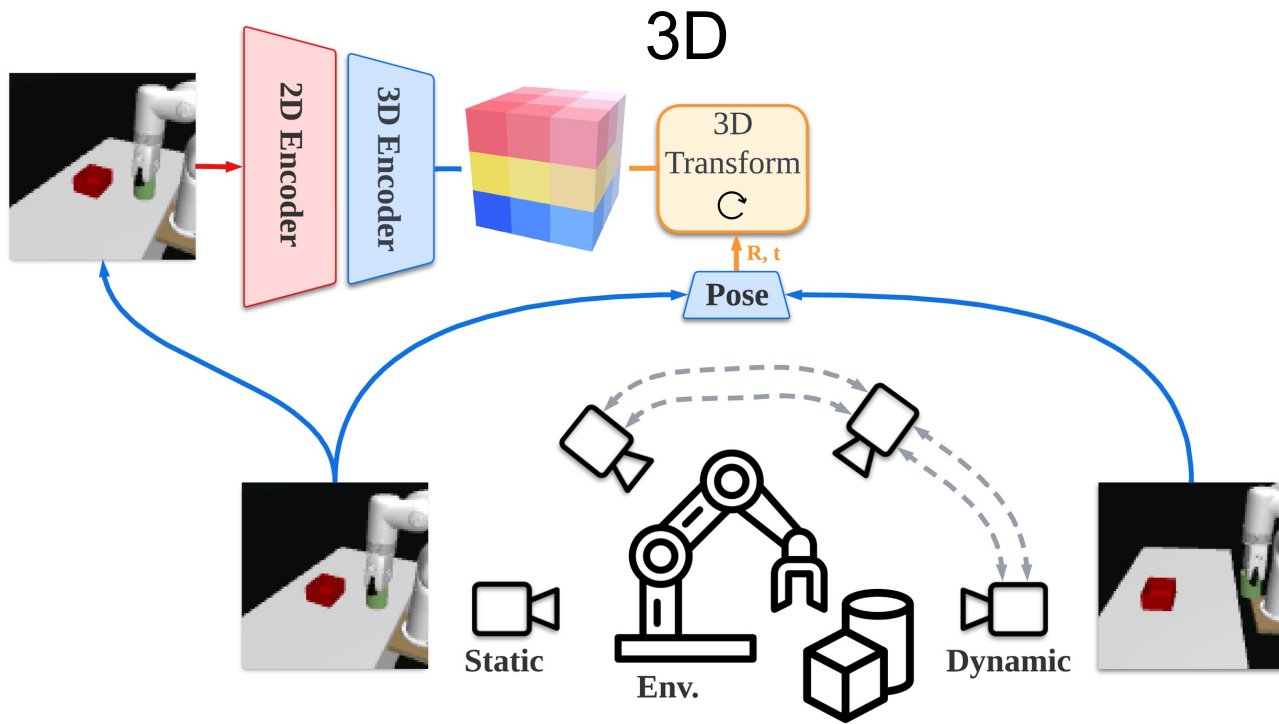
3D



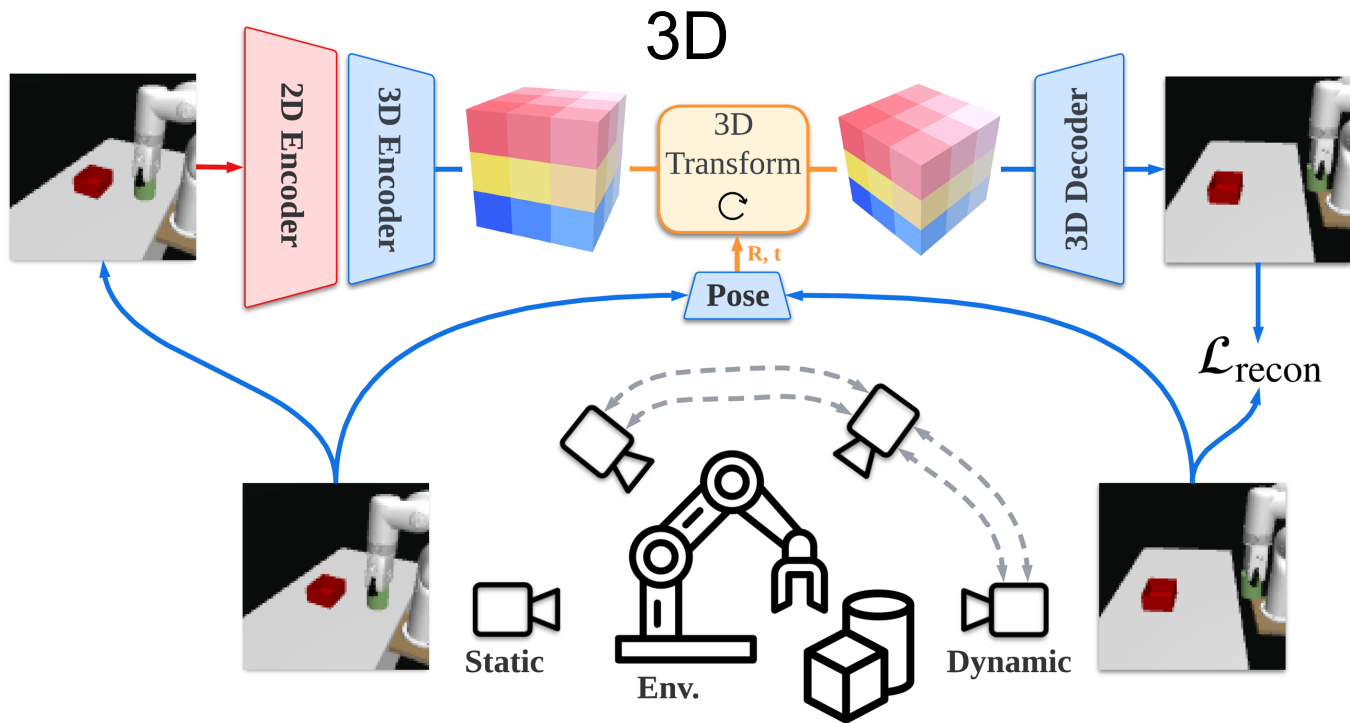
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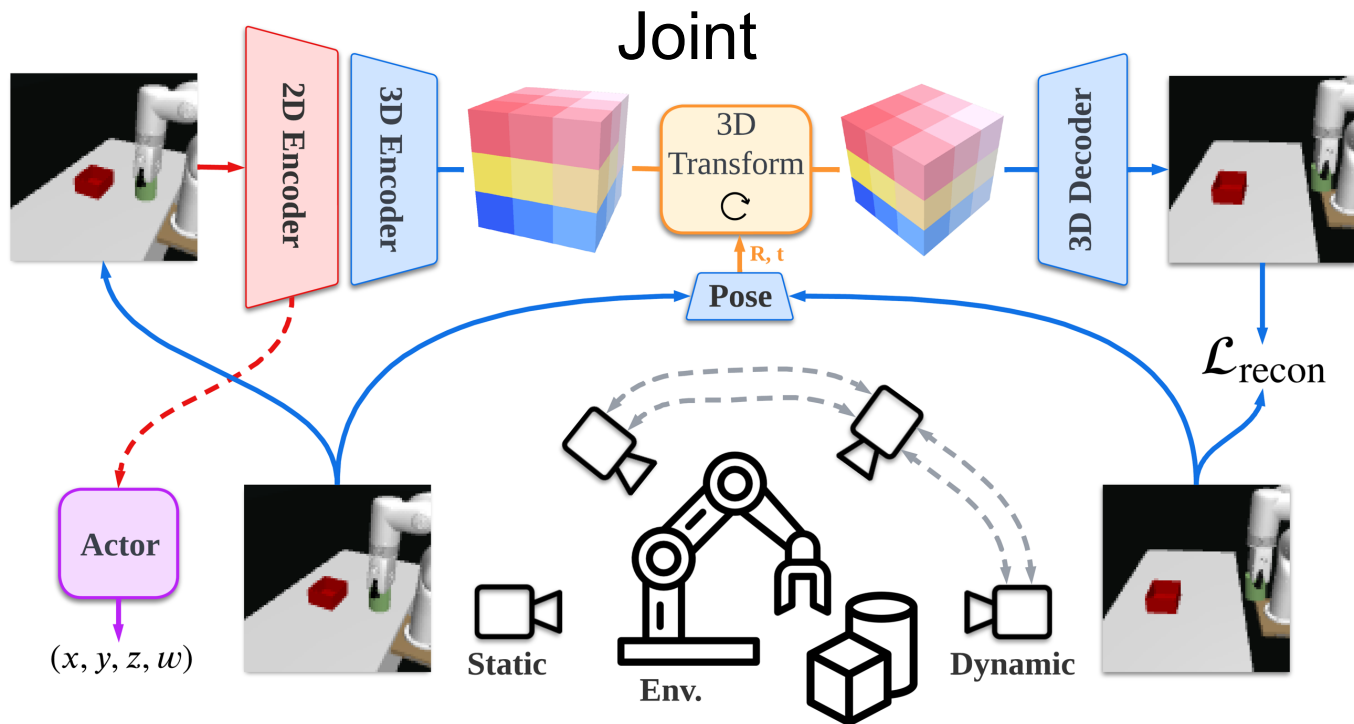
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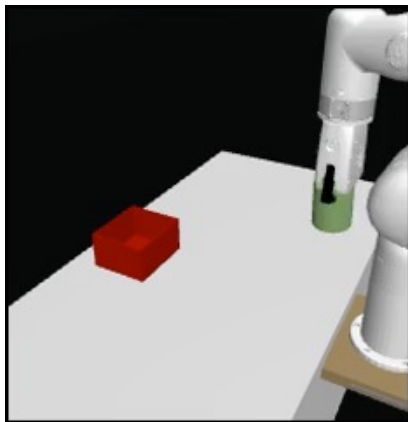


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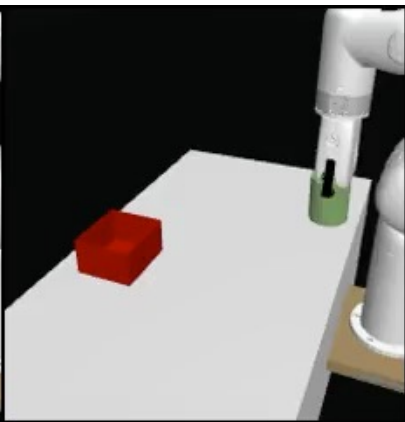


To achieve this, we need at least two cameras for RL tasks.
We design one static camera and one dynamic camera.

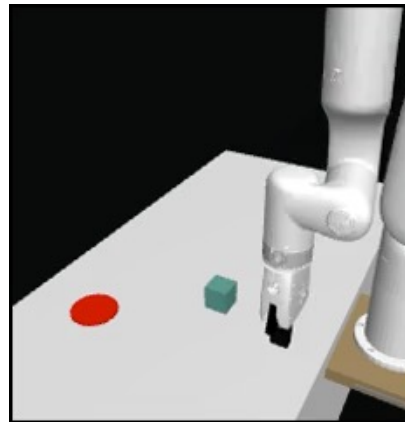
Static



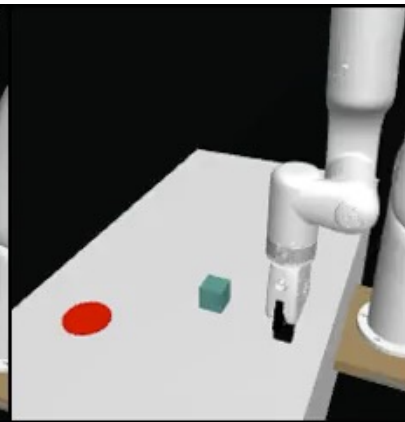
Dynamic



Static



Dynamic



Only trained in simulation, our method enjoys good performance when transferred to real.

Sim-to-real results.

Real	Scratch	ImageNet	MoCo	3D (<i>ours</i>)
Reach	84 \pm 12	96\pm4	80 \pm 11	96\pm4
Push	2 \pm 2	22 \pm 10	22 \pm 7	48\pm9
Peg in Box	40 \pm 14	62 \pm 20	50 \pm 15	76\pm19
Grasp	44 \pm 14	20 \pm 10	38 \pm 10	62\pm14
Lift	30 \pm 15	2 \pm 2	20 \pm 5	46\pm19

Thanks!