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

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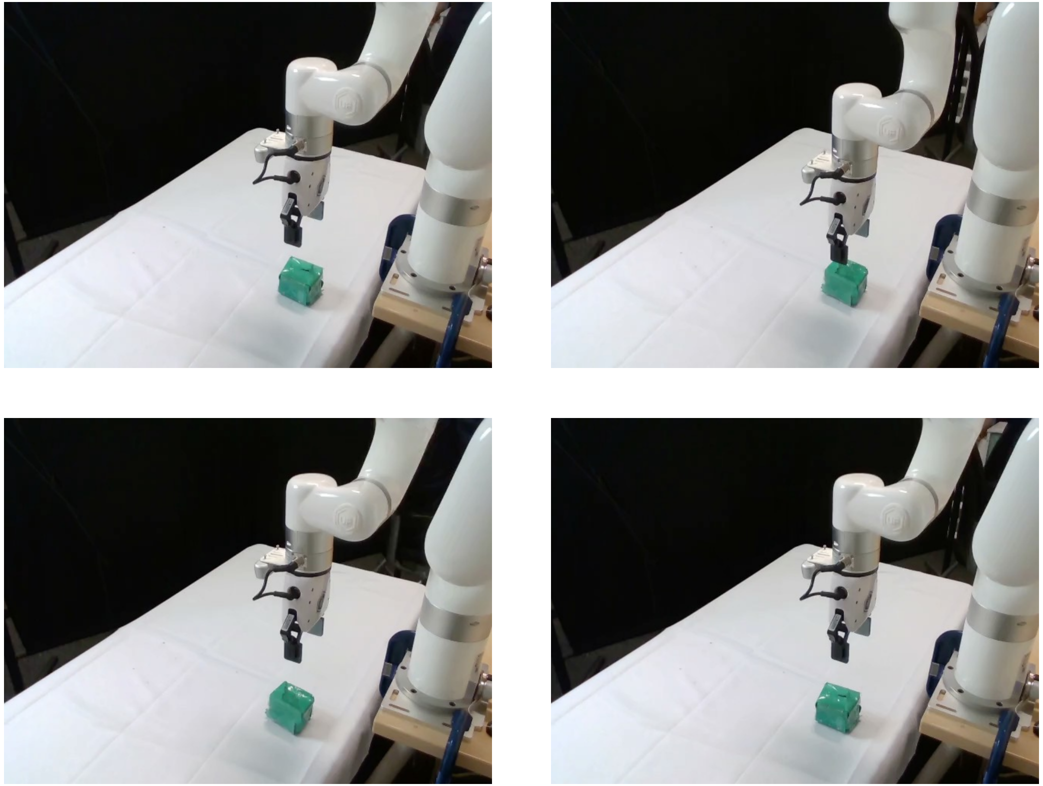
*Equal Contribution

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

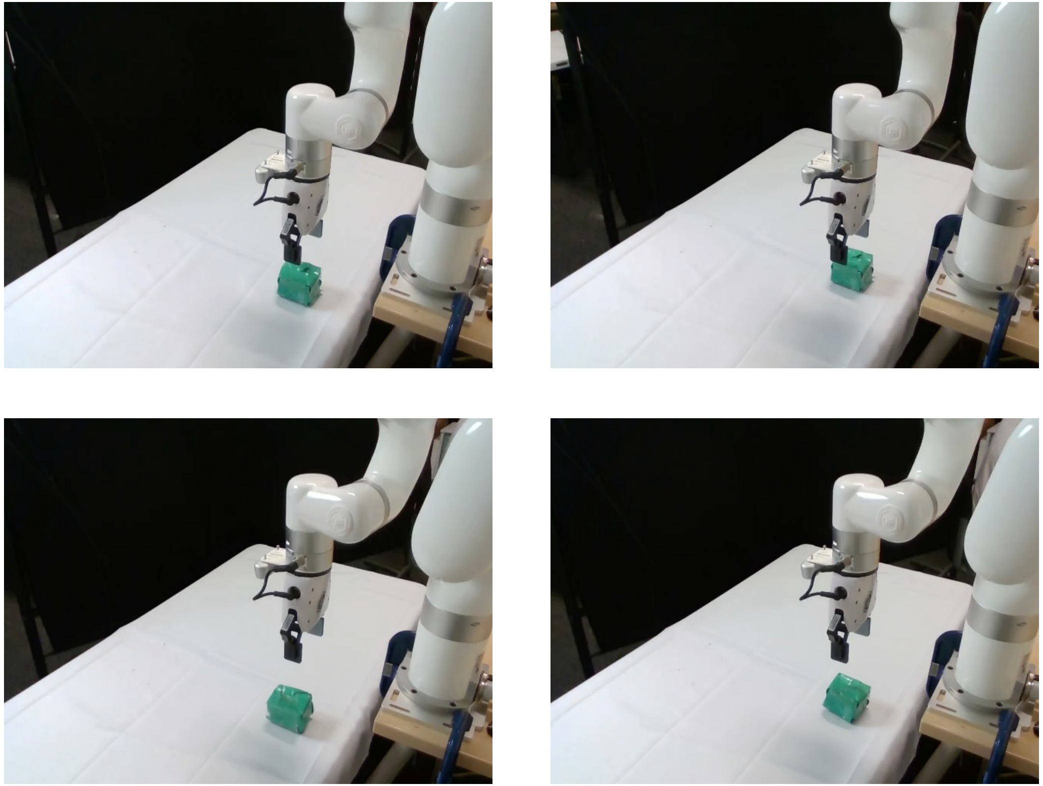
Lift

Ours (3D Pretrain)



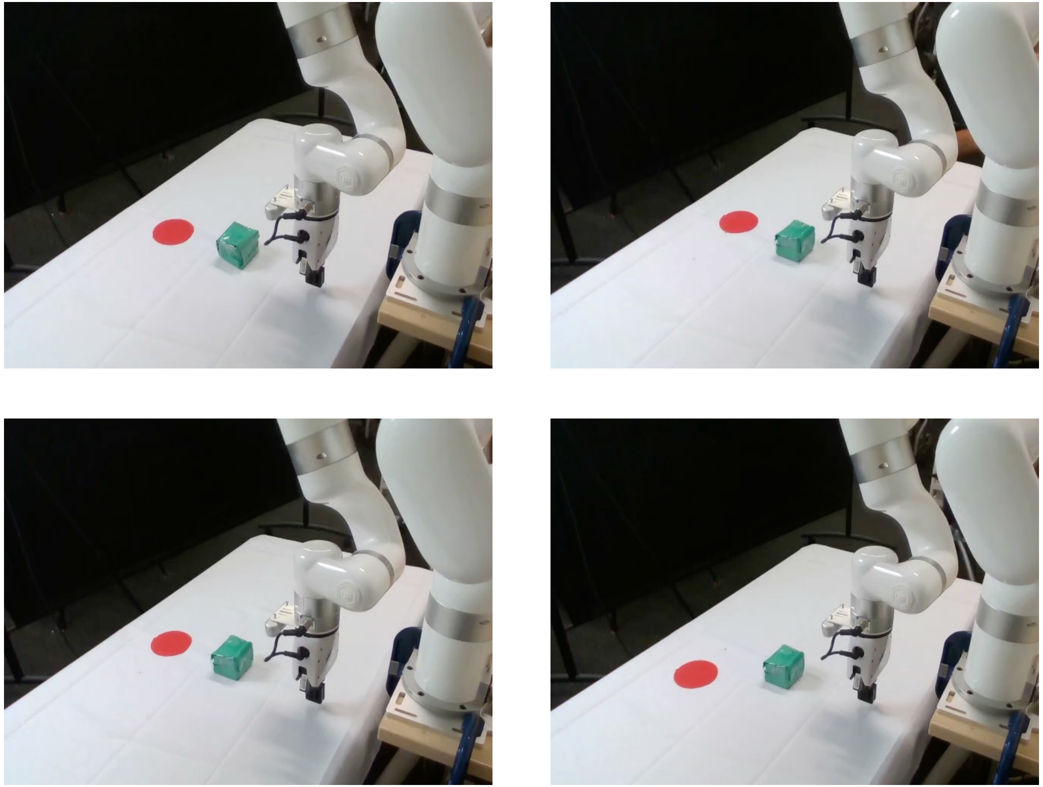
Lift

MoCo Pretrain



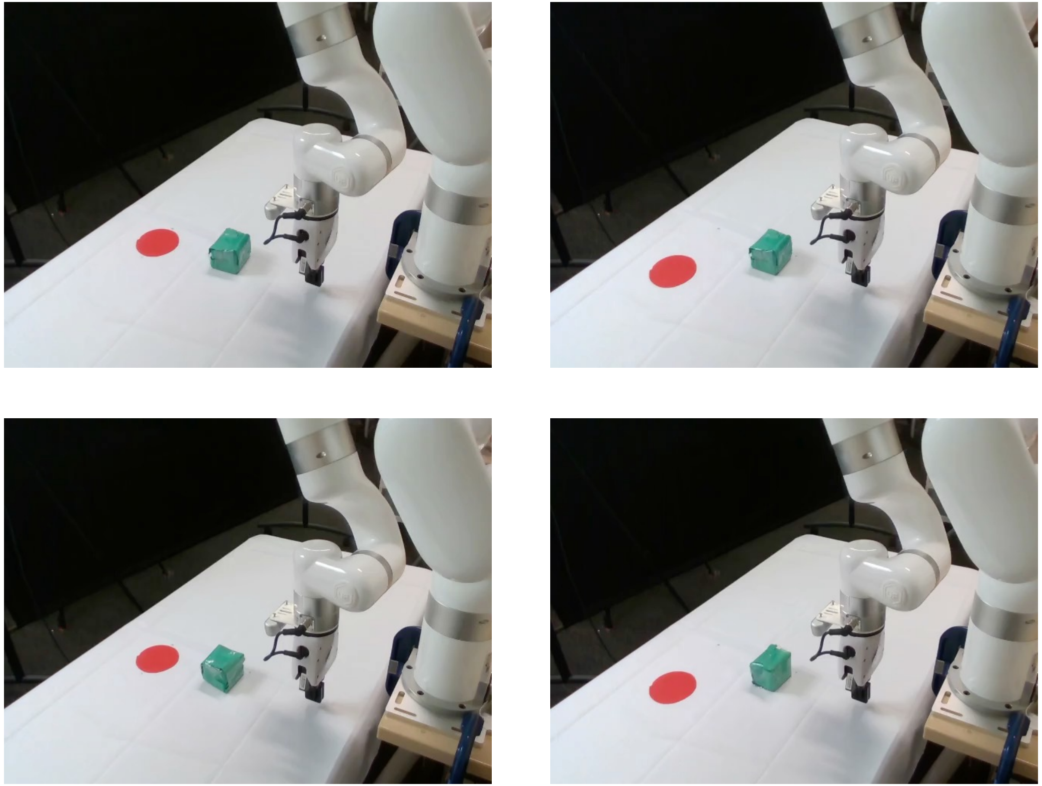
Push

Ours (3D Pretrain)



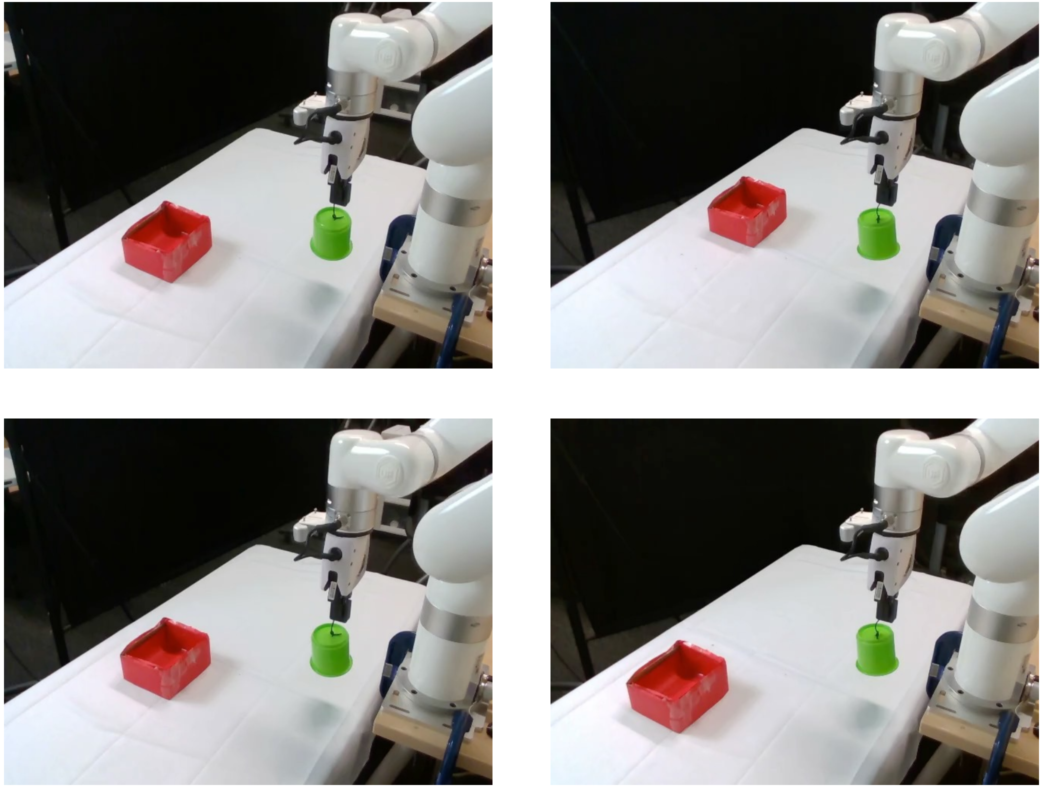
Push

MoCo Pretrain



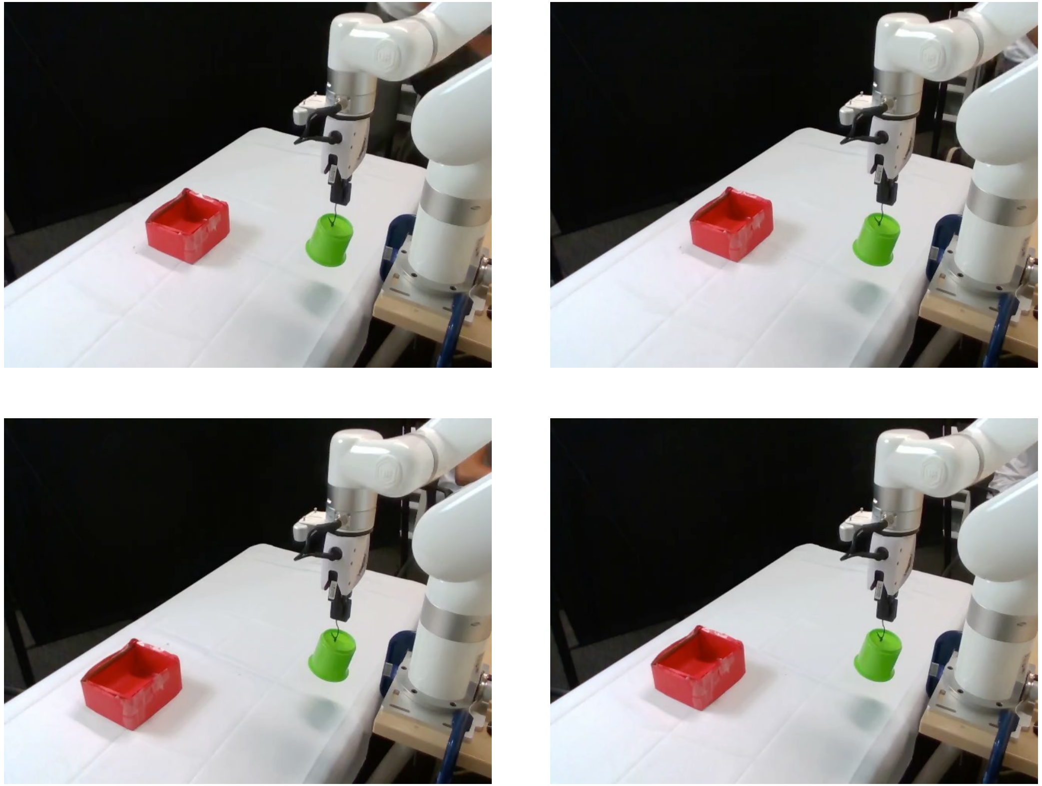
Peg in Box

Ours (3D Pretrain)



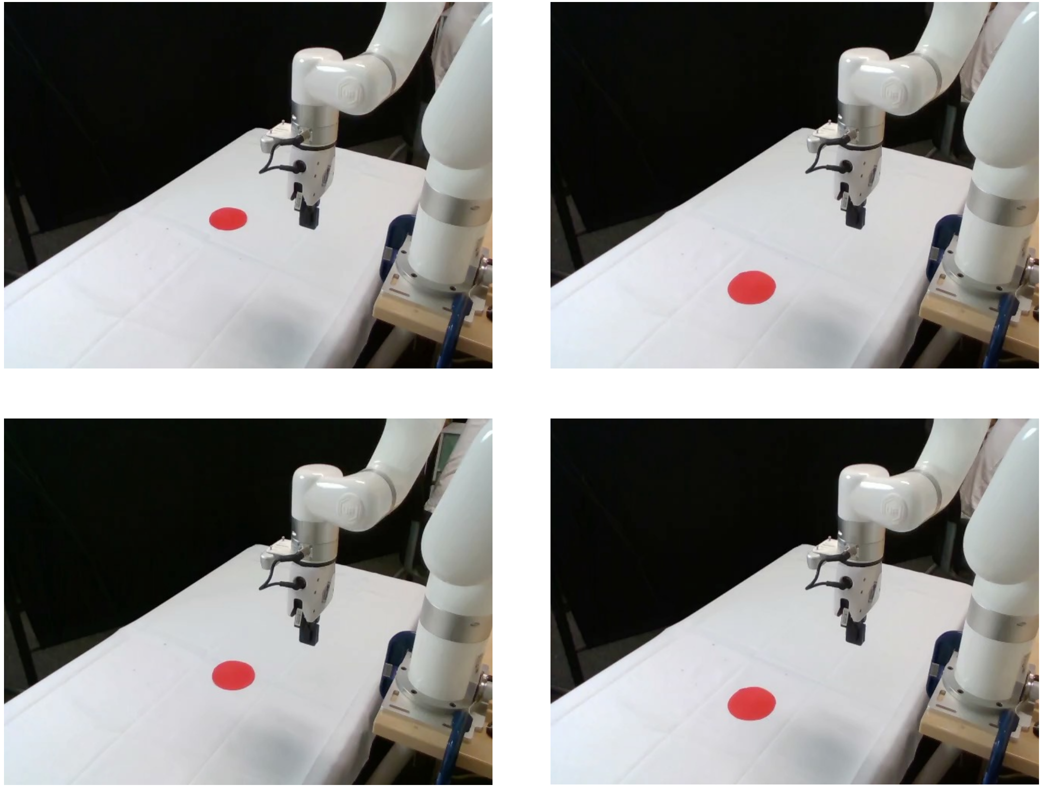
Peg in Box

MoCo Pretrain



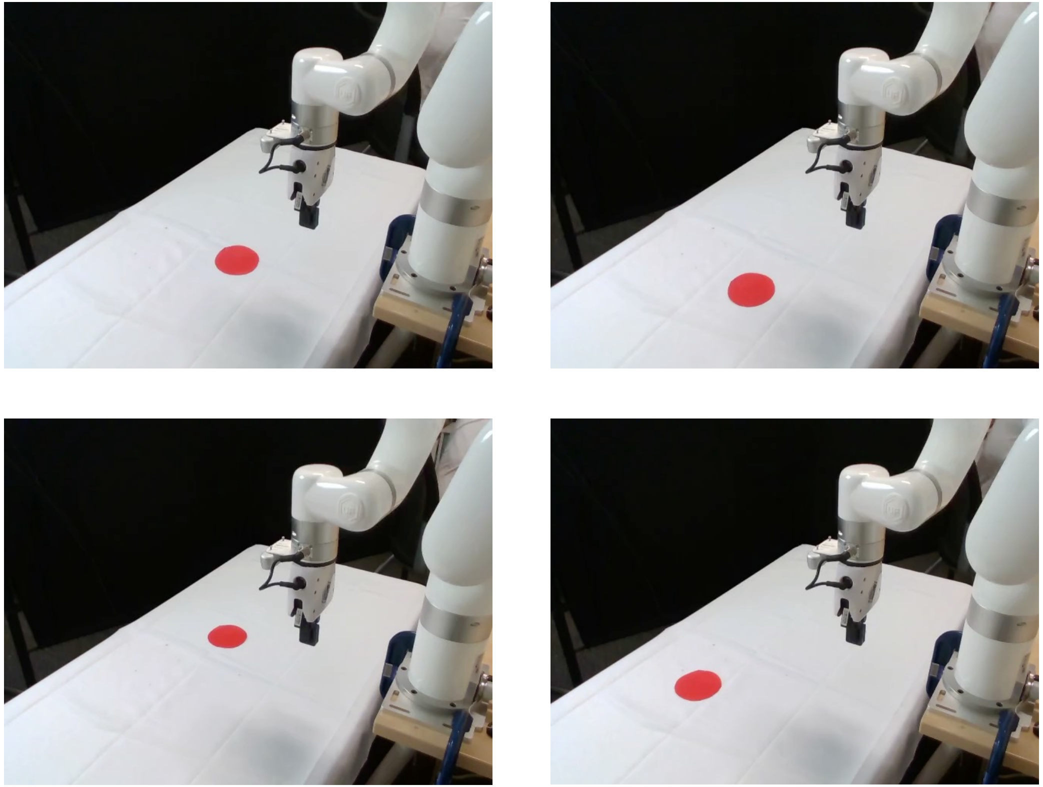
Reach

Ours (3D Pretrain)



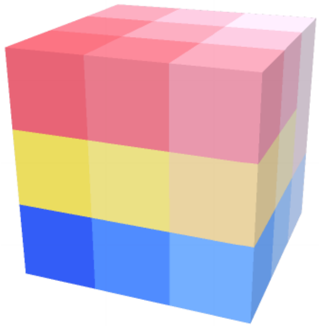
Reach

MoCo Pretrain



Our Method

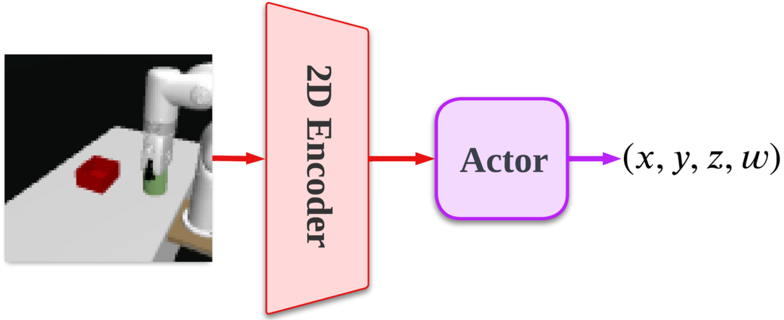
We use a voxel-based 3D scene representation.



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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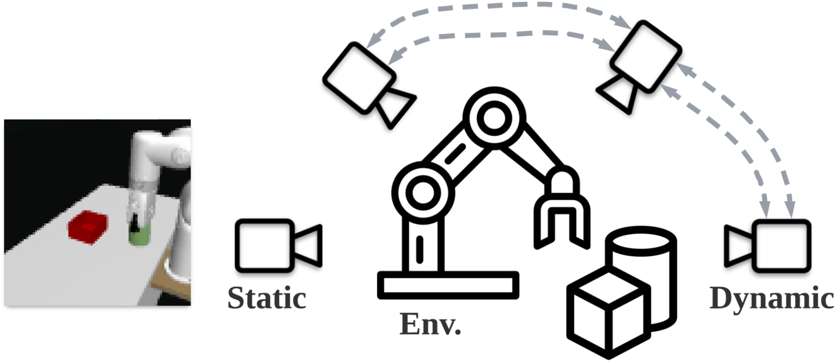
3D



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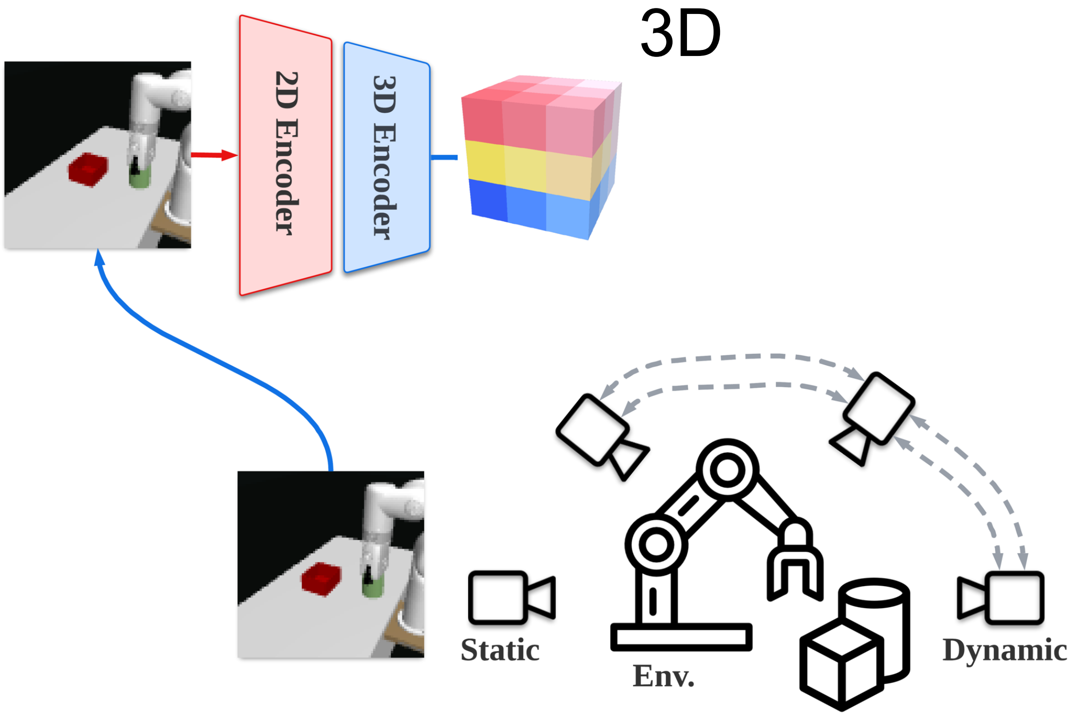

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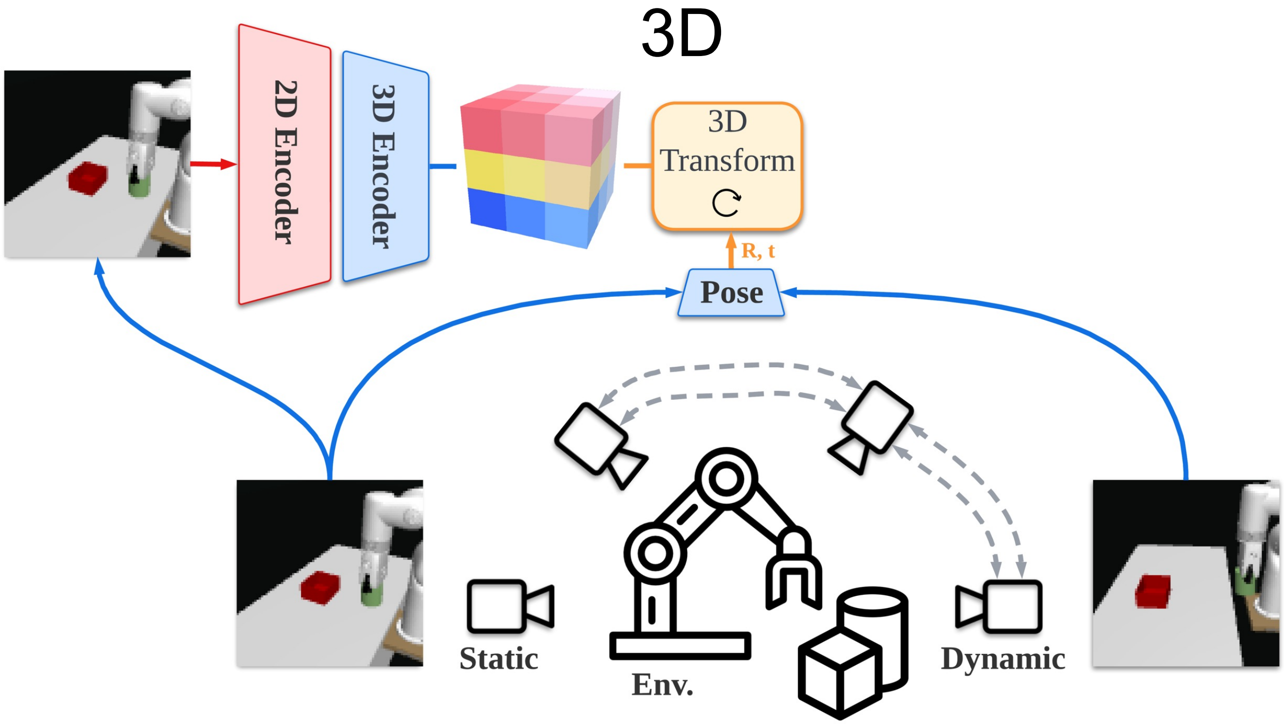

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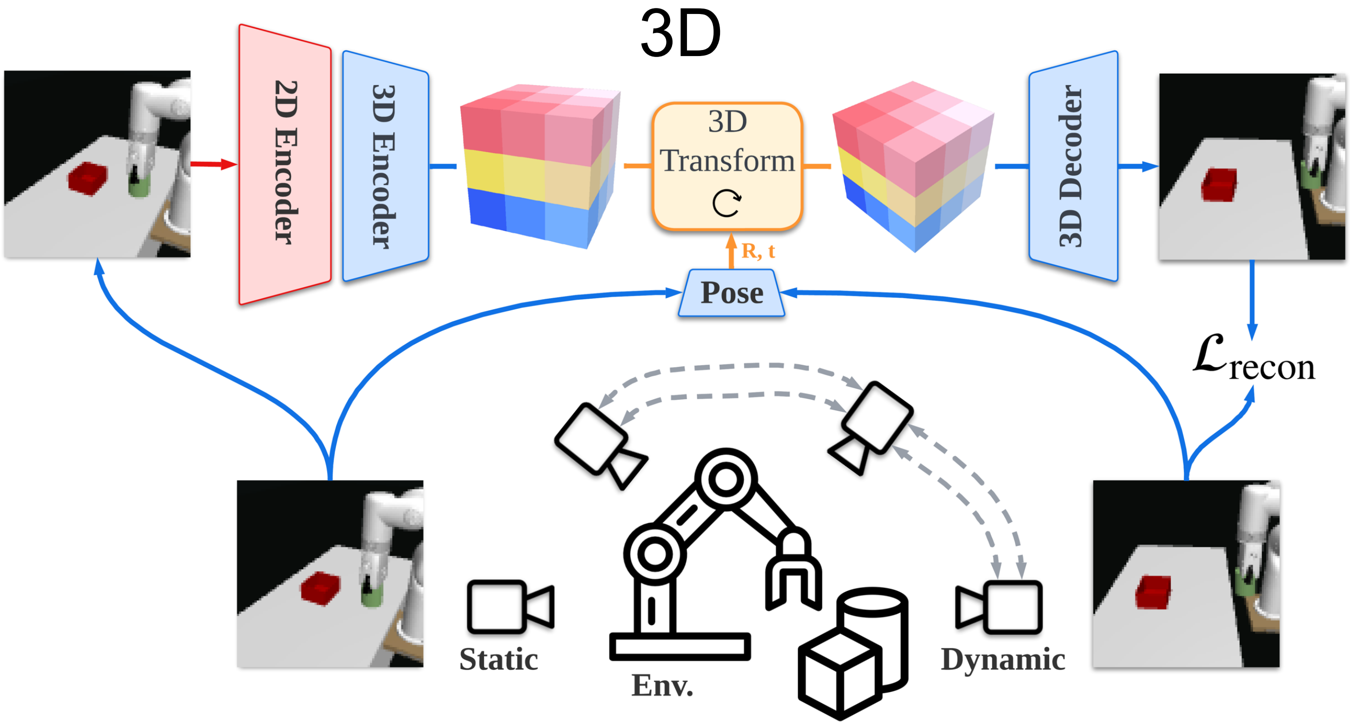

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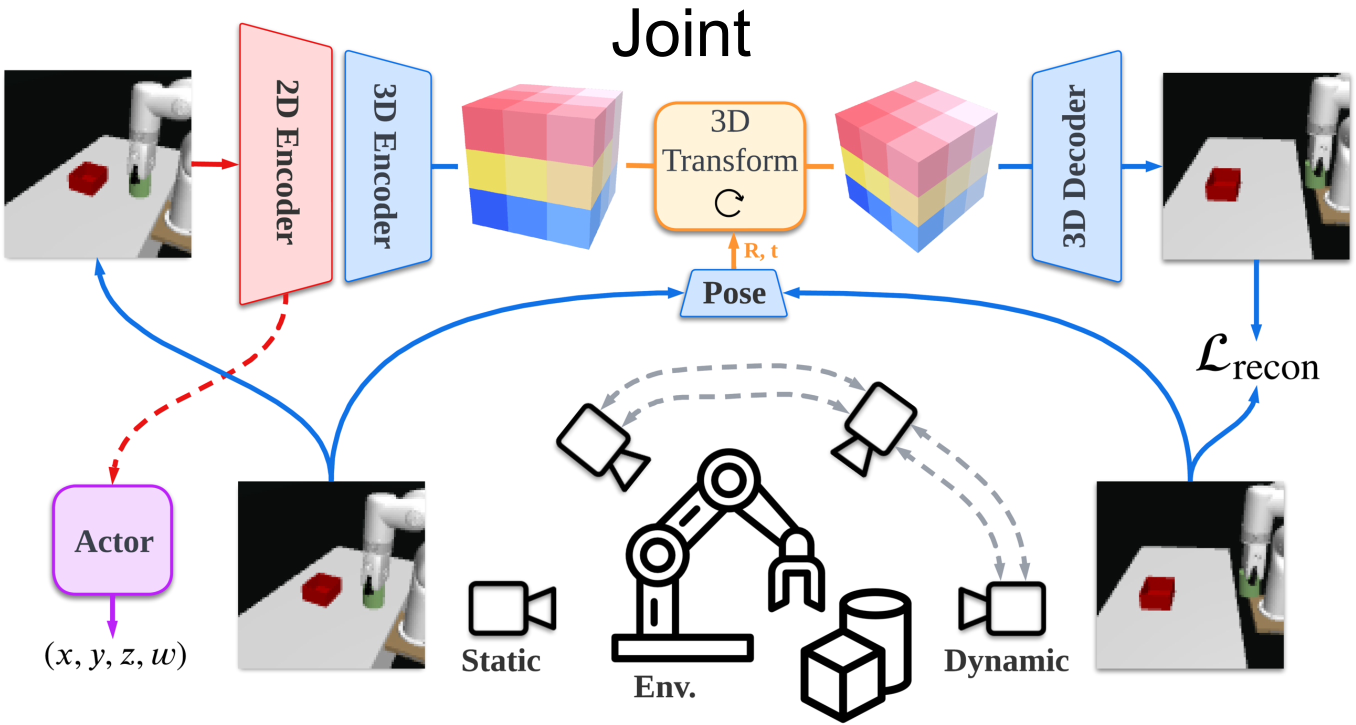
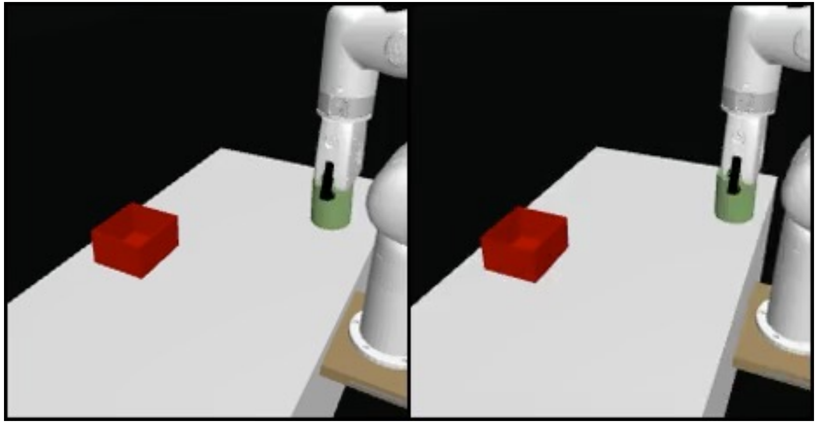
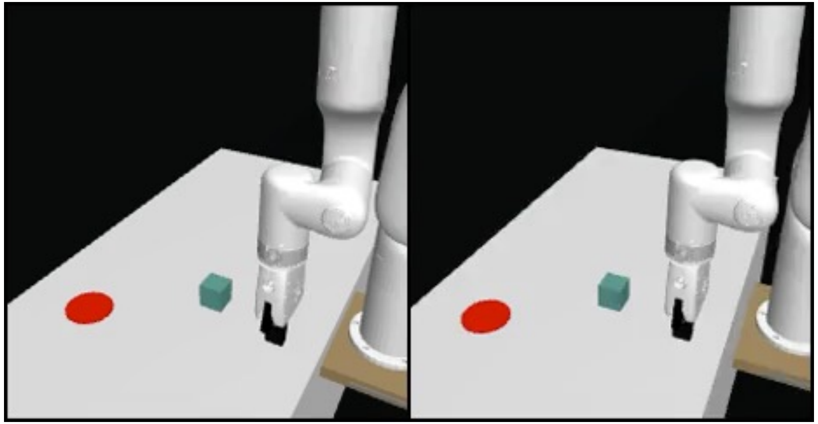


To achieve this, we need at least two cameras for RL tasks. We design one static camera and one dynamic camera.

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 (*ours*)
Reach	84$\pm$12	**96**$\pm$**4**	80$\pm$11	**96**$\pm$**4**
Push	2$\pm$2	22$\pm$10	22$\pm$7	**48**$\pm$**9**
Peg in Box	40$\pm$14	62$\pm$20	50$\pm$15	**76**$\pm$**19**
Grasp	44$\pm$14	20$\pm$10	38$\pm$10	**62**$\pm$**14**
Lift	30$\pm$15	2$\pm$2	20$\pm$5	**46**$\pm$**19**

Thanks!