PEARL

Efficient Off-Policy Meta-Reinforcement Learning via Probabilistic Context Variables

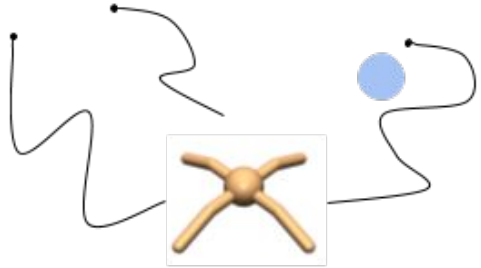
Kate Rakelly*, Aurick Zhou*, Deirdre Quillen, Chelsea Finn, Sergey Levine

“Hula Beach”, “Never grow up”, “The Sled” - by artist Matt Spangler, *mattspangler.com*

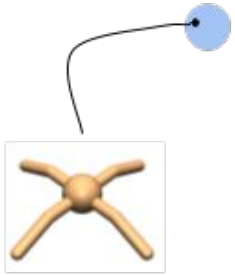
Meta-Reinforcement Learning

meta-testing

Given a small amount of experience...

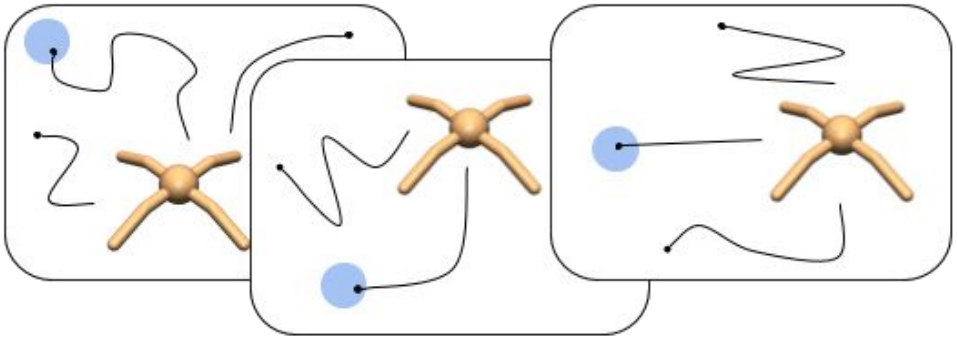


Learn to solve the task!



meta-training

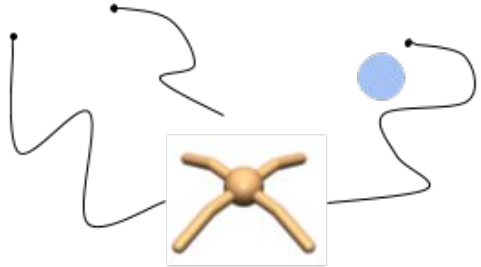
By learning to solve other related tasks



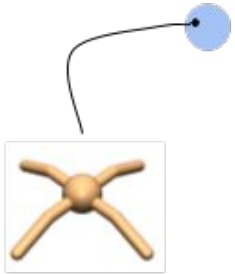
Meta-Reinforcement Learning

meta-testing

Given a small amount of experience...

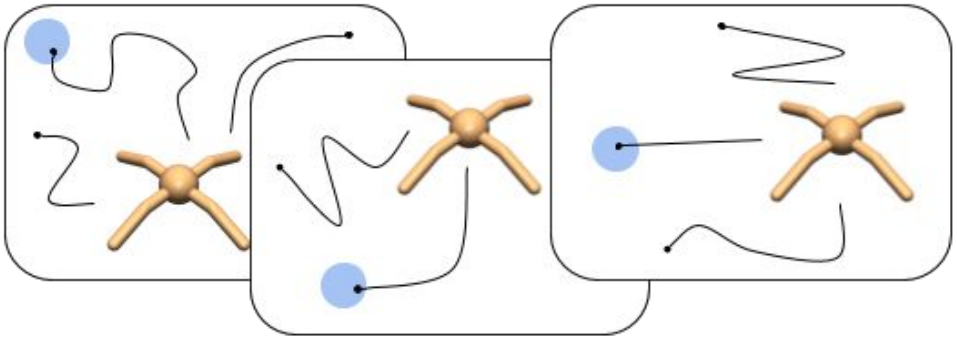


Learn to solve the task!



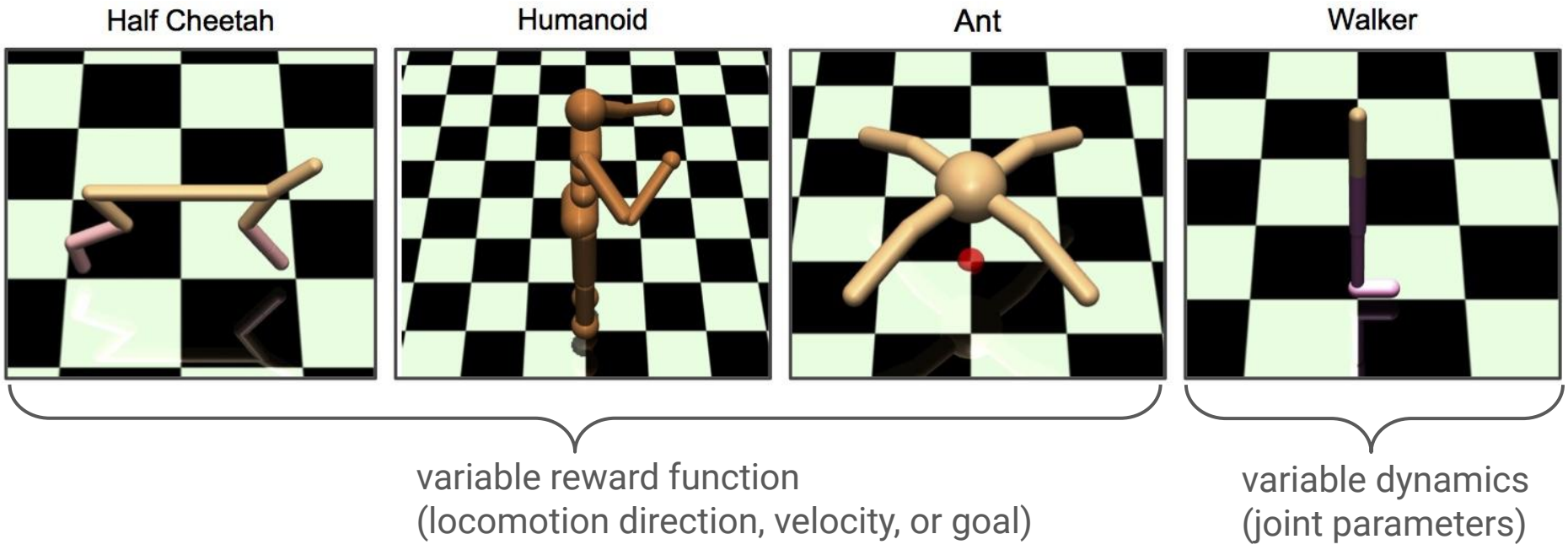
meta-training

By learning to solve other related tasks

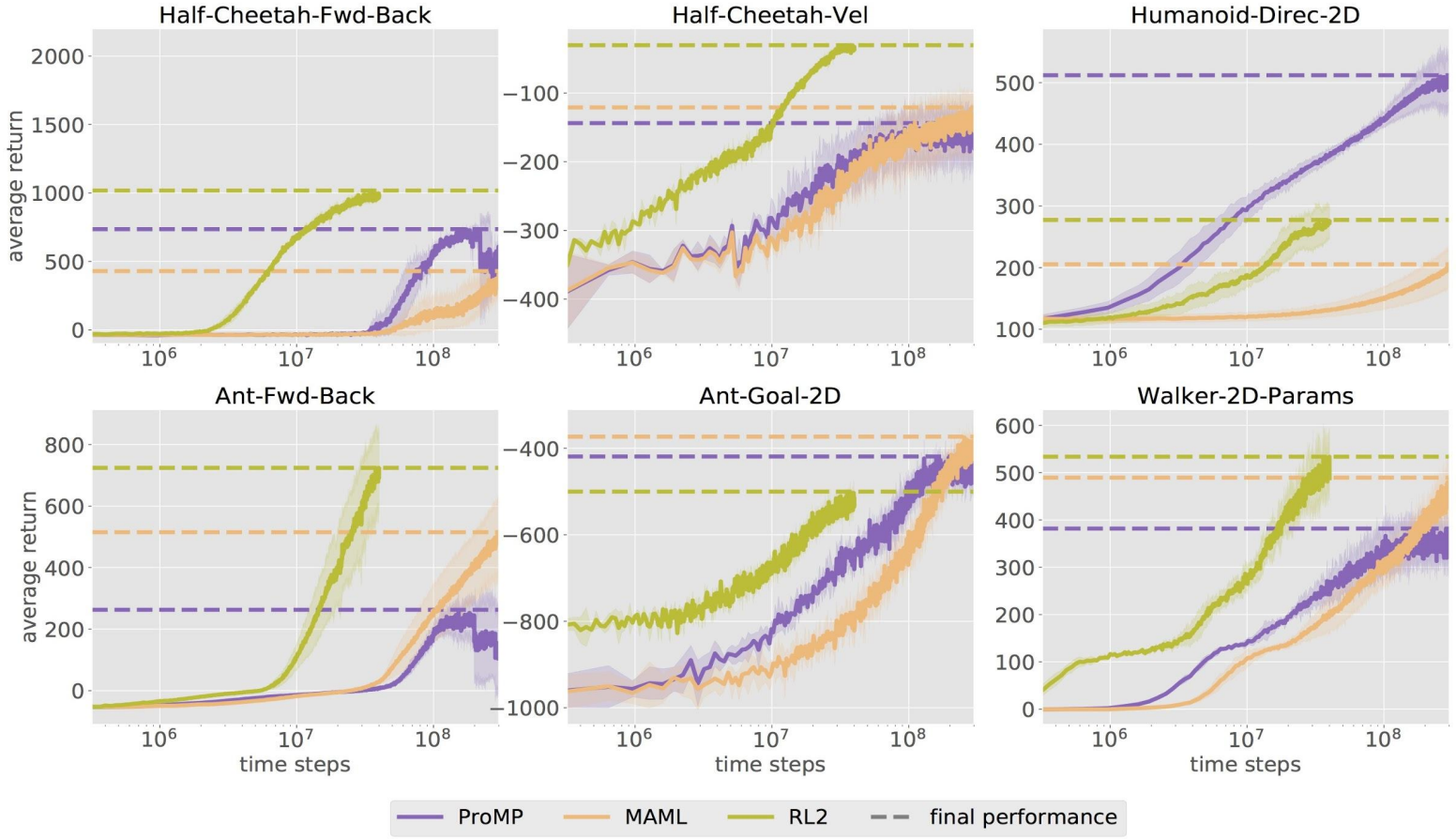


requires data from each task, exacerbates sample inefficiency of RL

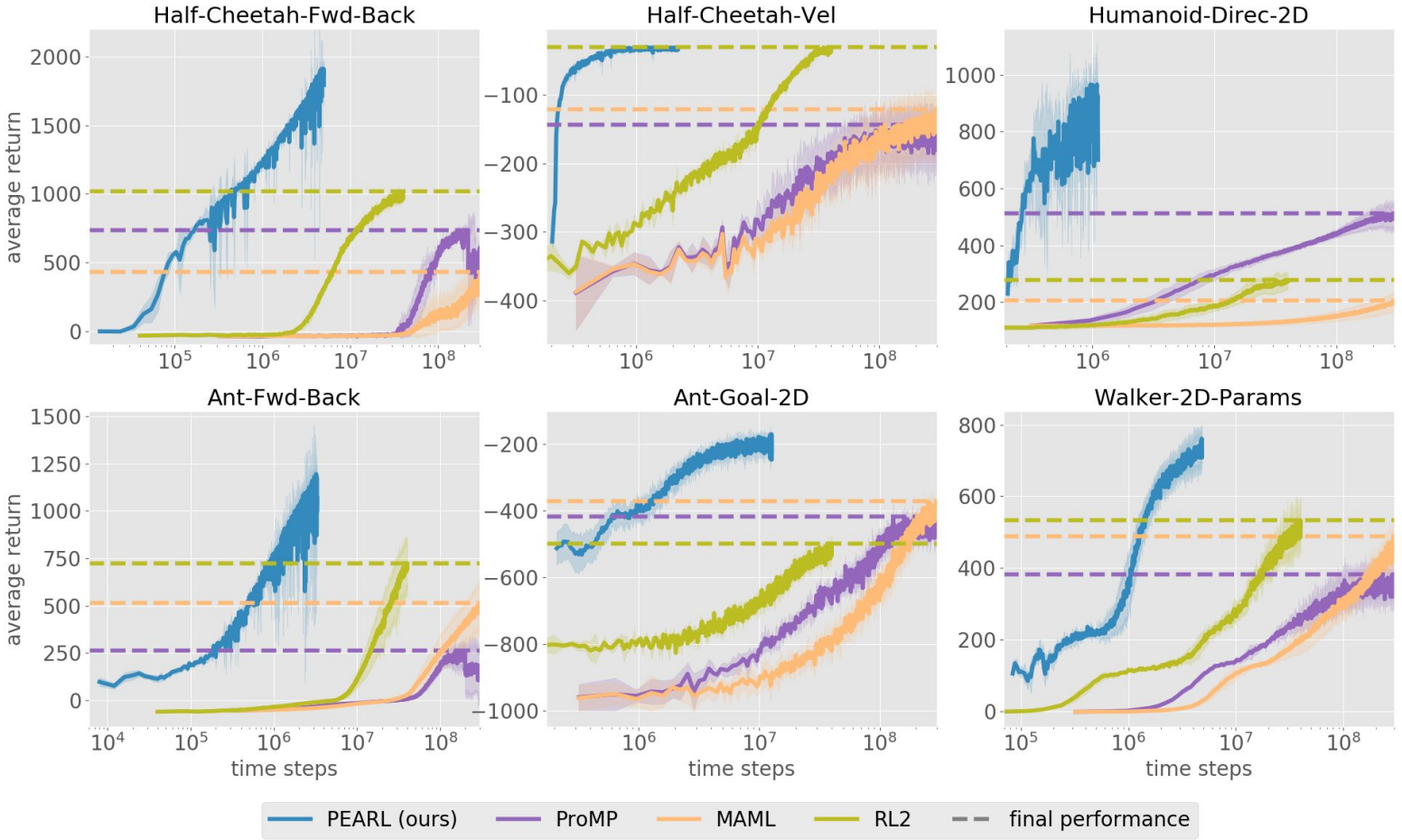
Meta-RL Experimental Domains



Simulated via MuJoCo (Todorov et al. 2012), tasks proposed by (Finn et al. 2017, Rothfuss et al. 2019)



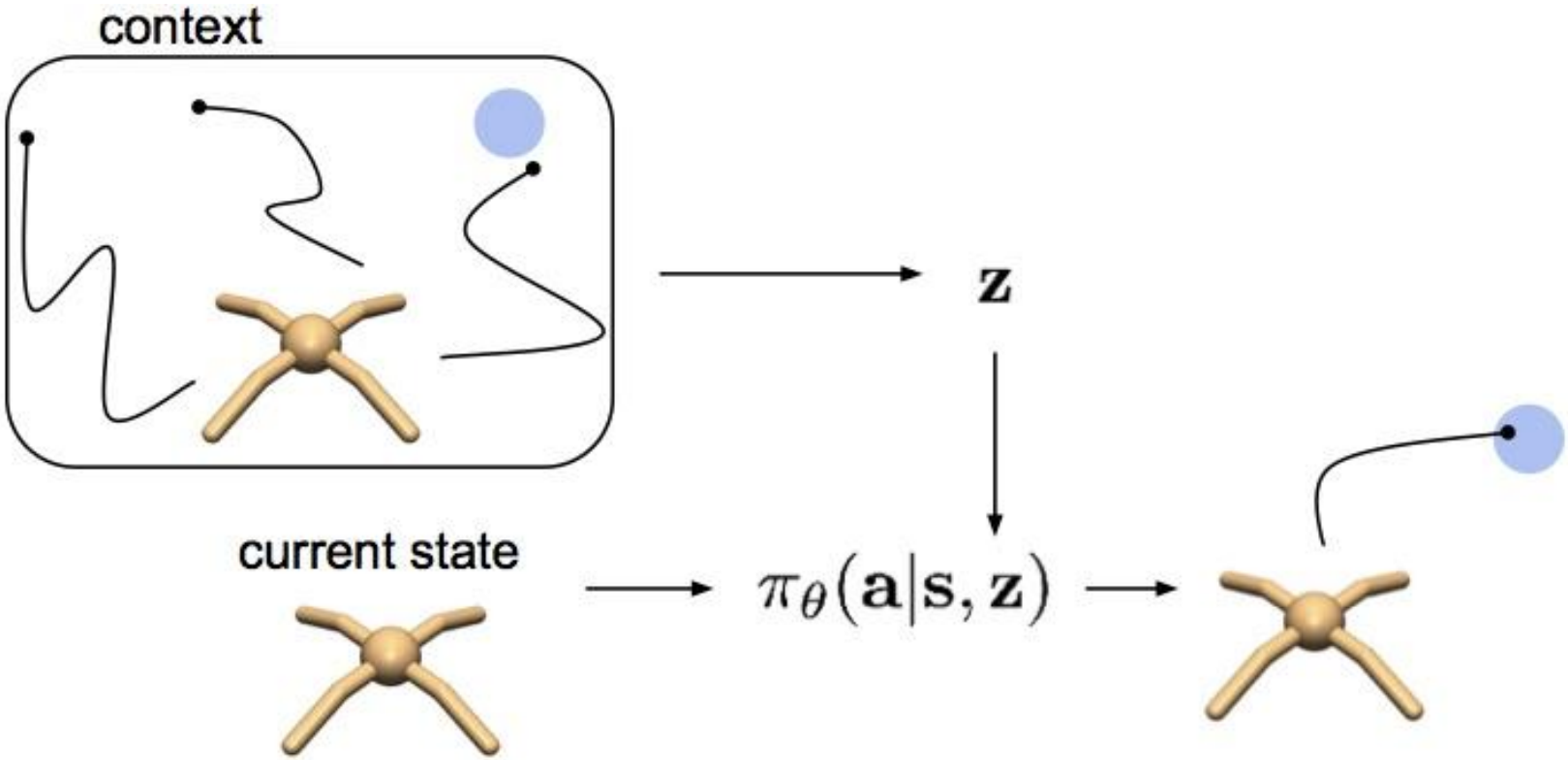
ProMP (Rothfuss et al. 2019), MAML (Finn et al. 2017), RL2 (Duan et al. 2016)



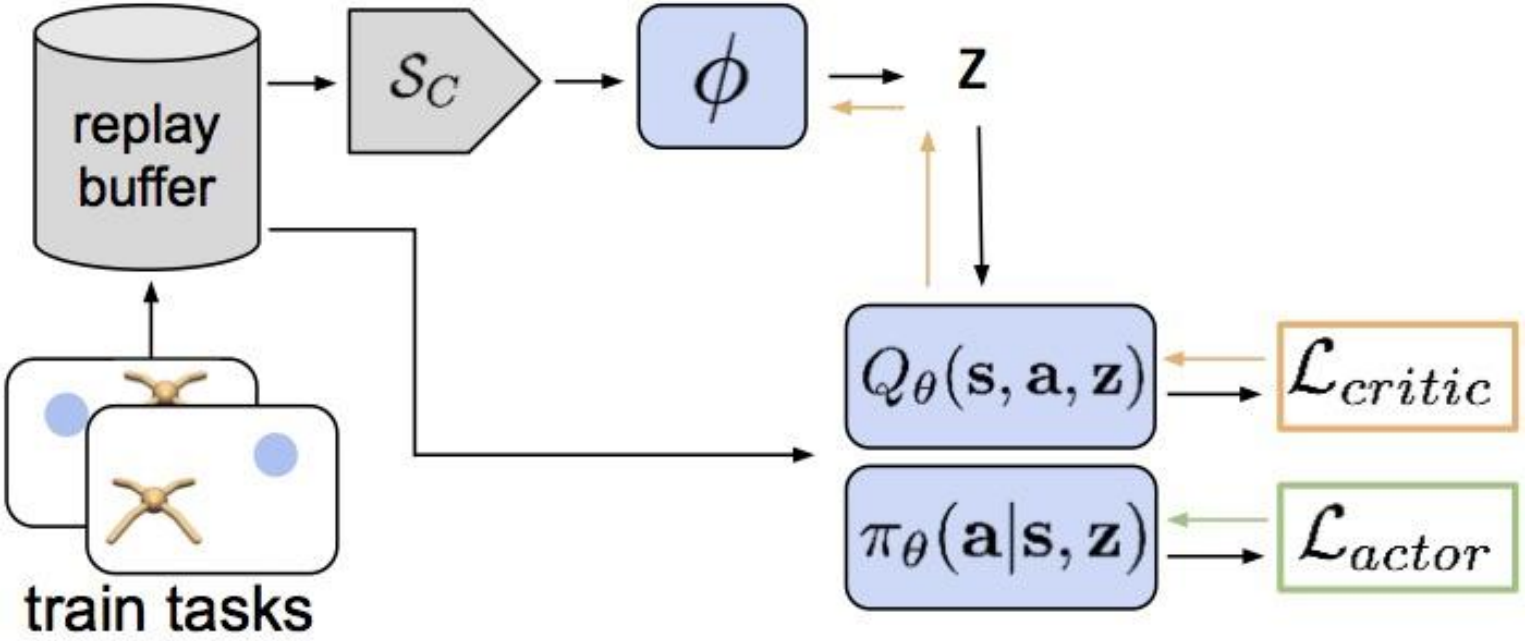
20-100X more sample efficient!

ProMP (Rothfuss et al. 2019), MAML (Finn et al. 2017), RL2 (Duan et al. 2016)

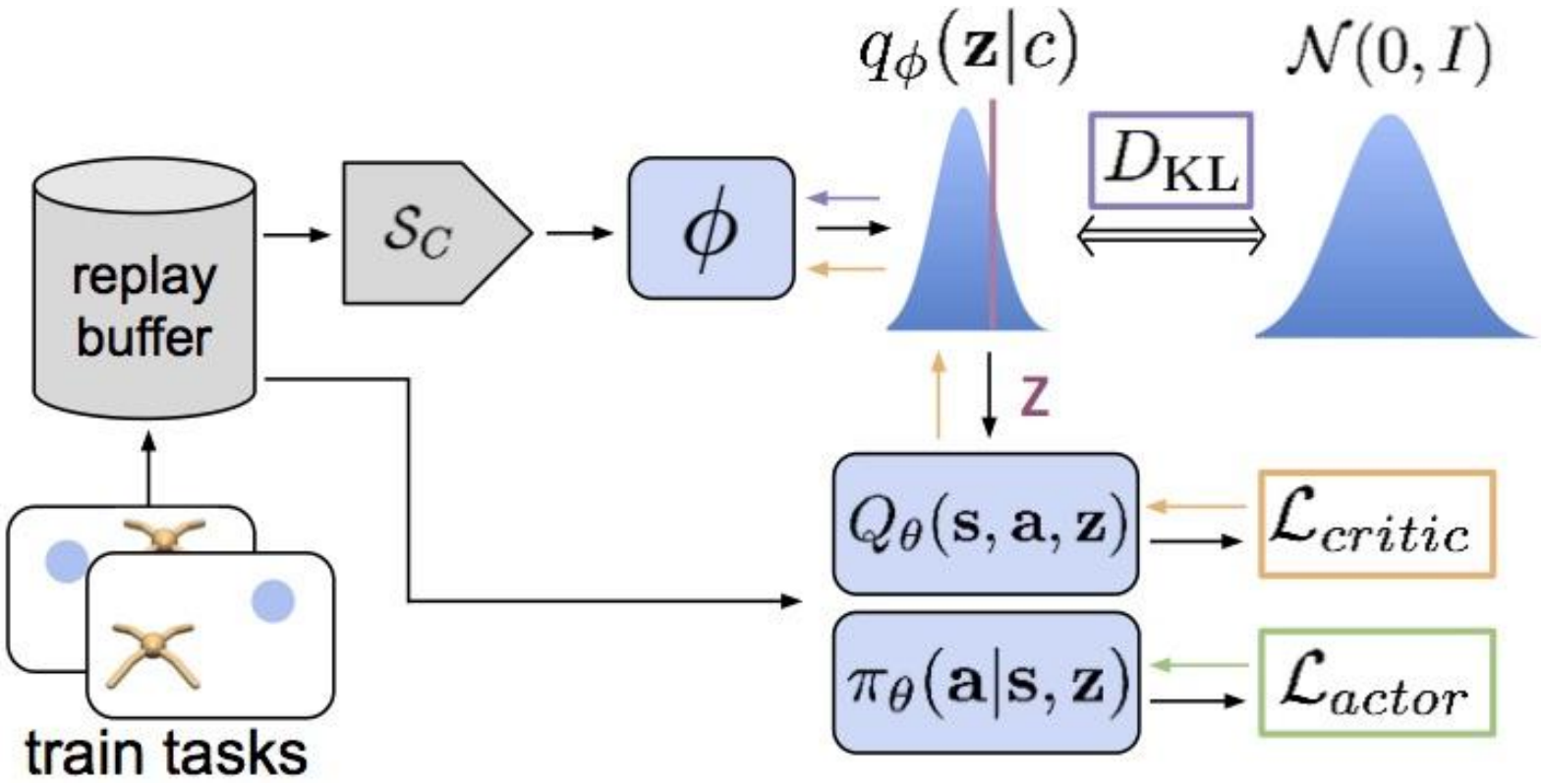
Disentangle task inference from control



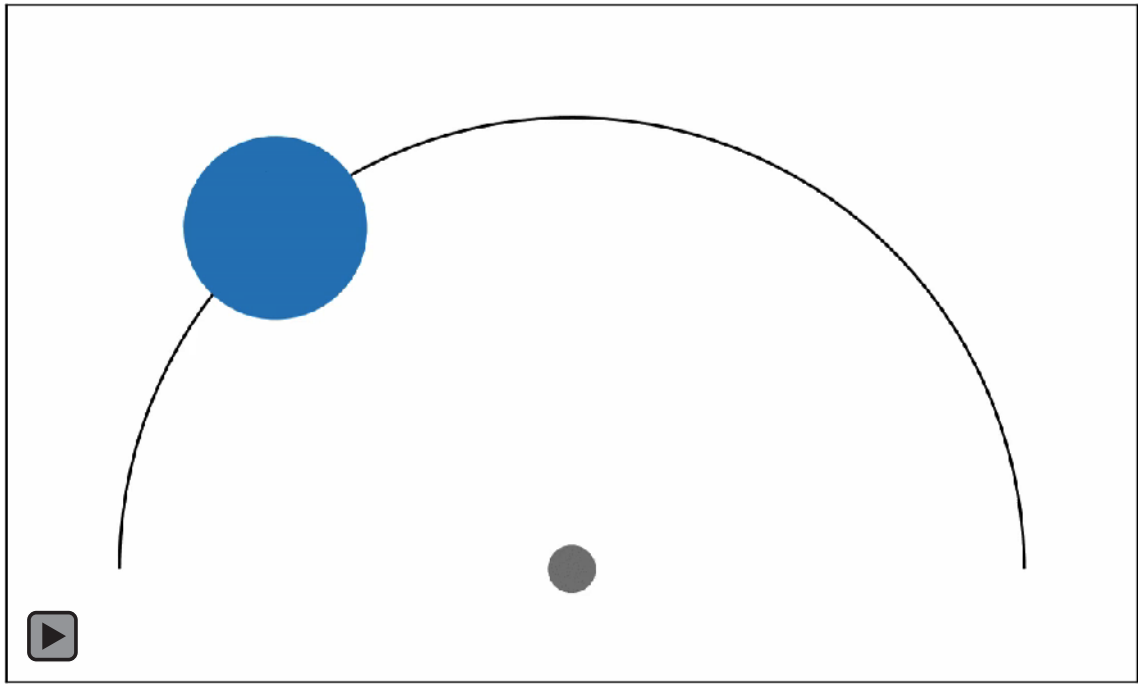
Off-Policy Meta-Training



Efficient exploration by posterior sampling



Posterior sampling in action



Takeaways

PEARL

- First off-policy meta-RL algorithm
- 20-100X improved sample efficiency on the domains tested, often substantially better final returns
- Probabilistic belief over the task enables posterior sampling for efficient exploration

arXiv: arxiv.org/abs/1903.08254v1

GitHub: github.com/katerakelly/oyster

Come talk to us tonight at Poster 40!