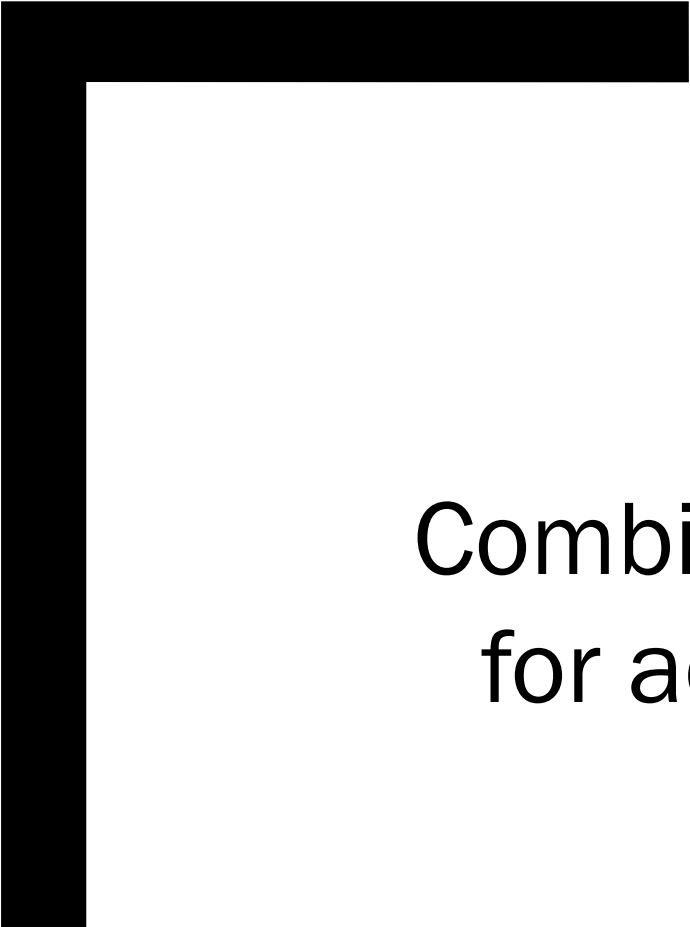
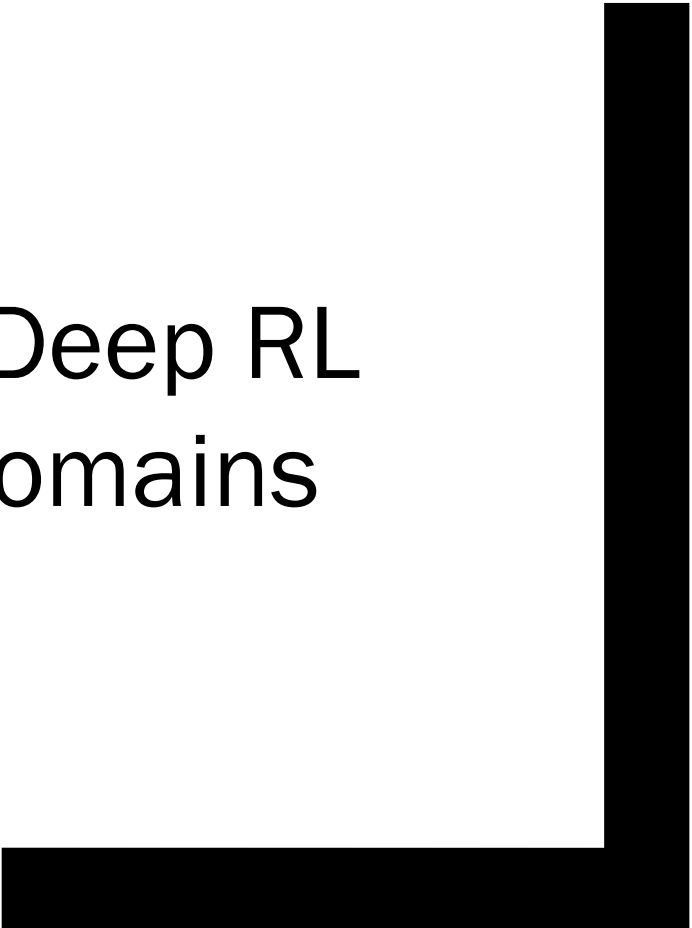




Deep RePReL

Combining Planning and Deep RL
for acting in relational domains





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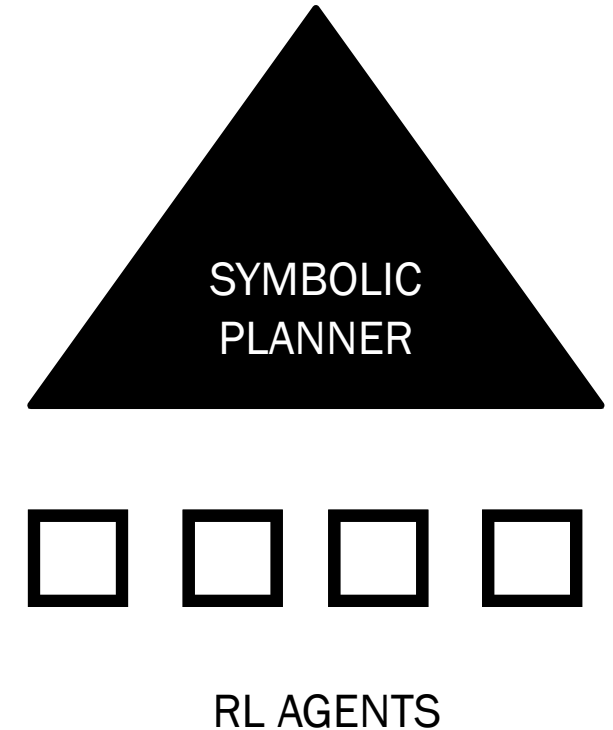


Relational Domains



RePReL

- Plan the sequence of high level subgoals and learn to execute each subgoal at lower level
- Advantage:
 - *Compositionality*
 - *Task specific state representations*
- Relational MDP which is deterministic and fully observable
- Adapt First Order Conditional Influence statements to specify bisimulation conditions of MDPs for ‘safe’ abstractions.



D-FOCI

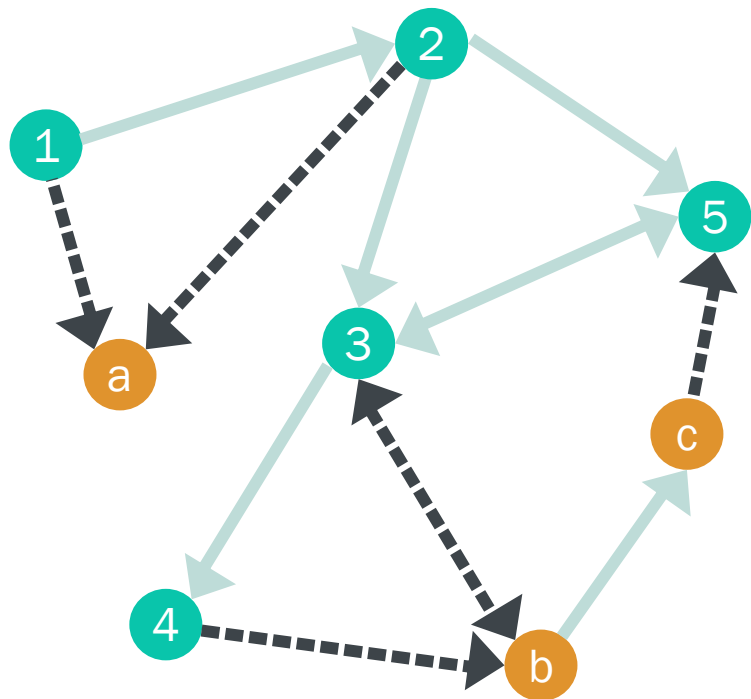
First Order Conditional Influence (FOCI) statements

if *condition* then $X1$ influence $X2$

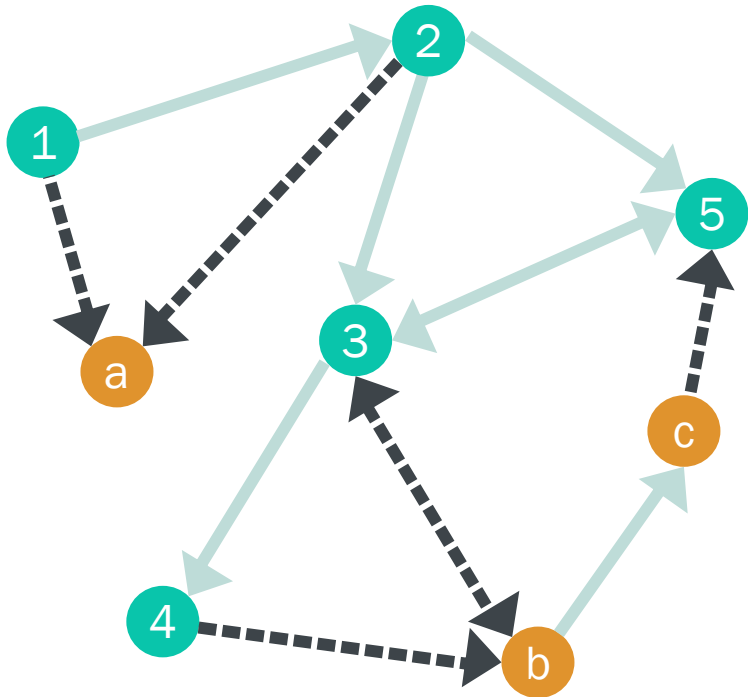
Dynamic FOCI statements

sub-task : $X1 \xrightarrow{+1} X2$

Example

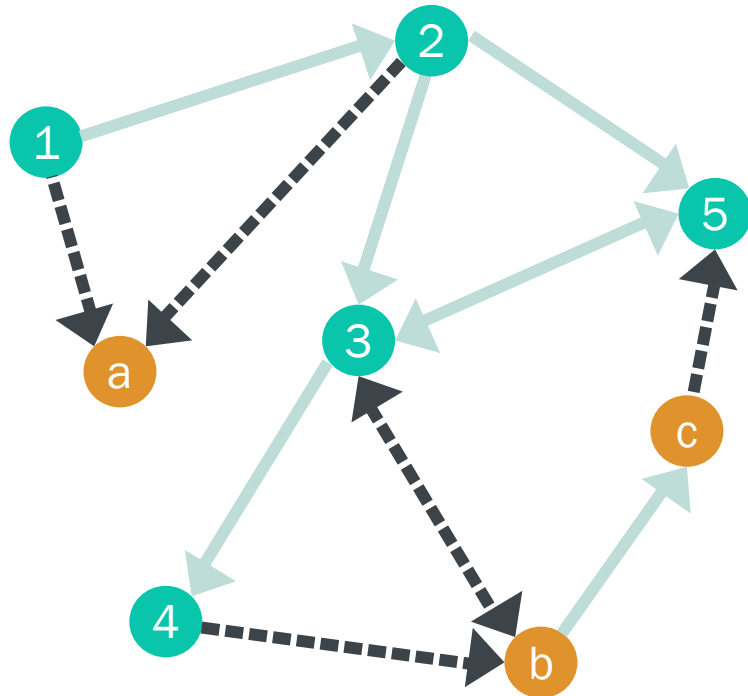


Example



task1(x): $Y \rightarrow X \xrightarrow{+1} X$

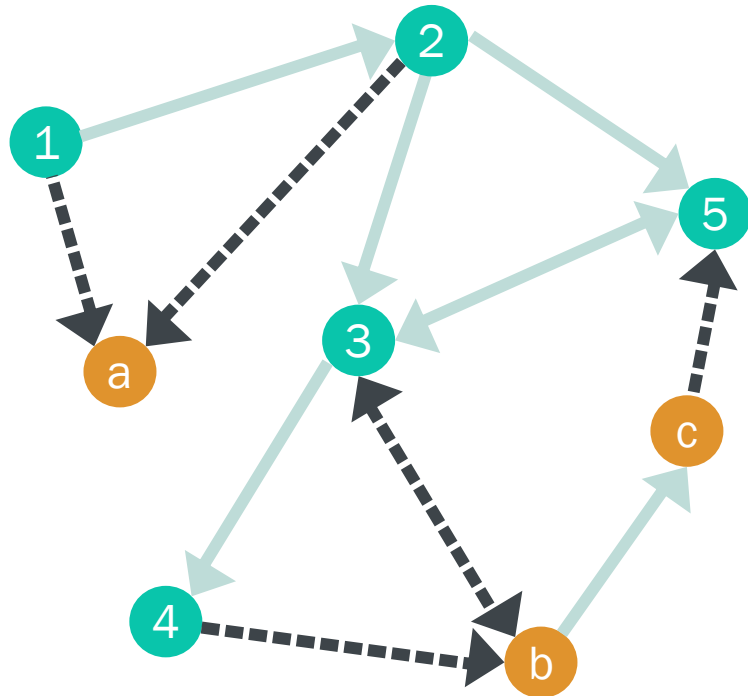
Example



task1(x): Y $\xrightarrow{\quad}$ X $\xrightarrow{+1}$ X

task1(x): X $\xrightarrow{+1}$ Reward

Example



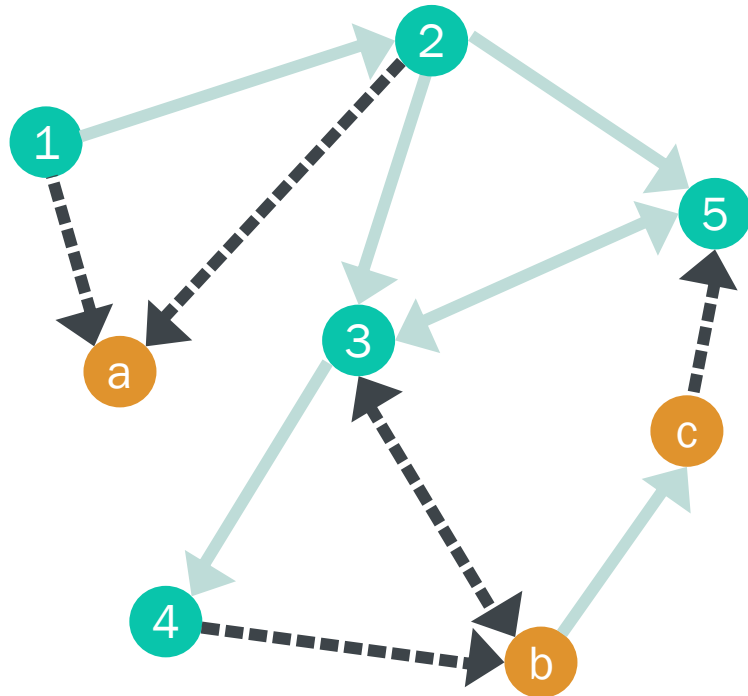
task1(x): $Y \xrightarrow{\quad} X \xrightarrow{+1} X$

task1(x): $X \xrightarrow{+1} \text{Reward}$

Abstract state for
task1(2):



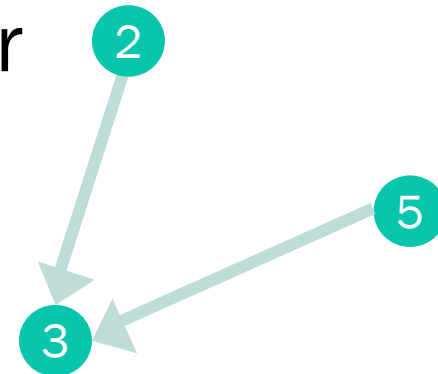
Example



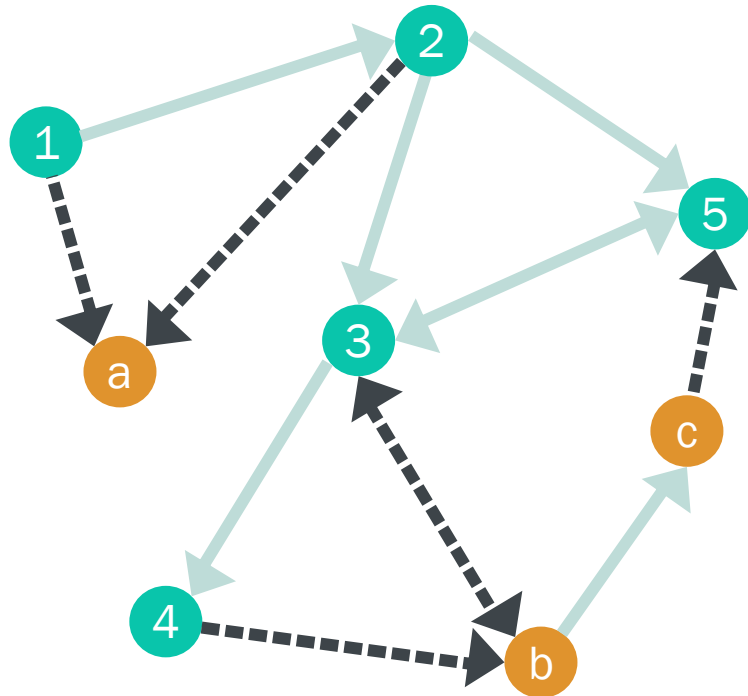
task1(x): $Y \xrightarrow{\quad} X \xrightarrow{+1} X$

task1(x): $X \xrightarrow{+1} \text{Reward}$

Abstract state for
task1(3):



Example

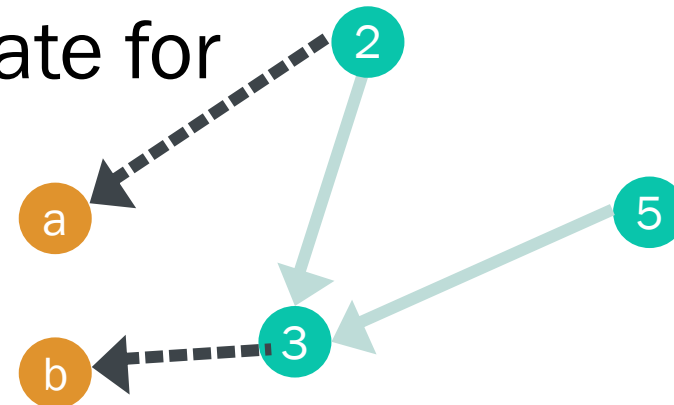


task1(x): $\xrightarrow{\text{dashed}}$ $\xrightarrow{+1}$

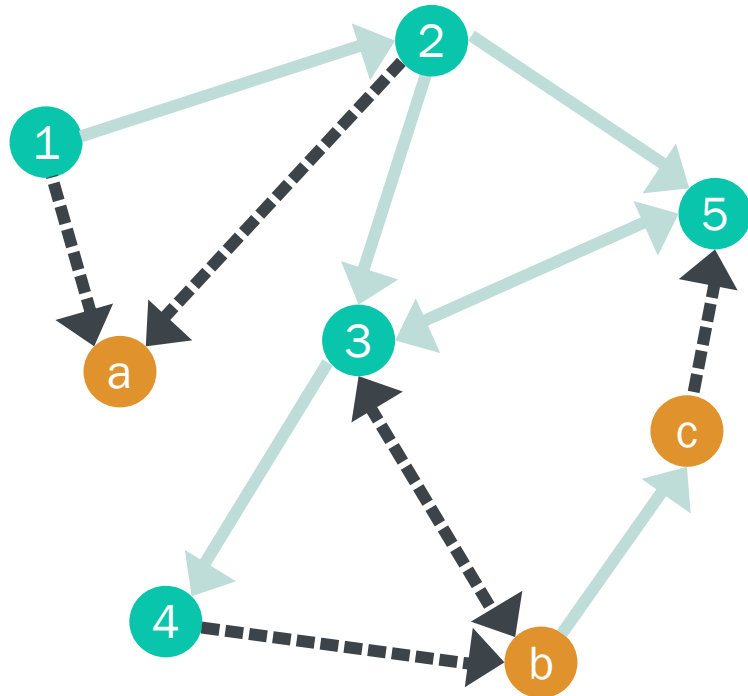
task1(x): $\xrightarrow{\text{solid}}$ $\xrightarrow{+1}$

task1(x): $\xrightarrow{+1}$ Reward

Abstract state for
task1(3):



Example



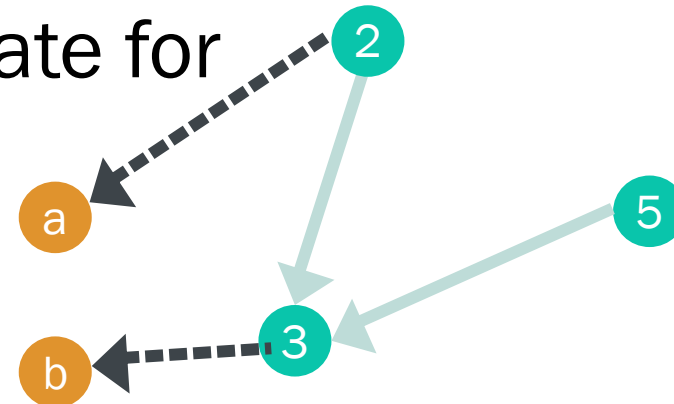
task1(x): $\xrightarrow{\text{dashed}}$ $\xrightarrow{+1}$

task1(x): $\xrightarrow{\text{solid}}$ $\xrightarrow{+1}$

task1(x): $\xrightarrow{+1}$ Reward

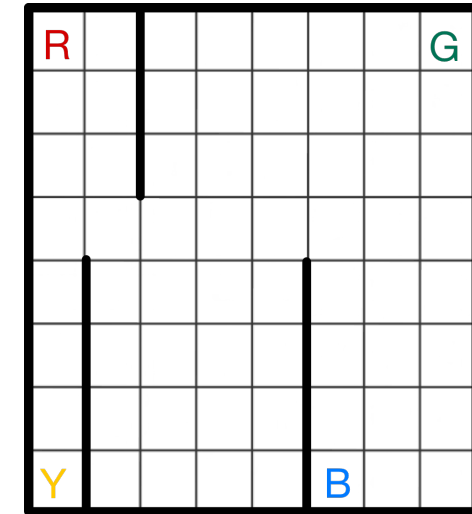


Abstract state for
task1(3):

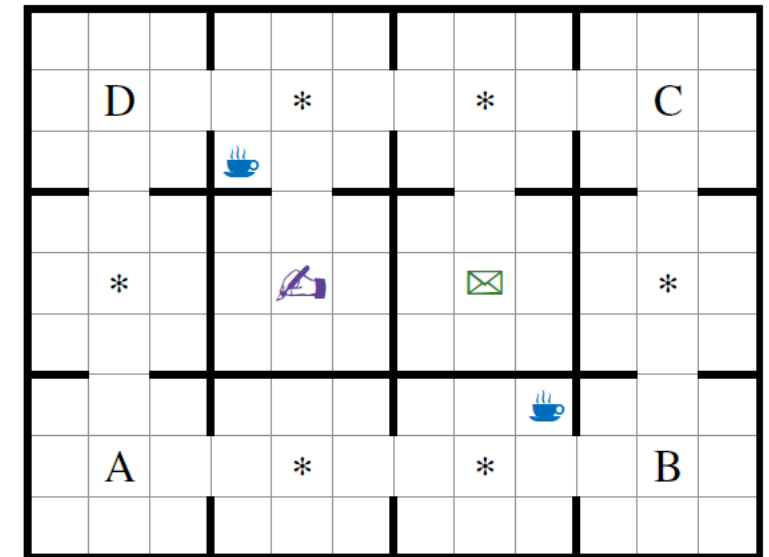


Experiments

- Domains
 - *Taxi and Office World*
- Baselines
 - *DQN*
 - *HDQN*
 - *TRL (Taskable RL, Illanes et al. 2020)*



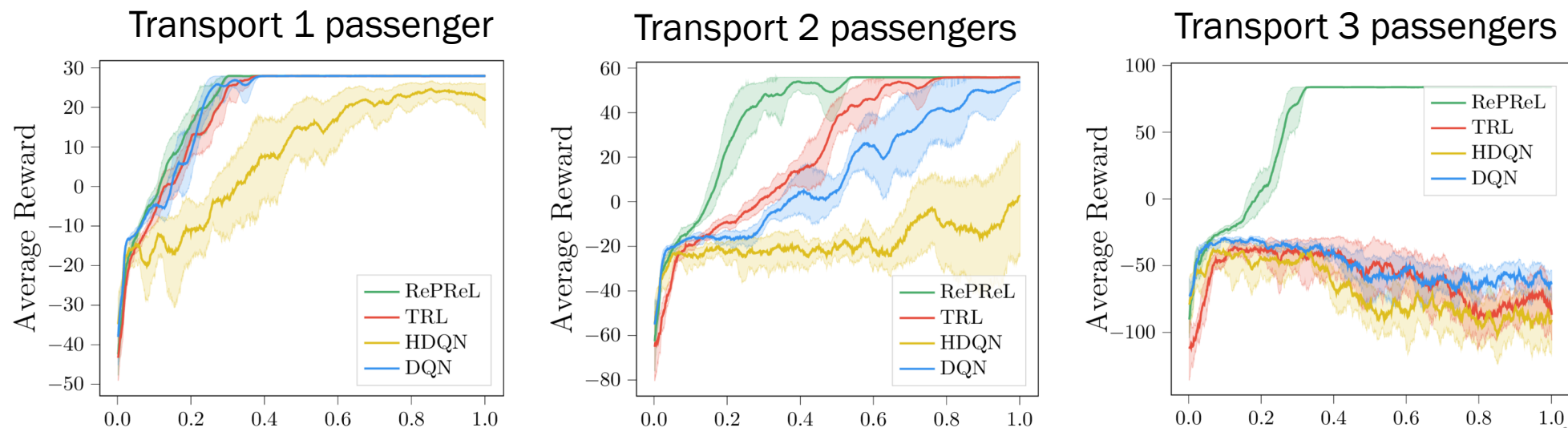
Taxi



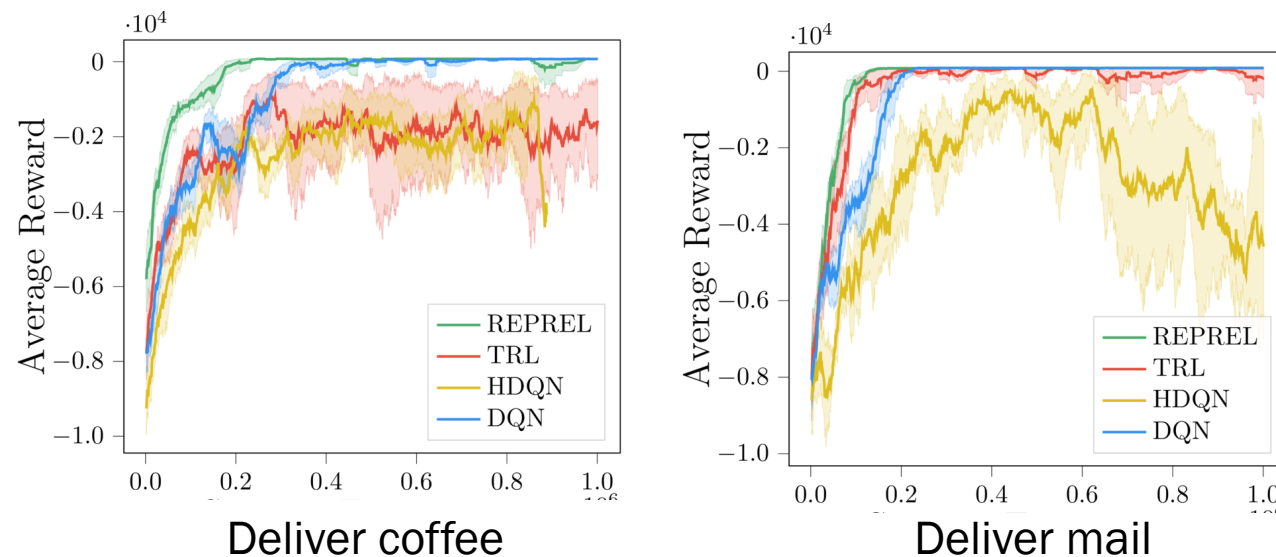
Office

Sample Efficiency

Taxi

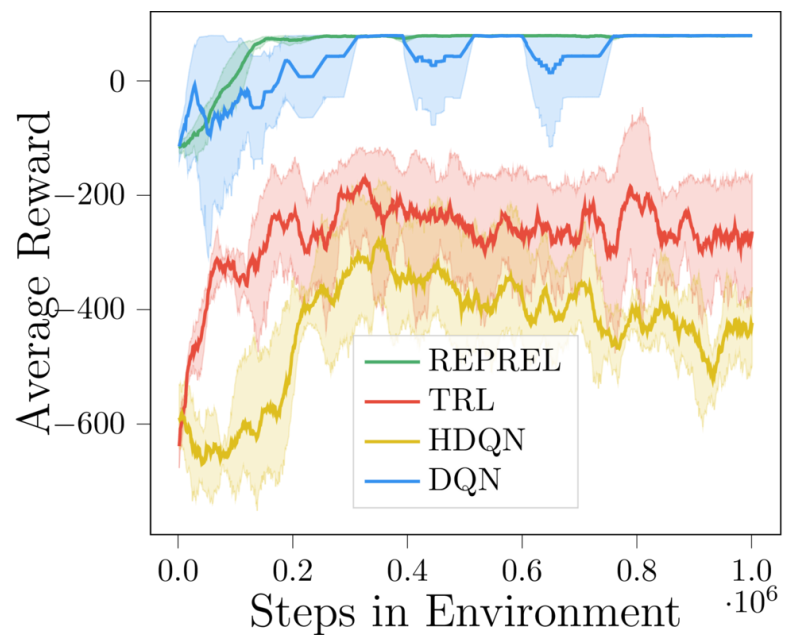


Office

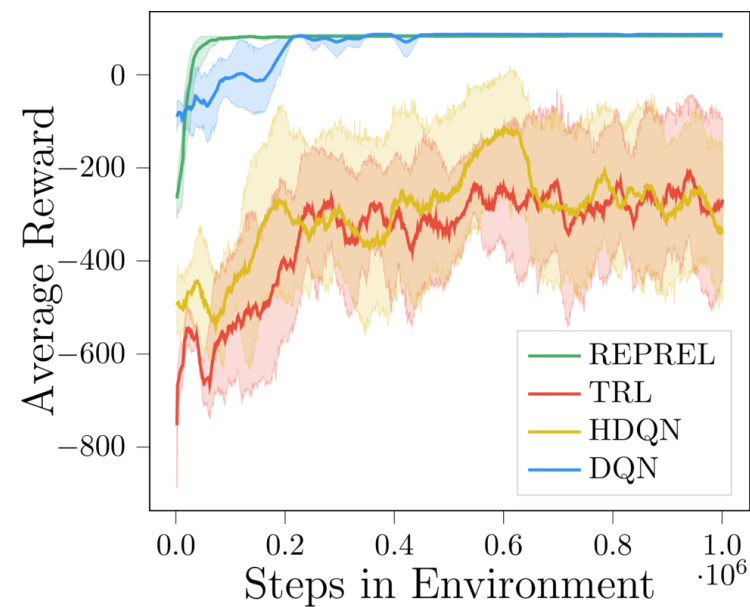


Transfer

With Transfer



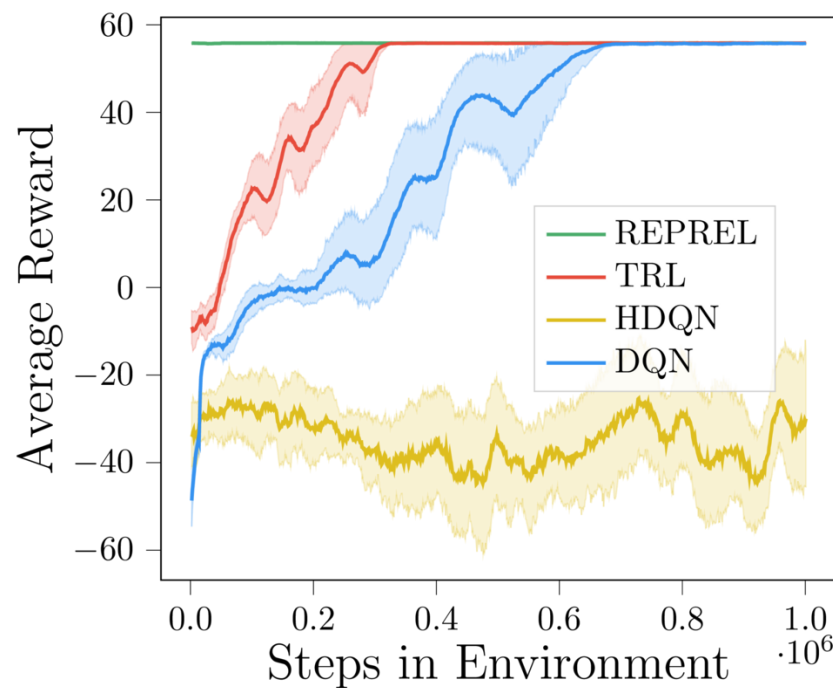
Deliver Coffee



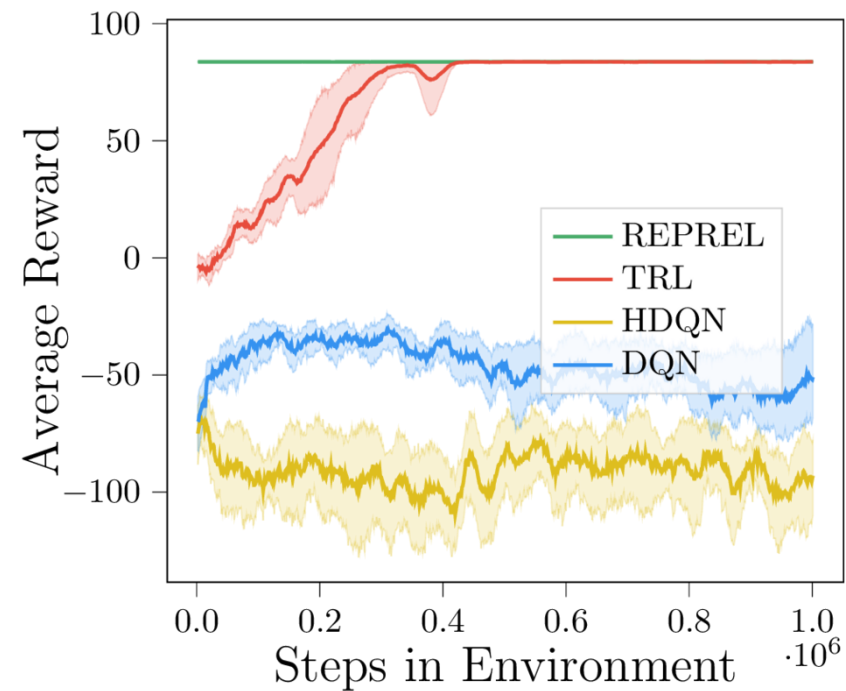
Deliver Mail

Generalization

With Transfer



Transport 2 passengers



Transport 3 passengers

THANKS

