NEURAL INFORMATION PROCESSING SYSTEMS

Domain Adaptive Imitation Learning from Visual Observation

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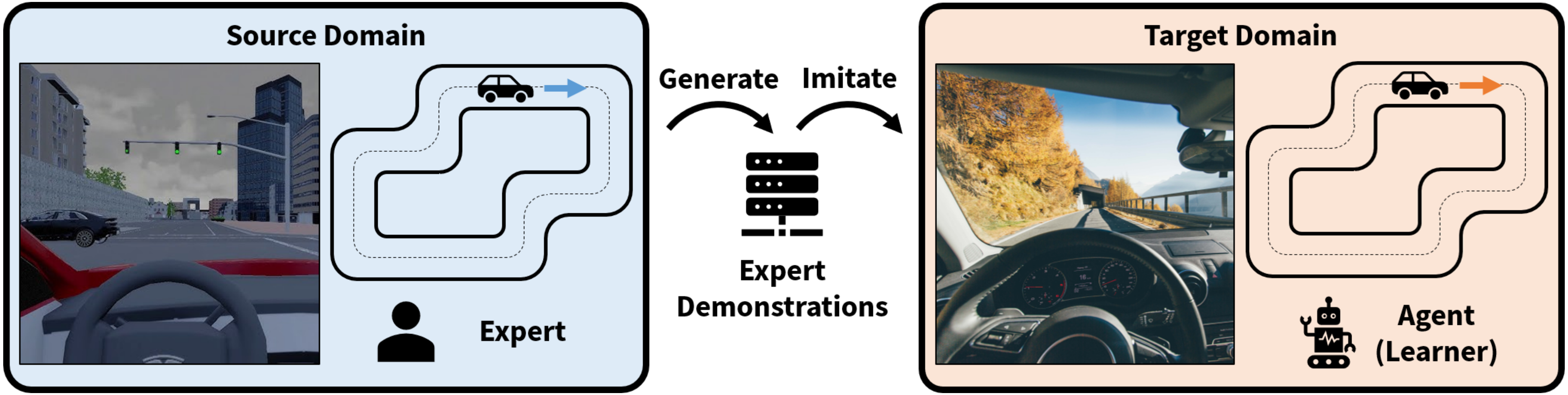
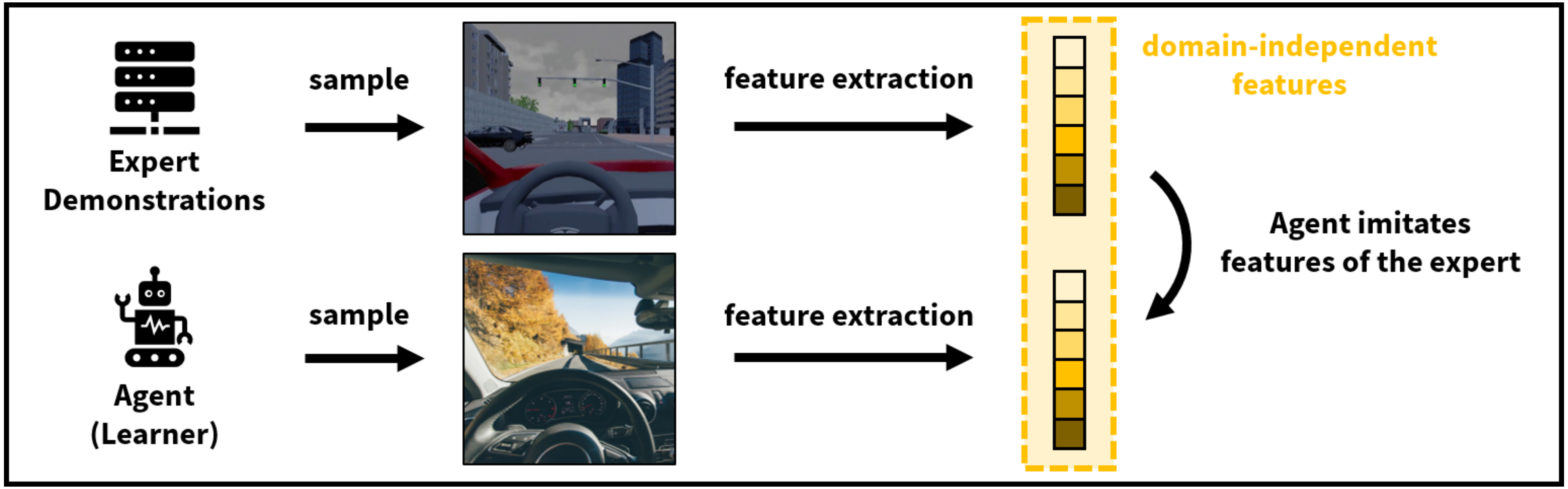
Imitation Learning (IL) with Domain Shift



- Learns behaviors by imitating expert demonstrations without access to true rewards
- Domain shift in IL: Expert domain (source domain) ≠ Agent domain (target domain)
- We focus on the case where the demonstrations are provided as visual observations.

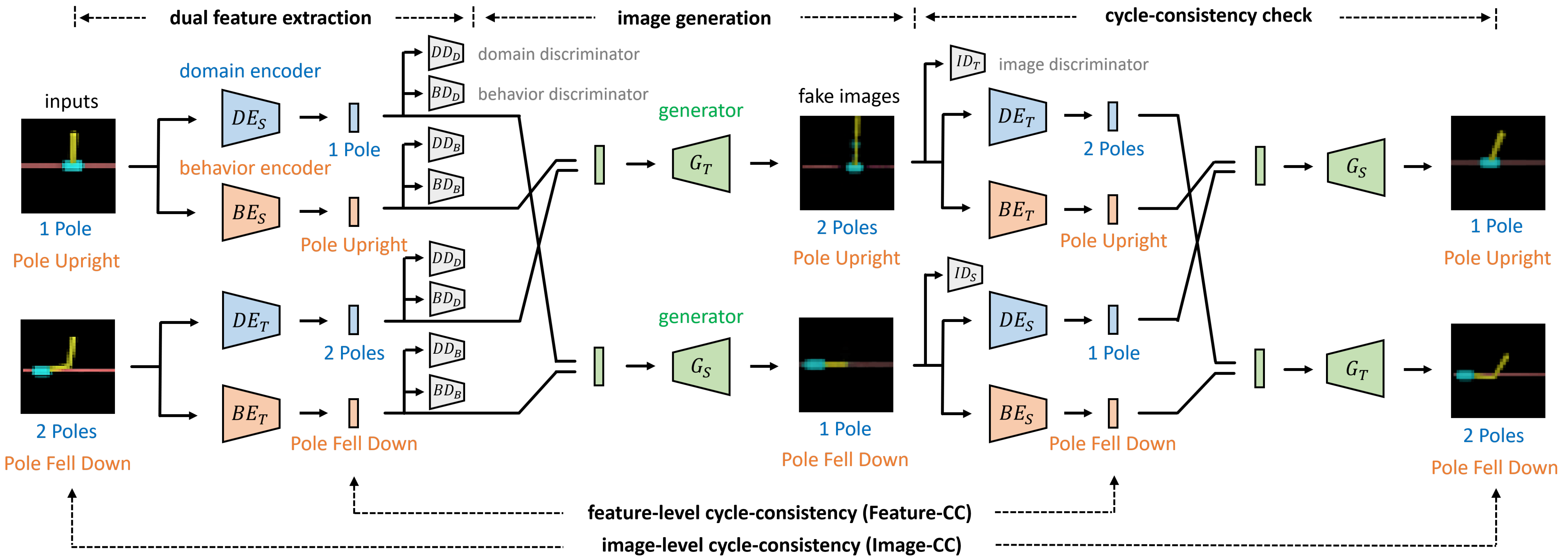
A Problem in Imitation Learning with Domain Shift



- Due to domain shift, the learner cannot directly mimic the expert demonstration.
- We proposed *D3IL (Dual feature extraction and Dual cycle-consistency for Domain adaptive IL with visual observation)* for enhanced feature extraction and policy update.

Methodology

- Our feature extraction model is built based on the ideas of dual feature extraction, image generation, and dual cycle consistency.



Dual Feature Extraction

- The domain feature contains only domain information of the input.
- The behavior feature contains only task-relevant information of the input.

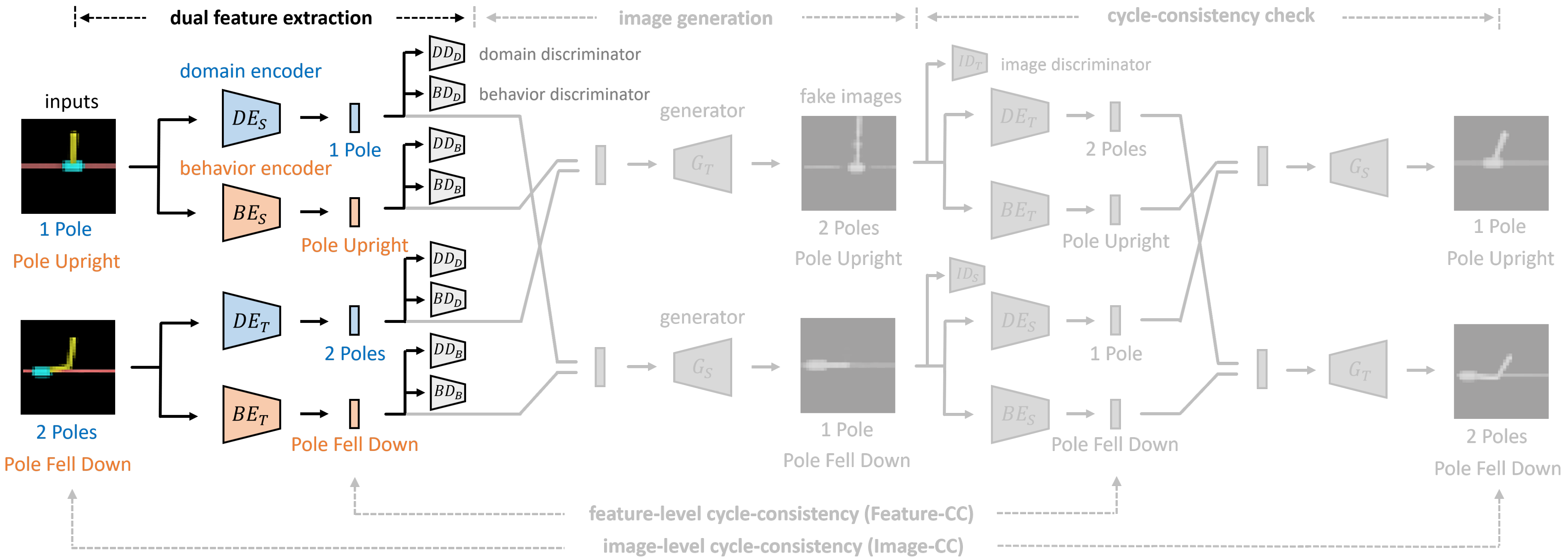
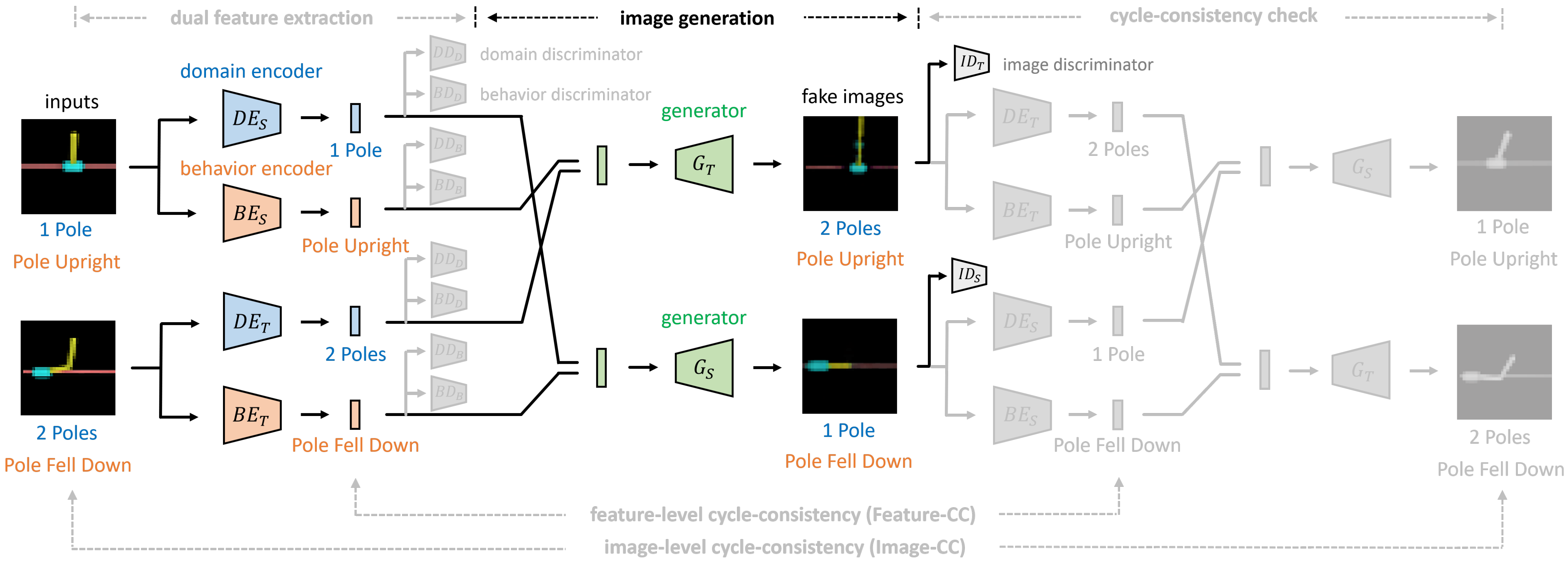


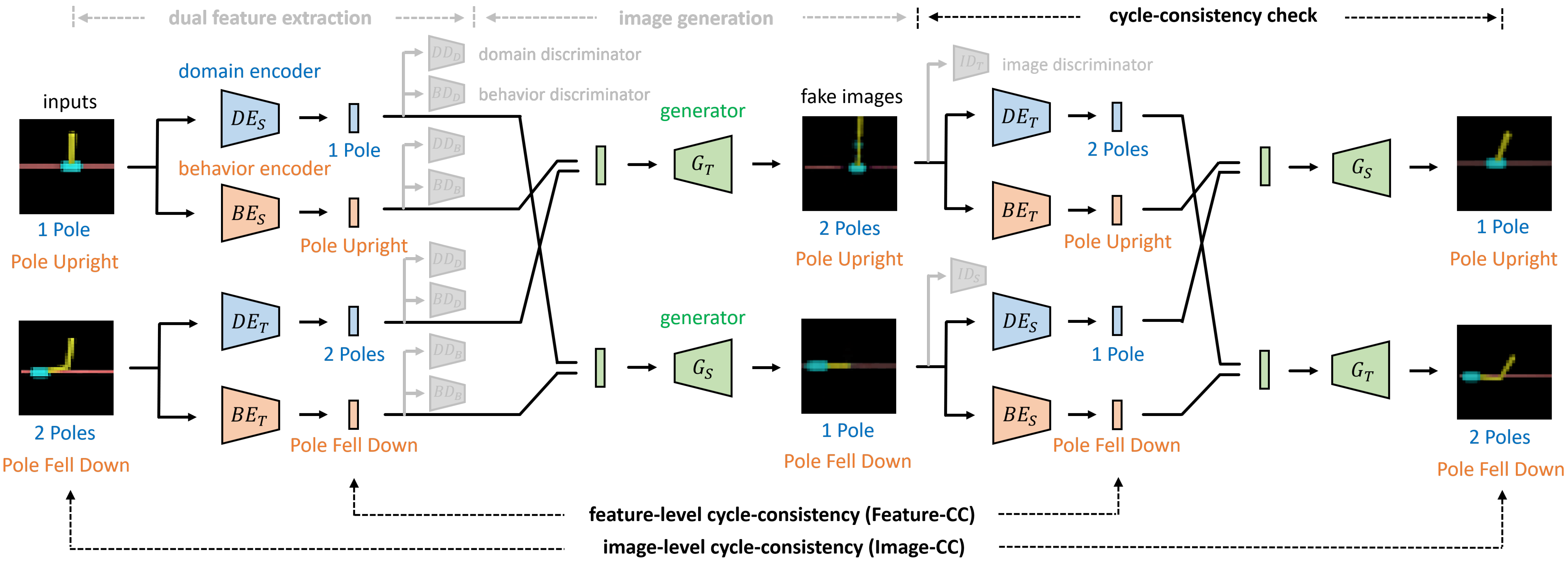
Image Generation

- The generators produce images that contain domain and behavioral characteristics.



Dual Cycle-Consistency

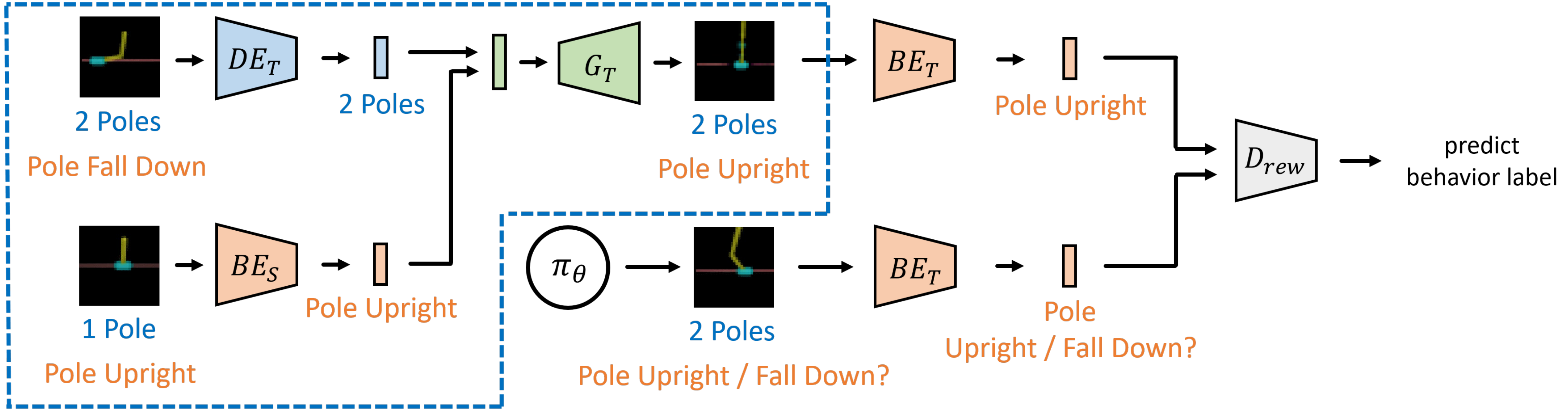
- Input images = Images after applying feature extraction and image generation twice
- Features via first-stage feature extraction = Features via second-stage feature extraction



Reward Generation and Learner Policy Update

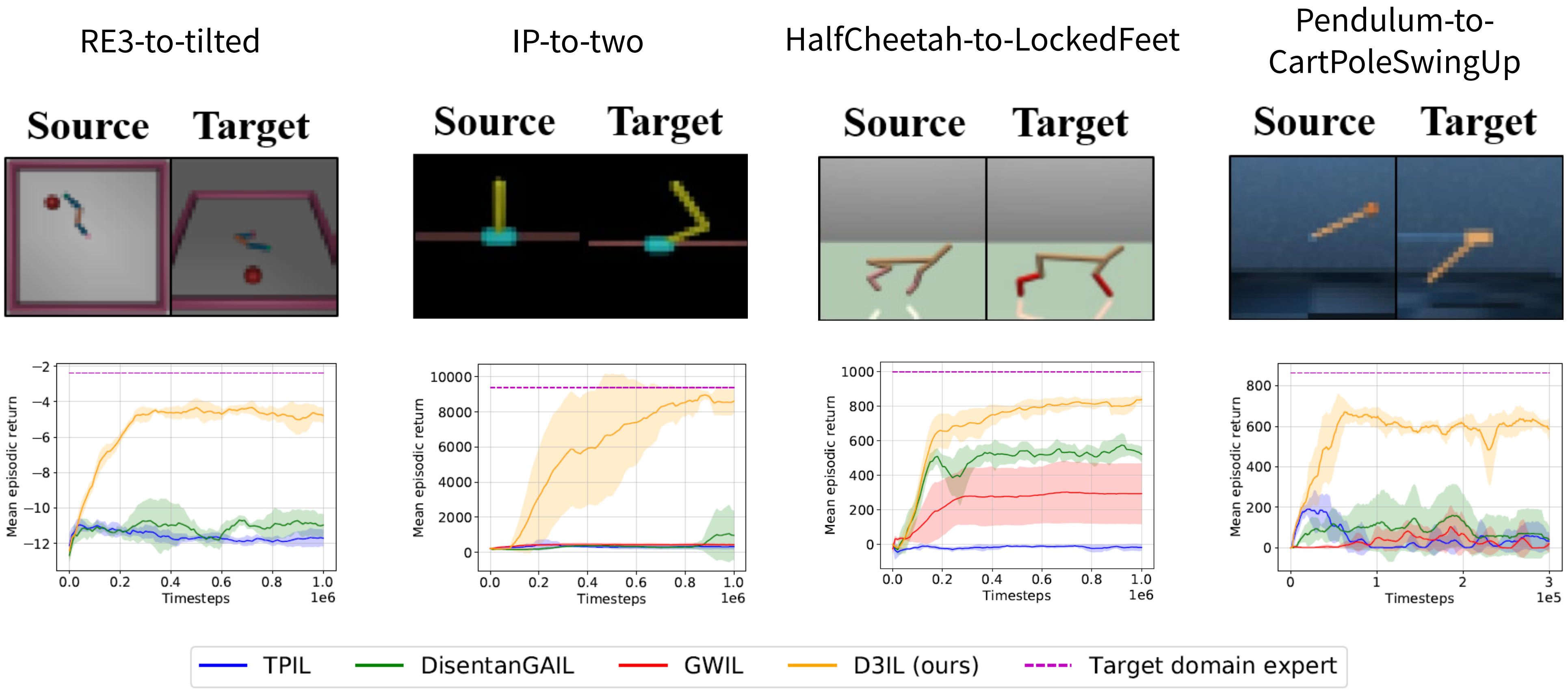
- Adversarial learning between reward-generating discriminator D_{rew} and policy π_θ
- The imitation reward for an observation o_t is defined by

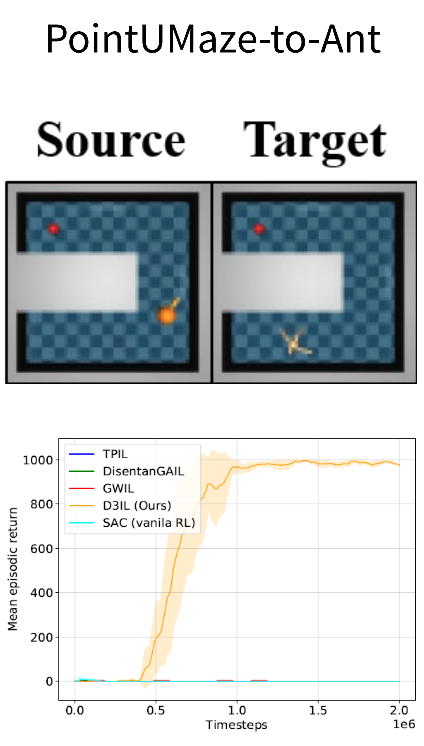
$$\hat{r}(o_t) = \log D_{rew}(BE_T(o_t)) - \log(1 - D_{rew}(BE_T(o_t)))$$



Experiments

- We evaluated D3IL on imitation learning tasks with various types of domain shifts.
- D3IL is also effective when directly obtaining a target domain expert is challenging.





Thank You!

- If you have any questions, feel free to ask during the poster session.

- Poster Session 3 (Wed 13 Dec 10:45 a.m. CST — 12:45 p.m. CST)
- Poster Location: Great Hall & Hall B1+B2 #1406

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