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Language-Conditioned Semantic Search-Based Policy (SBP) for Robotic Manipulations Tasks

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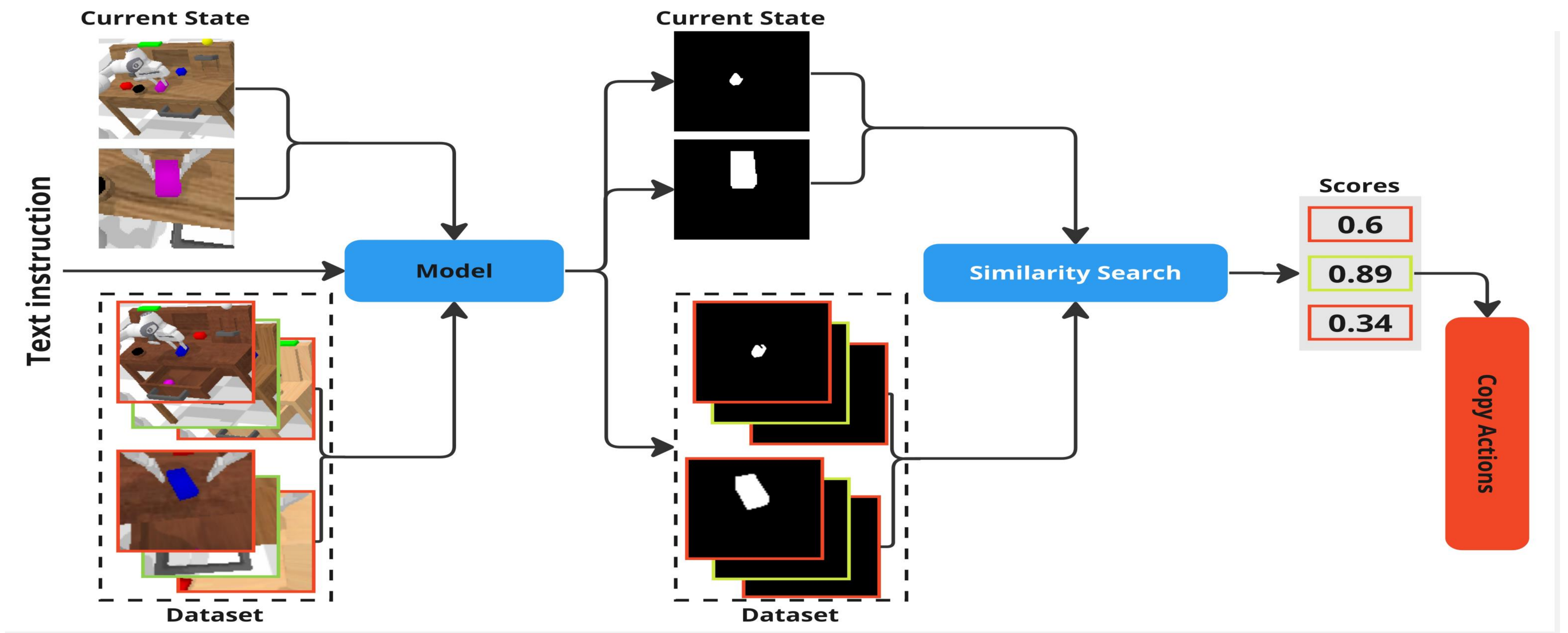
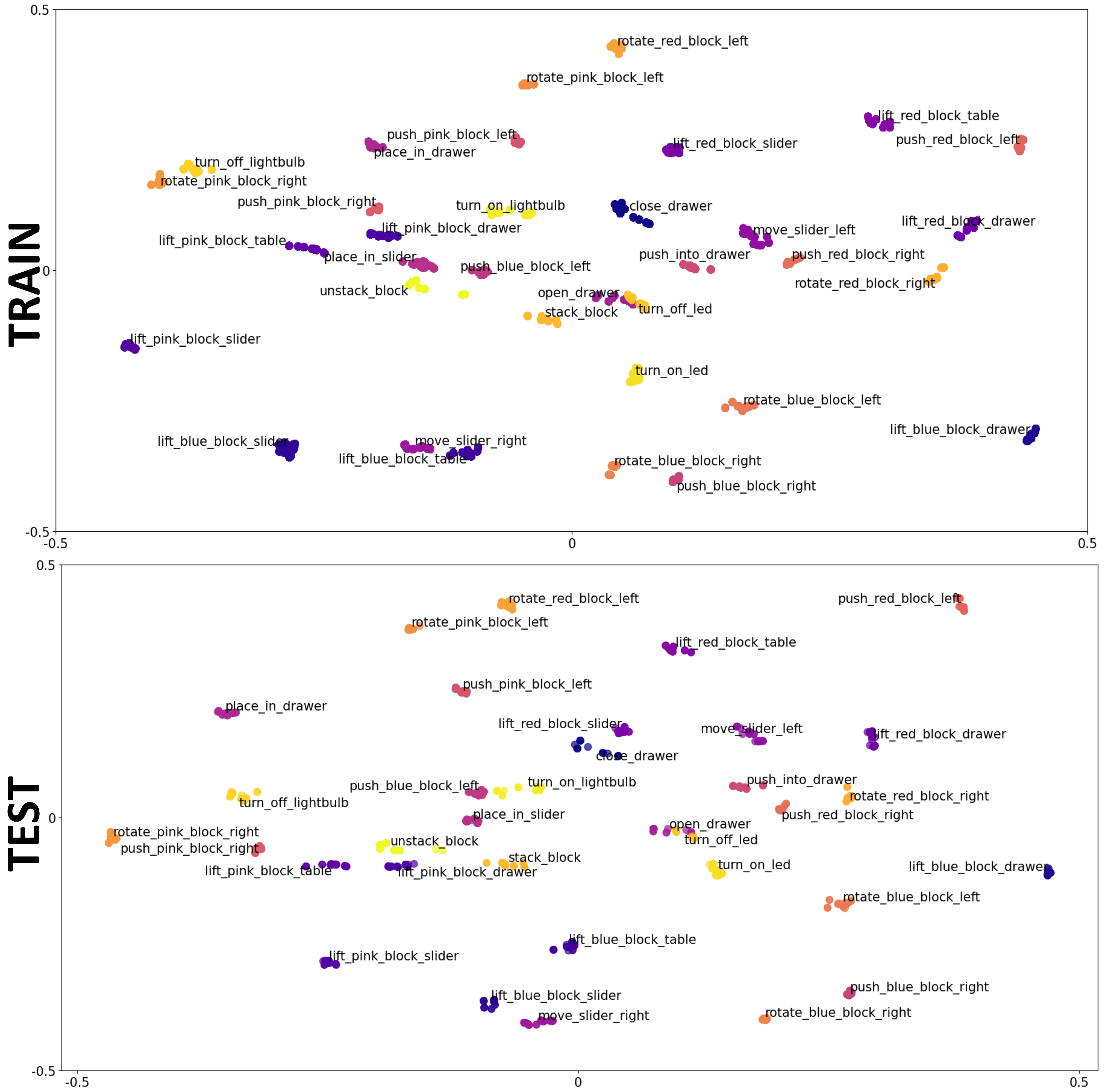
Overview

- Instead of training a complex policy, we search in a demonstration dataset for the most similar state and copy the corresponding actions
- Each state is transformed into a latent space capturing the object of interest
- We apply a weighted similarity score between the static and gripper camera, heavily focusing on the gripper camera



Overview of our framework. We obtain a binary mask of the object of interest in the static and gripper camera views and then find the most similar state in the dataset and start cloning the corresponding actions



Clustered natural language instructions using GTE base model embeddings of size 768. The near-perfect separation between the language instructions using K-Means highlights the capability of using natural language instructions to identify the relevant objects we want to encapsulate in our latent space

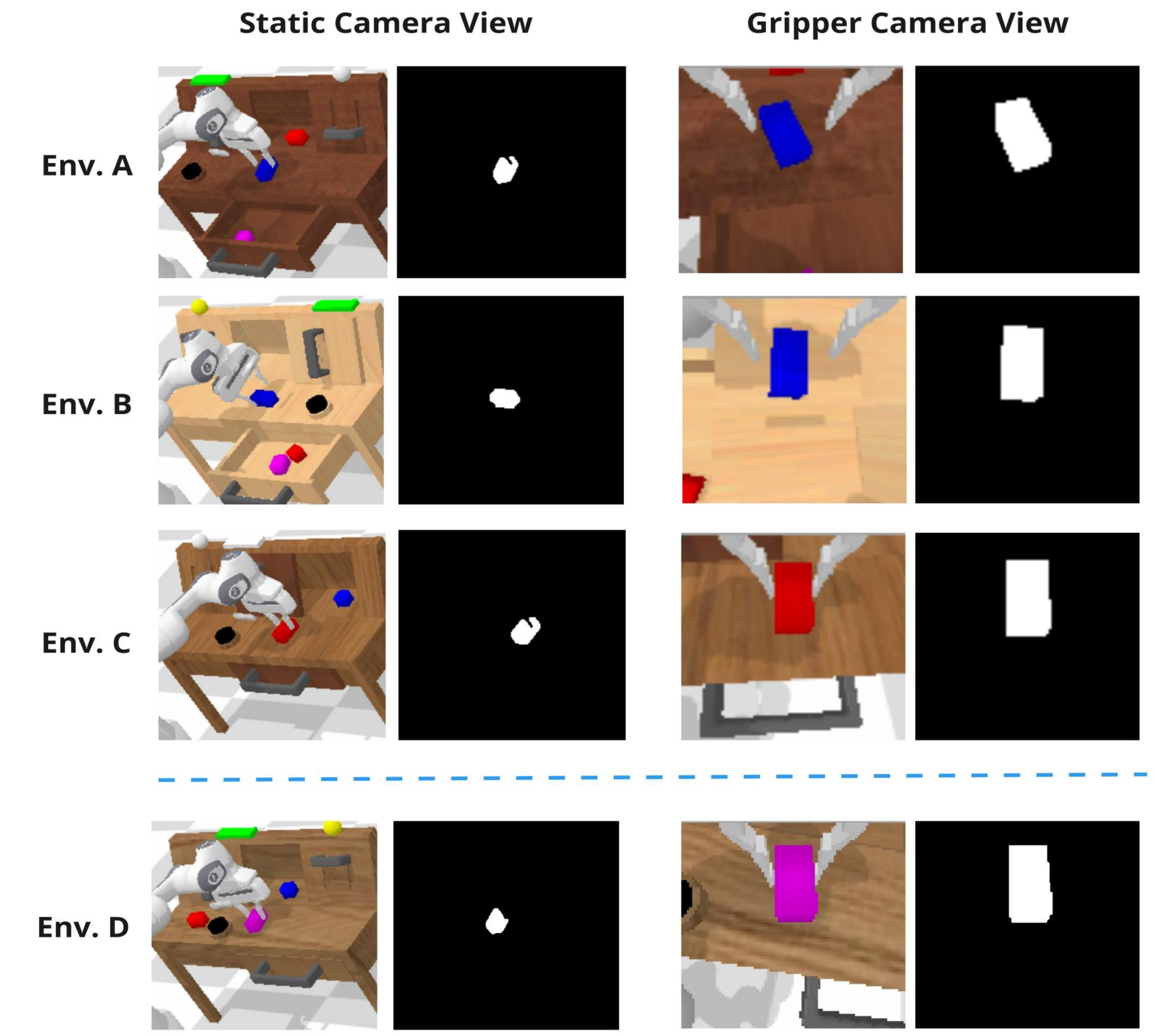
Our search-based policy shows promising results and zero-shot adaptation capabilities. Foundations Models seamlessly align with our proposed framework

Method	Input	Success Rate First Setting	Success Rate Second Setting
Baseline	Static RGB & Gripper RGB	38%	30.4%
HULC	Static RGB & Gripper RGB		41.8%
Ours	Static RGB & Gripper RGB	**61.4%**	**57.2%**

Table 1: Combined results for the Zero-Shot Multi Environment in different evaluation settings.

Task	Success Rate	Task	Success Rate
push pink block left	100%	rotate pink block left	80%
push red block left	100%	rotate red block left	90%
push blue block left	70%	rotate blue block left	30%
push pink block right	90%	rotate pink block right	40%
push red block right	20%	rotate red block right	70%
push blue block right	80%	rotate blue block right	40%
push into drawer	0%	unstack block	70%
lift pink block drawer	90%	stack block	0%
lift red block drawer	70%	turn on led	90%
lift blue block drawer	90%	turn off led	50%
lift pink block slider	50%	turn on lightbulb	70%
lift red block slider	20%	turn off lightbulb	80%
lift blue block slider	10%	place in drawer	100%
lift pink block table	40%	place in slider	30%
lift red block table	30%	move slider right	80%
lift blue block table	50%	move slider left	70%
open drawer	100%	close drawer	90%

Table 2: Our results over all tasks in the first evaluation setting.


Static Camera View
Gripper Camera View
Env. A
Env. B
Env. C
Env. D