Hierarchical Human Demonstration Toward Imitation Learning of Generalist Robot Planner

Name
Cynthia Maria Ochoa Rey

Laboratory’ｓ name
Robot Learning Laboratory

Supervisor’ｓ name
Takamitsu Matsubara

Abstract

Imitation Learning (IL) has emerged as a promising approach for teaching robots to perform tasks through human demonstrations. However, its application to developing generalist robot planners—robots capable of achieving diverse goals across varied tasks—remains hindered by two key challenges: (i) error accumulation caused by discrepancies between human demonstrations and robotic execution, commonly referred to as error compounding, and (ii) limited generalization across diverse goals, as models are typically restricted to tasks with previously demonstrated goals. To overcome these limitations, this thesis proposes a novel method grounded in *interactive hierarchical human demonstrations* and an enriched dataset, termed meta-sub-goal data, which captures causal relationships among sub-goals. Through human-robot online interactions, a human expert provides corrective demonstrations reducing error compounding. Simultaneously, the meta-sub-goal data enables the robot to learn causal dependencies between sub-goals, allowing it to execute new plans for final goals beyond those explicitly demonstrated. The proposed approach is validated through simulations and real-robot experiments in a kitchen-like environment with varying task complexities. The results demonstrate significant improvements in task execution accuracy and generalization across diverse goals. These findings underscore the potential of Interactive IL, combined with task structure understanding, to advance robotic learning for complex real-world applications.