EXPLORING ZERO-SHOT EMERGENT COMMUNICATION IN EMBODIED AGENT POPULATIONS

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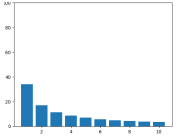
OVERARCHING GOAL:

To Emerge General Communication Skills for Embodied Agents (through *Movement*)

RESEARCH QUESTION:

Under what *realistic*, *minimal* common-knowledge constraints can we obtain zero-shot coordination for embodied communication protocols?

Physical Energy Exertion



Nonuniform Distribution over Intents

KEY CHALLENGE:

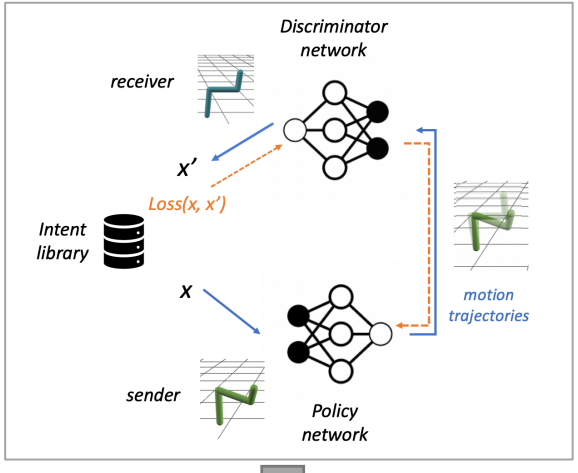
High Dimensional Continuous Channel + Self-Play
$\Longrightarrow$ *Highly Nonconvex* Optimization Landscape

GENERAL APPROACH:

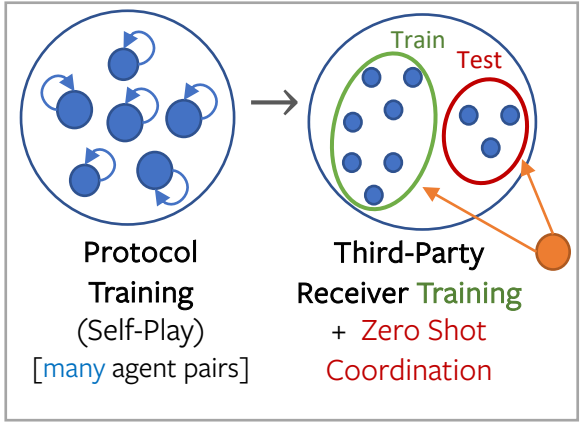
Induce high mutual information $\boldsymbol{I}$ -- between Intents $\boldsymbol{G}$ and Energy Exertion $\mathbf{E}$ of Trajectories $\boldsymbol{\tau}$

GOAL: $\mathrm{I}(G,\tau) = \mathrm{I}\big(G,\mathrm{E}(\tau)\big) \gg 0$

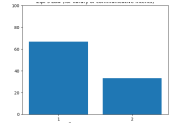
Game (Self-Play) [*one* agent pair]



Overall Method

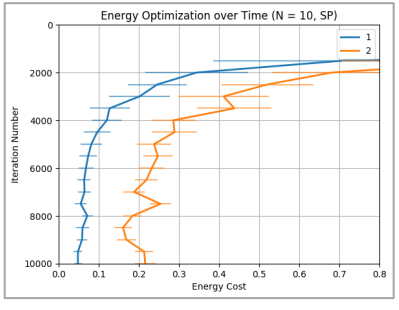


Analysis (*Proof-Concept* 2-Intent Task)

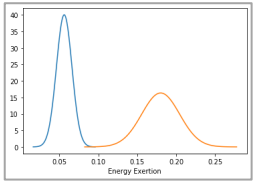


Intent Distribution

Energy Cost over Training (by Intent)



Energy Exertion $E(\tau)$ -- by Intent [*End* of Training]



ZS Coordination (by *Test* Input)

Max Class (Baseline): 0.67	τ	$\mathbf{E}(\tau)$
	0.75	**0.97**