Minimax Iterative Dynamic Game

Ogunmolu

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Minimax Iterative Dynamic Game

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The robustness conundrum

Minimax Iterative Dynamic Game

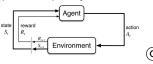
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Research Overview

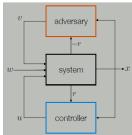
Approach

Problem Setu

■ How to know a priori a policy's robustness limits?



How to inculcate robustness into multistage decision policies?



Problem Setup

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■ To quantify the brittleness, we optimize the stage cost

$$\max_{\mathbf{v}_t \sim \psi \in \Psi} \left[\sum_{t=0}^T \underbrace{c(\mathbf{x}_t, \mathbf{u}_t)}_{\text{nominal}} - \gamma \underbrace{g(\mathbf{v}_t)}_{\text{adversarial}} \right]$$

■ To mitigate lack of robustness, we optimize the *cost-to-go*

$$\mathcal{J}_t(\mathbf{x}_t, \pi, \psi) = \min_{\mathbf{u}_t \sim \pi} \max_{\mathbf{v}_t \sim \psi} \left(\sum_{t=0}^{T-1} \ell_t(\mathbf{x}_t, \mathbf{u}_t, \mathbf{v}_t) + L_T(\mathbf{x}_T) \right),$$

and seek a saddle point equilibrium policy that satisfies

$$\mathcal{J}_t(\mathbf{x}_t, \pi^*, \psi) \leq \mathcal{J}_t(\mathbf{x}_t, \pi^*, \psi^*) \leq \mathcal{J}_t(\mathbf{x}_t, \pi, \psi^*),$$



Results: Brittleness Quantification

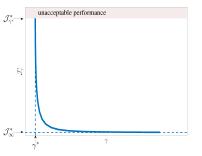
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ILQG Algorithm Example

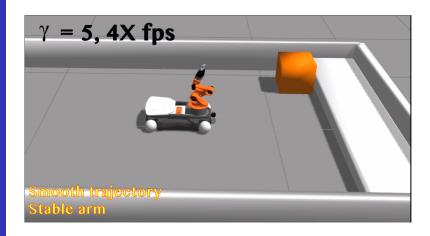
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Results: Iterative Dynamic Game

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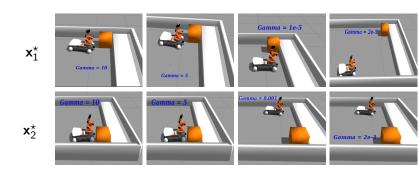


Table: *

End pose of the KUKA platform with our iDG formulation given different goal states and γ -values

