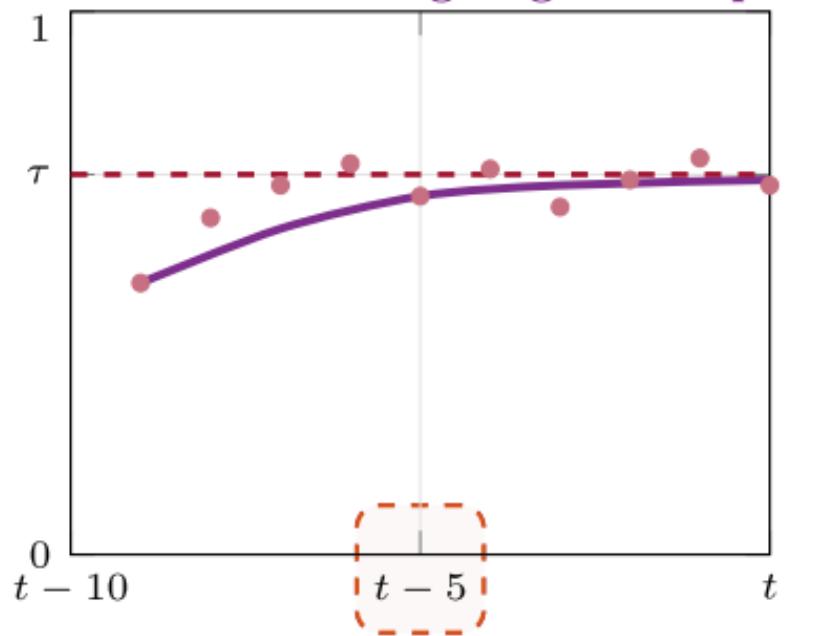


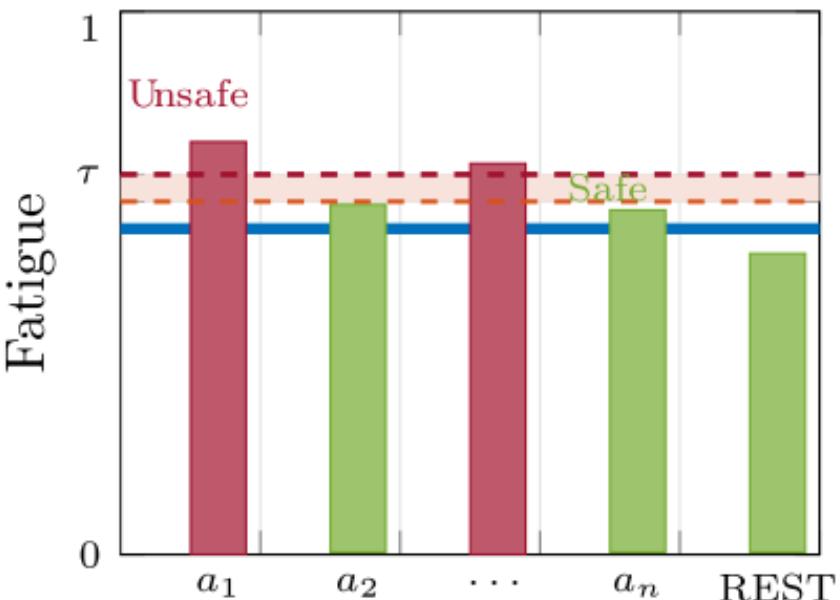
Slow Timescale: Lagrangian Adaptation



$$\begin{aligned}\hat{C}_f^{(t)} > \tau &\Rightarrow \lambda_t \uparrow \\ \hat{C}_f^{(t)} < \tau &\Rightarrow \lambda_t \downarrow\end{aligned}$$

Output: λ_t
(penalty multiplier)

Fast Timescale: Predictive Guard



Both used in

PianoMPC Controller

Plans with λ_t penalty over $\mathcal{A}_{\text{safe}}(t)$

$$f_{t+1|t}(a) \leq \tau - \delta_{\text{safe}}$$

↓

Output: $\mathcal{A}_{\text{safe}}(t)$
(filtered actions)