



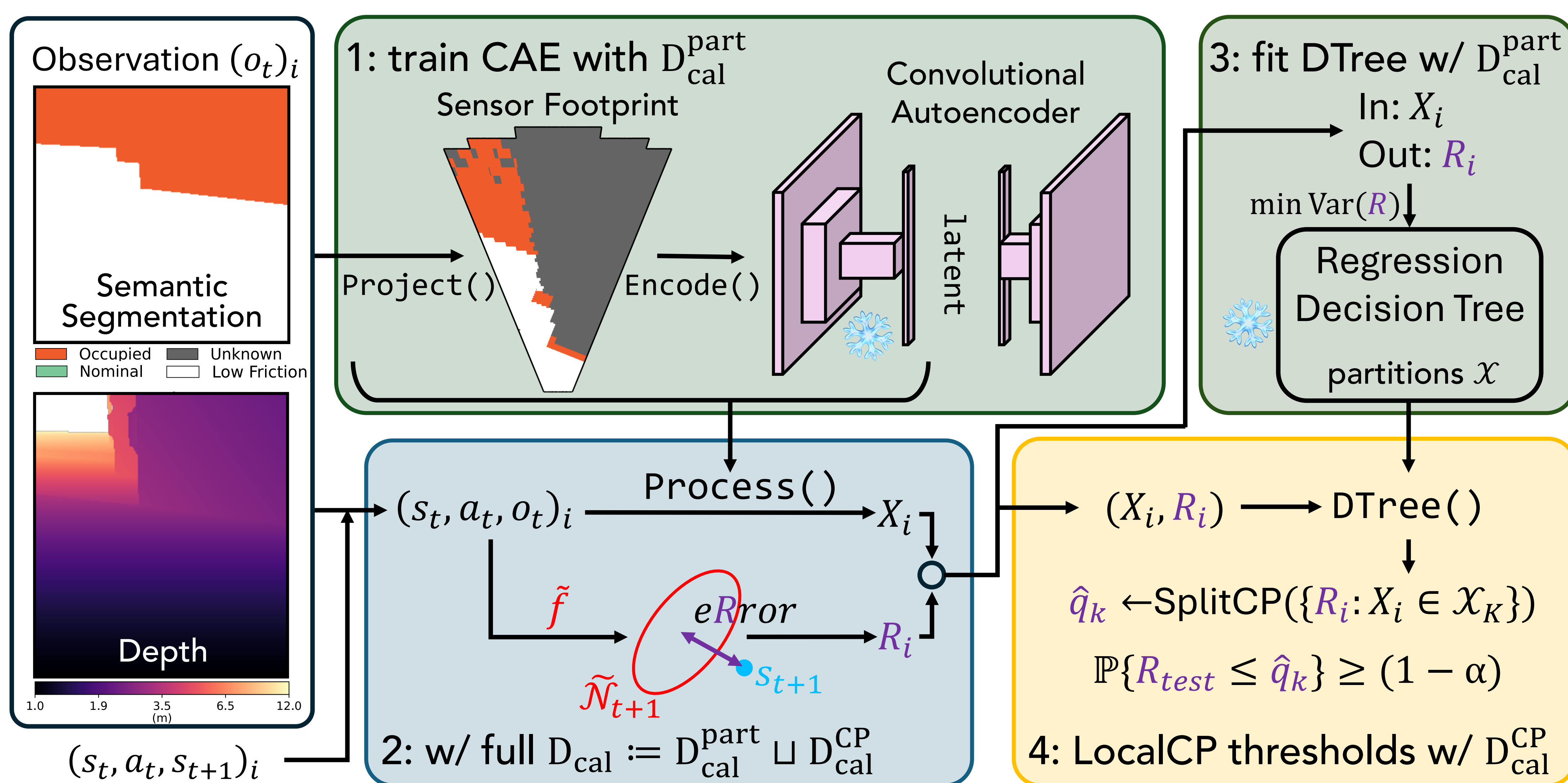
Local Conformal Calibration of Dynamics Uncertainty from Semantic Images

Luís Marques, Dmitry Berenson
University of Michigan

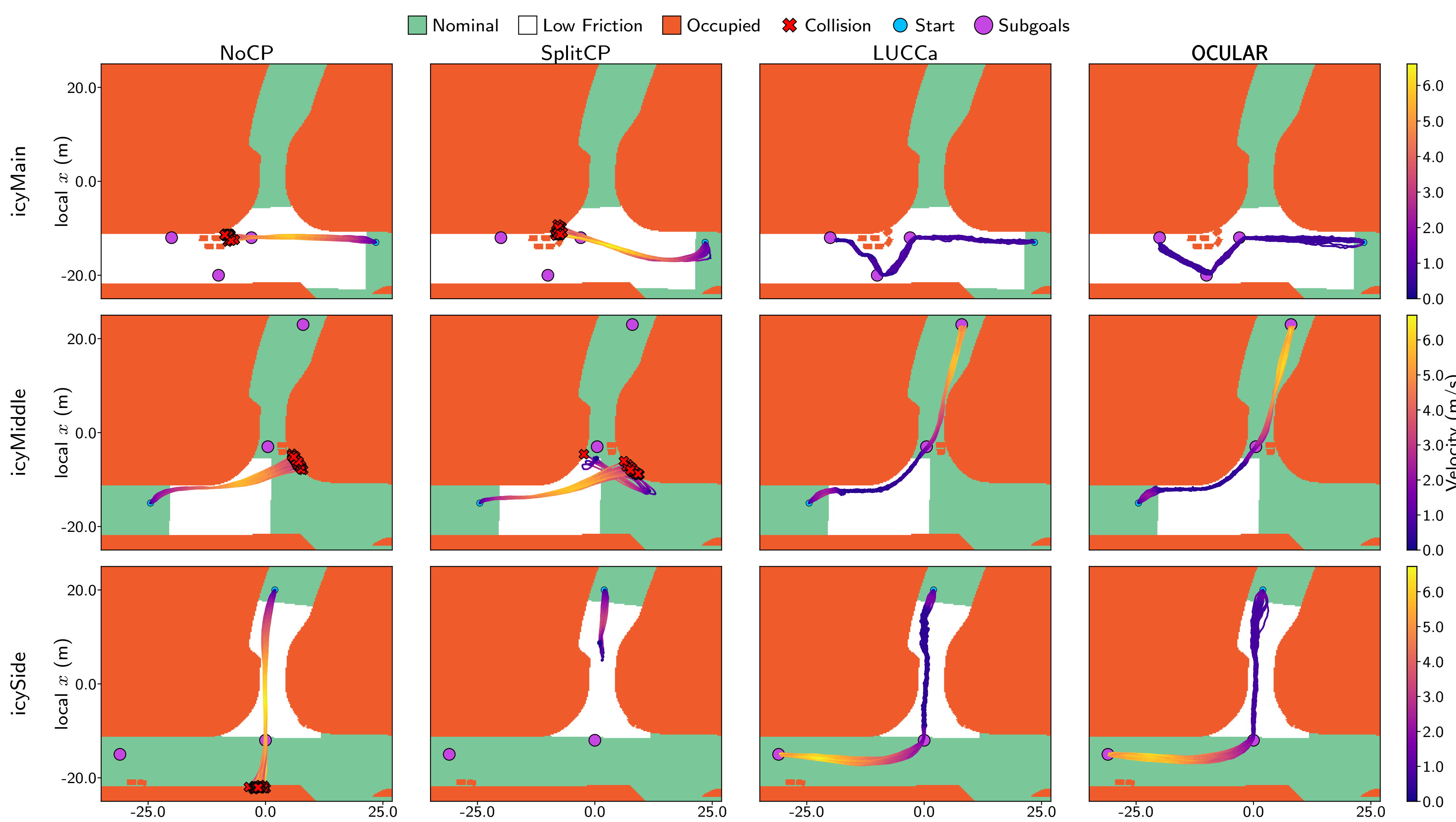
Given an approximate Gaussian dynamics model \tilde{f} and a transitions dataset $D_{cal} = \{(s_t, a_t, o_t, s_{t+1})\}$, we:

- ▶ perform a **state-action-observation-dependent** uncertainty calibration of *unknown* system dynamics
- ▶ provide **safety guarantees** $\mathbb{P}(s_{t+1} \in \text{SAFE}) \geq (1 - \alpha)$ despite *stochasticity* and *model mismatch*
- ▶ generalize to **unseen** test-time environments

Method: OCULAR



Planning performance with MPPI (plots + table)



Method	Tested map not in \mathcal{D}_{cal} ?	Success (%) \uparrow			Steps to completion (mean \pm std) \downarrow		
		icySide	icyMain	icyMiddle	icySide	icyMain	icyMiddle
NoCP	N/A	0	0	0	–	–	–
SplitCP	\times	0	0	0	–	–	–
LUCCa	\times	100	100	100	339.1 \pm 8.7	332.1 \pm 13.1	288.4 \pm 7.8
OCULAR (ours)	\checkmark	100	100	100	208.1 \pm 3.1	311.3 \pm 4.7	278.6 \pm 6.4

Success = reaching all subgoals without collisions.

Model Predictive Control Rollouts (Isaac Sim)

(robot modeled as double-integrator)

Momentum buildup and uncertainty underestimation can lead to entering regions of inevitable collision

SplitCP (baseline) has data from test env



OCULAR (ours)
no data from test env

