

## 1. Key Contributions

1. We introduce How Does It Feel (HDIF), a method that **predicts continuous traversability costmaps** from the robot's own proprioceptive terrain interaction feedback, **without human annotated labels**.
2. We demonstrate our method on short-scale and large-scale navigation trials on two different robot platforms: an autonomous Yamaha ATV and a Clearpath Warthog UGV.

For videos and more details, visit our website!



## 2. System Overview

### Training time:

#### Input:

- Patches cropped from a BEV RGB map and height map along the driving trajectory.
- Fourier-parameterized velocity per patch.

#### Output:

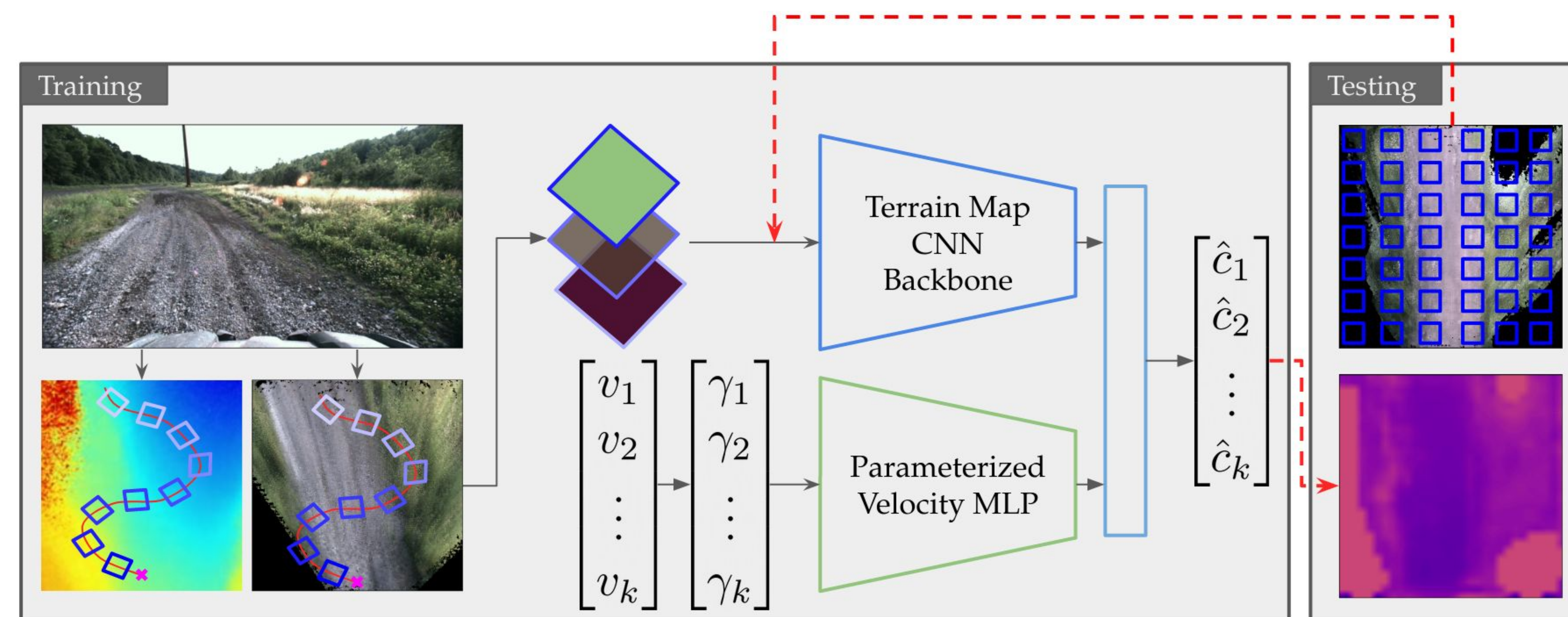
- Continuous traversability cost for each patch

#### Loss:

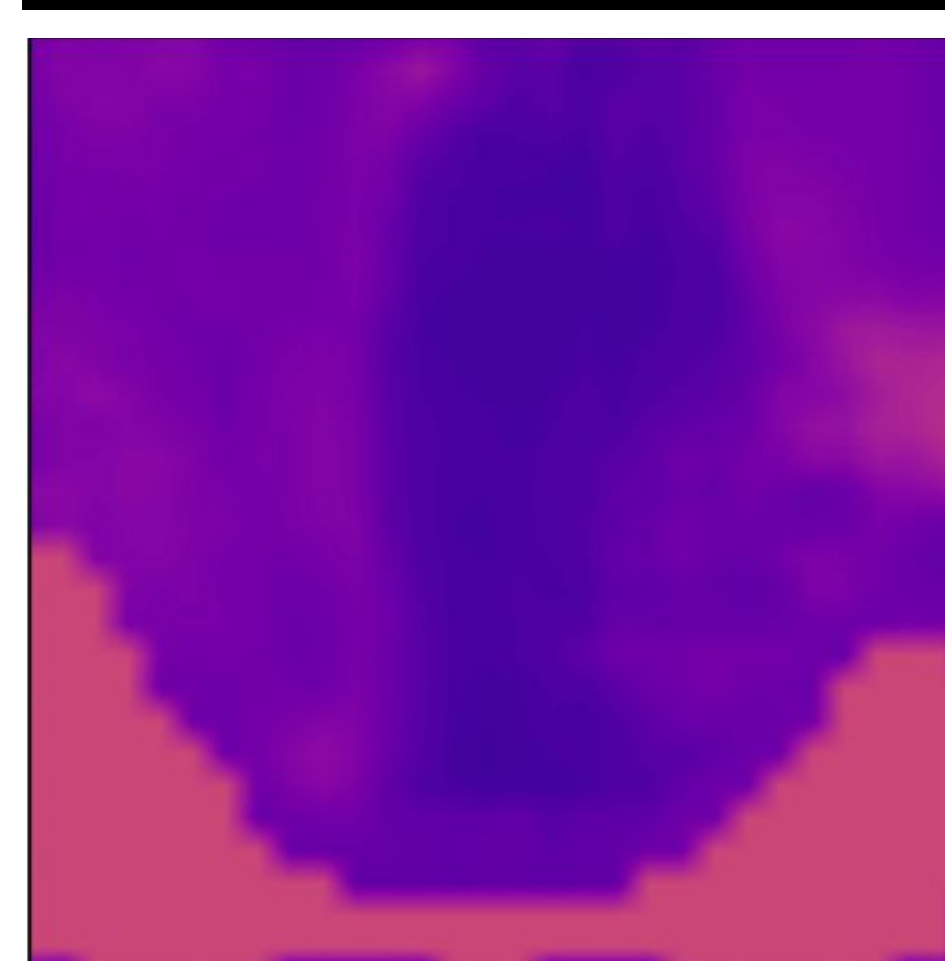
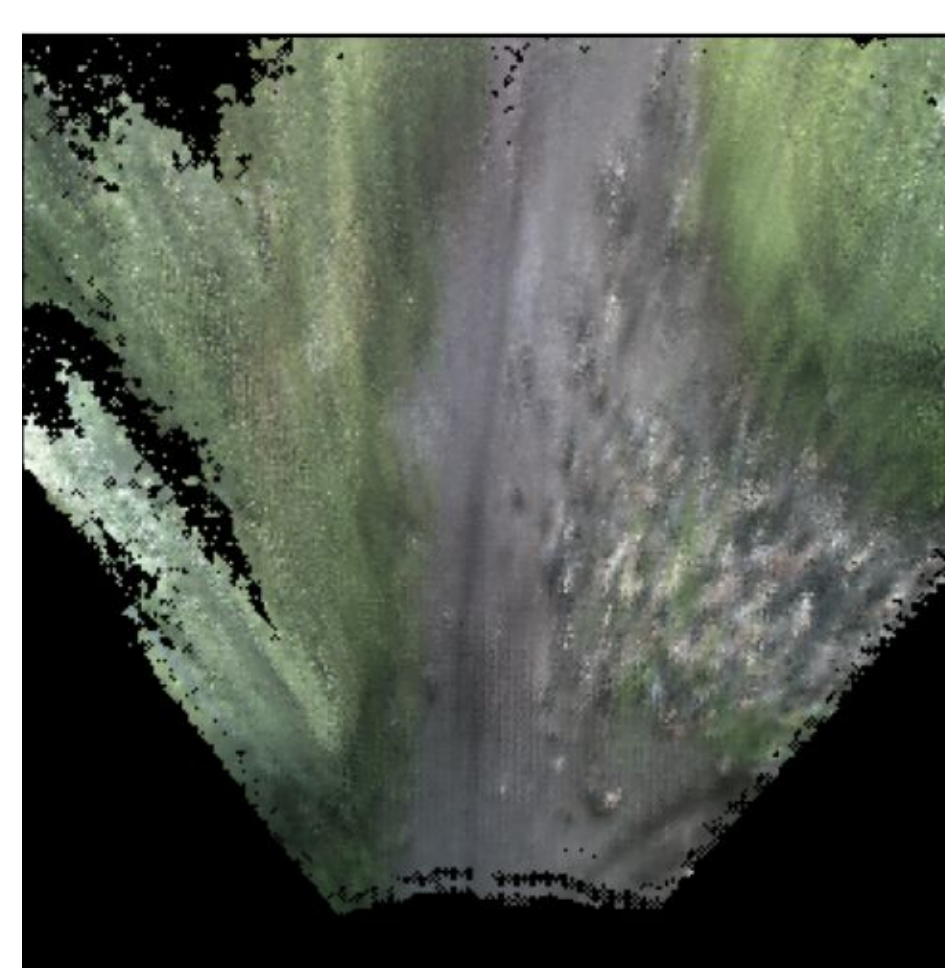
- L2 loss between predicted cost and pseudo ground-truth cost generated from IMU.

### Test time:

Subsample current map into small patches, then feed into the network to generate a continuous costmap.



## 3. Dataset and Output Costmaps



Low  High

**Training set:** TartanDrive (Triest et al., ICRA 2022)

**BEV Mapping:** Projected from dense point clouds from stereo images and registered using TartanVO (Wang et al., CoRL 2020).

### Lower predicted cost:

- Packed dirt
- Concrete

### Higher predicted cost:

- Vegetation
- Gravel
- Fallen leaves
- Logs

## 4. Navigation Results

**Short-scale experiments:** our robot prefers smoother paths using our costmaps.

**Large-scale experiments:** up to 57% fewer interventions than an occupancy-based navigation baseline.



Navigation Stack	Course	Num. Interventions	Approx. Course Length (m)
Baseline	Red	7	400
HDIF (Ours)	Red	3	400
Baseline	Blue	9	3150
HDIF (Ours)	Blue	6	3150
Baseline	Green	11	950
HDIF (Ours)	Green	7	950