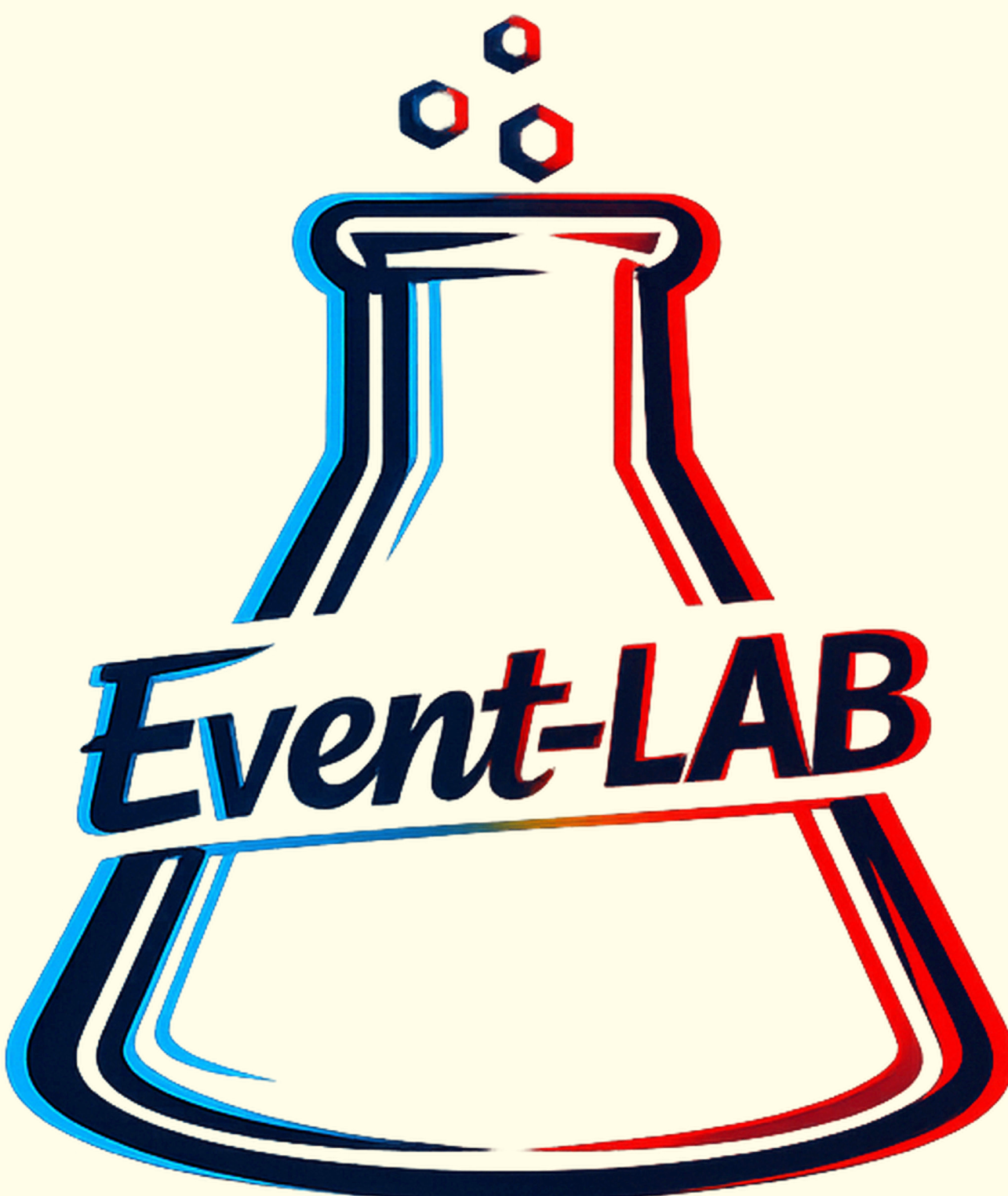
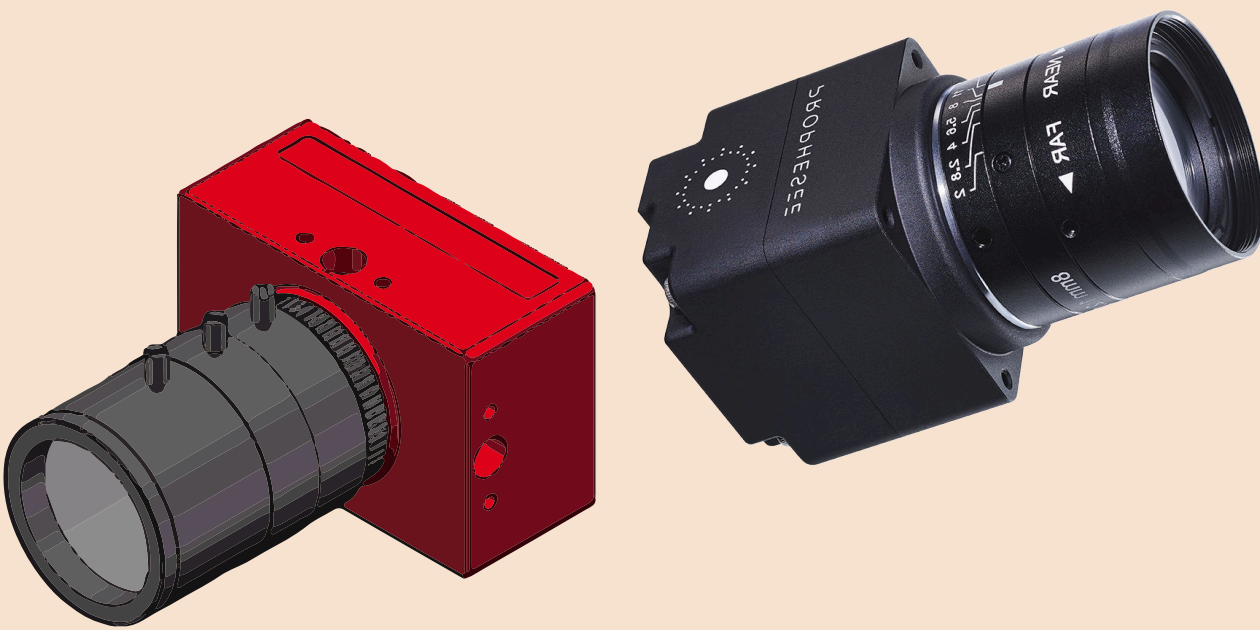


EVENT-LAB: TOWARDS STANDARDIZED EVALUATION OF NEUROMORPHIC LOCALIZATION METHODS

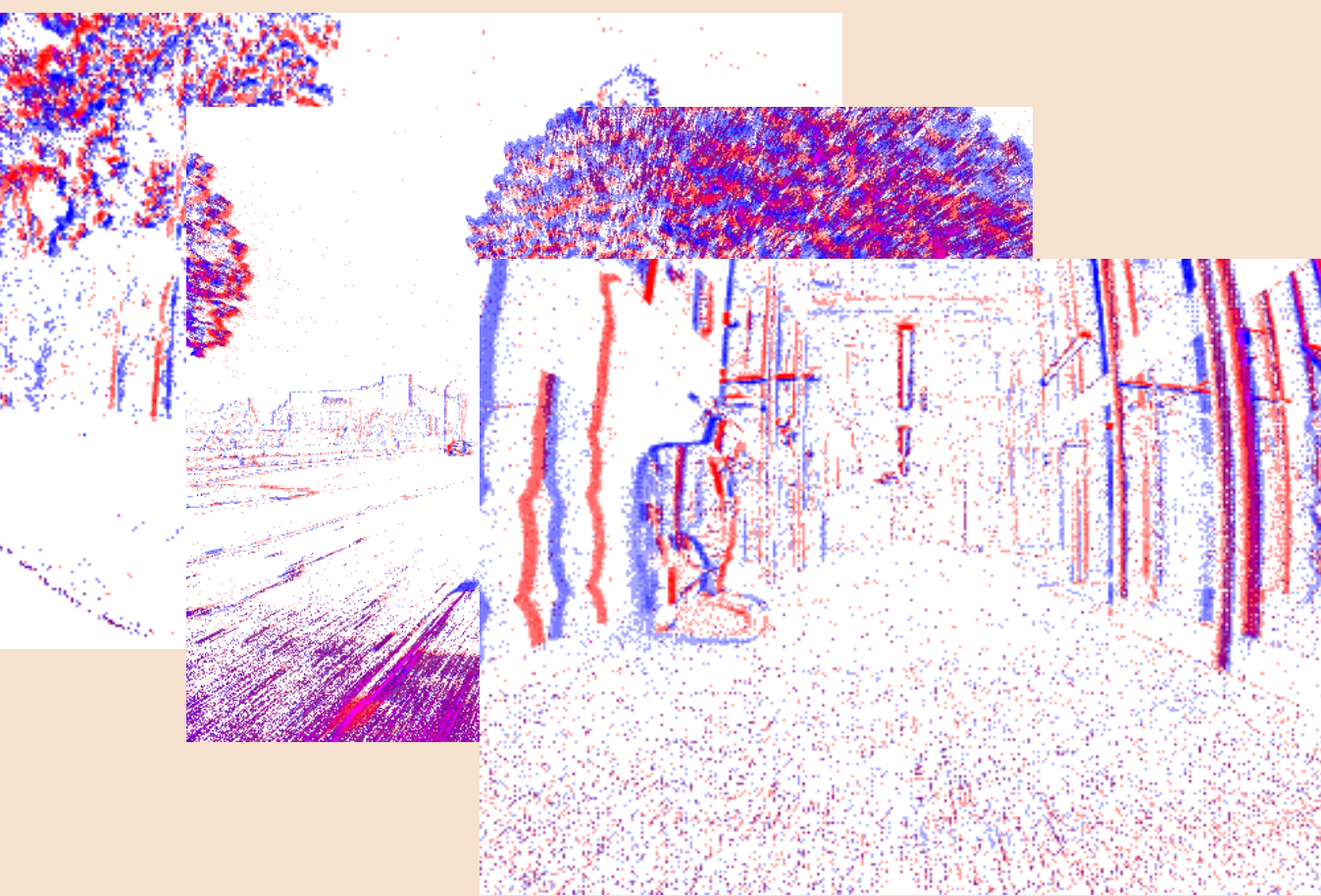
ADAM D HINES*, ALEJANDRO FONTAN, MICHAEL MILFORD, TOBIAS FISCHER
QUT CENTRE FOR ROBOTICS, BRISBANE QUEENSLAND, AUSTRALIA



THE PROBLEM



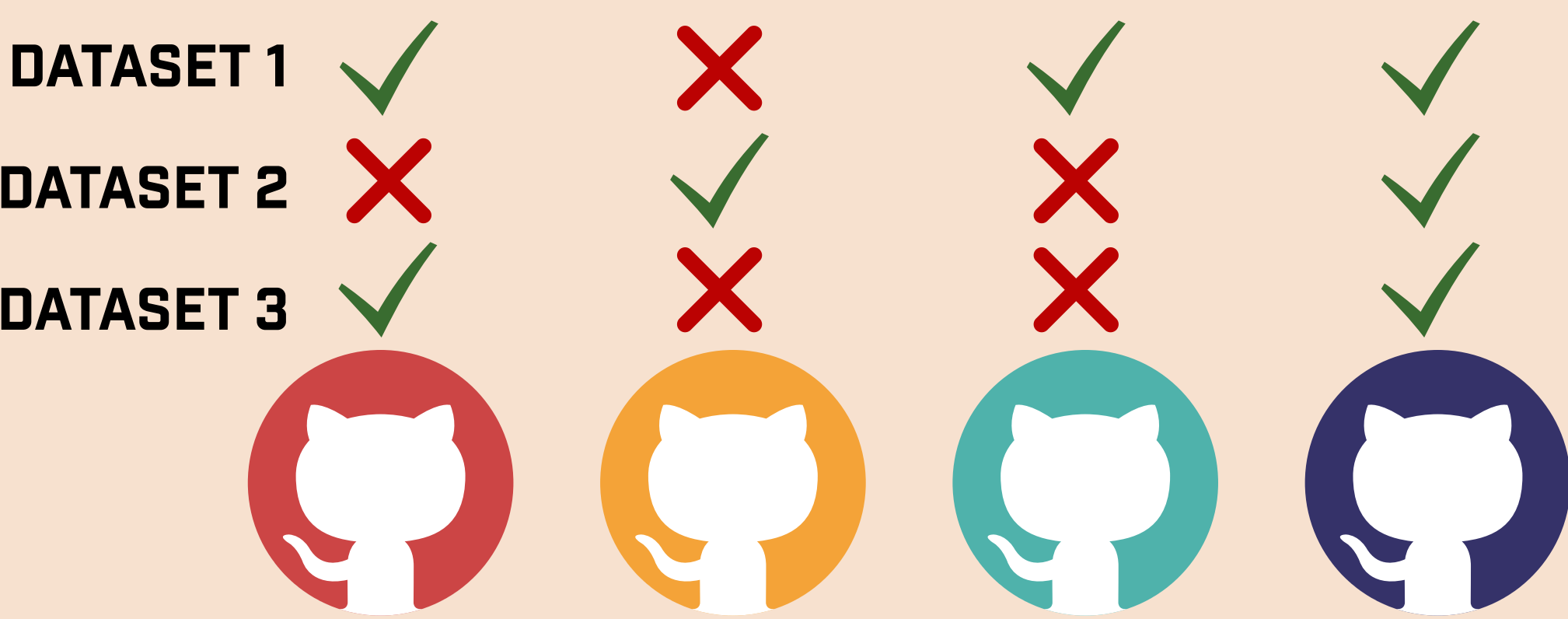
MULTIPLE SENSORS



MULTIPLE DATASETS



NON-STANDARDIZED PARAMETERS



POOR BASELINE INTEGRATION

THE SOLUTION

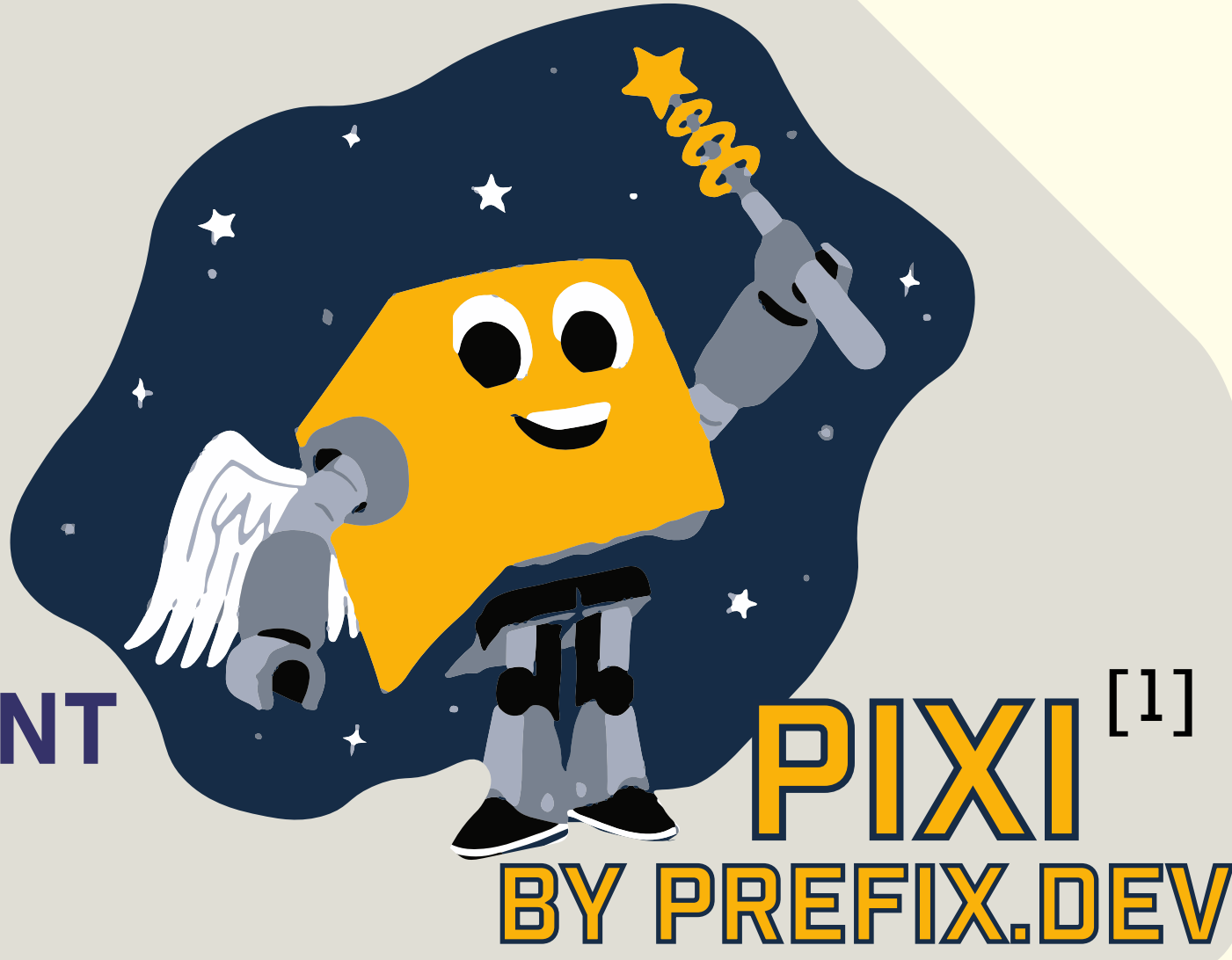
```
1 # Install pixi
2 curl -fsSL https://pixi.sh/install.sh | sh
3
4 # Clone the Event-LAB repository
5 git clone https://github.com/EventLAB-Team/Event-LAB && cd Event-LAB
6
7 # Run the evaluation
8 pixi run eventlab lens brisbane_event sunset2 sunset1
```

pixi run eventlab

- data = get_data('nsavp', 'R0_FA0')
- frames = build_frames(data, 'count')
- baseline = get_baseline('LENS')
- results = run(baseline, frames)

Recall@K, Precision-Recall

- BIT-FOR-BIT REPRODUCIBLE
- SINGLE COMMAND INVOCATION
- STANDARDIZED METRICS
- EASY DEPENDENCY MANAGEMENT

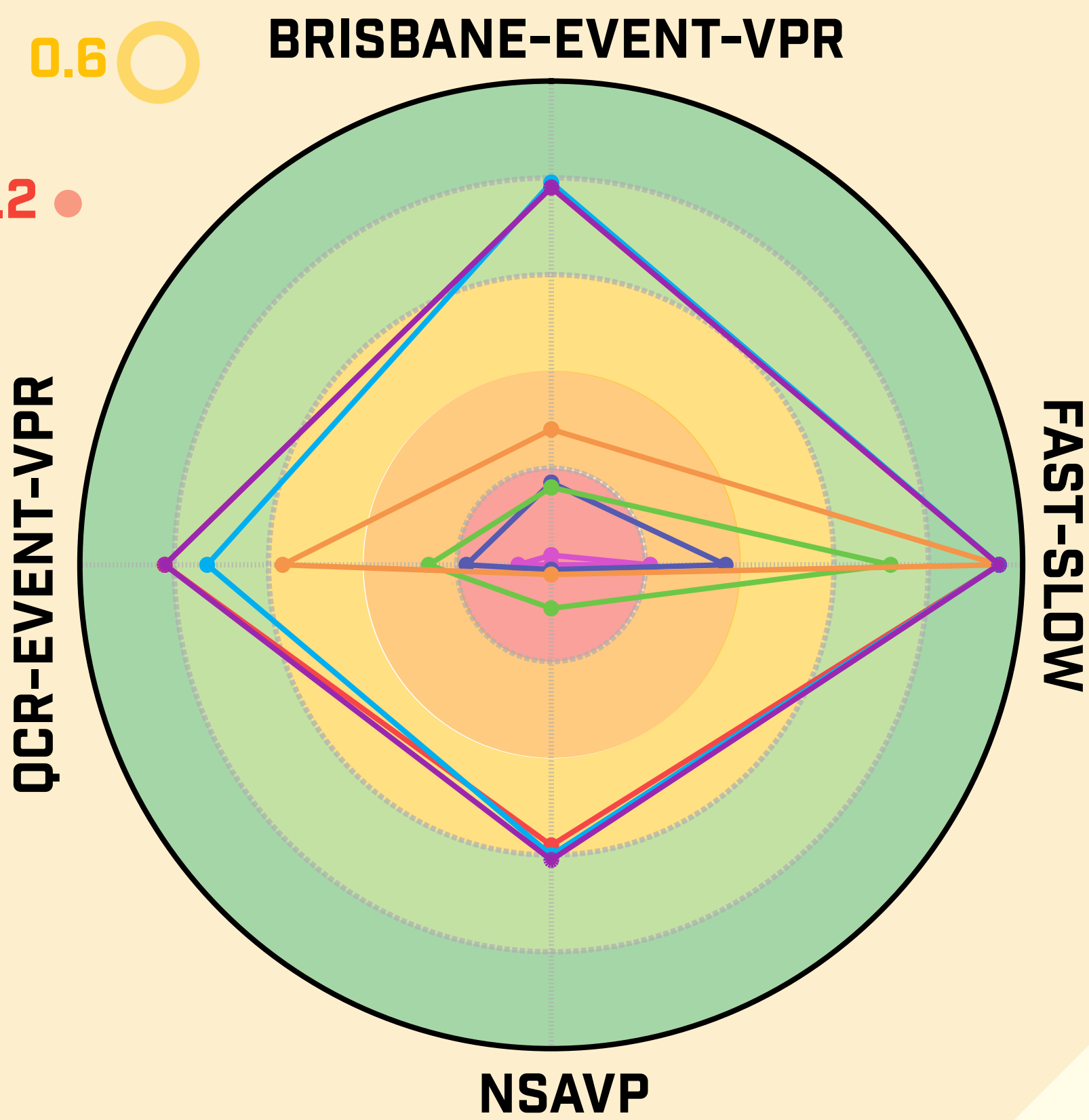
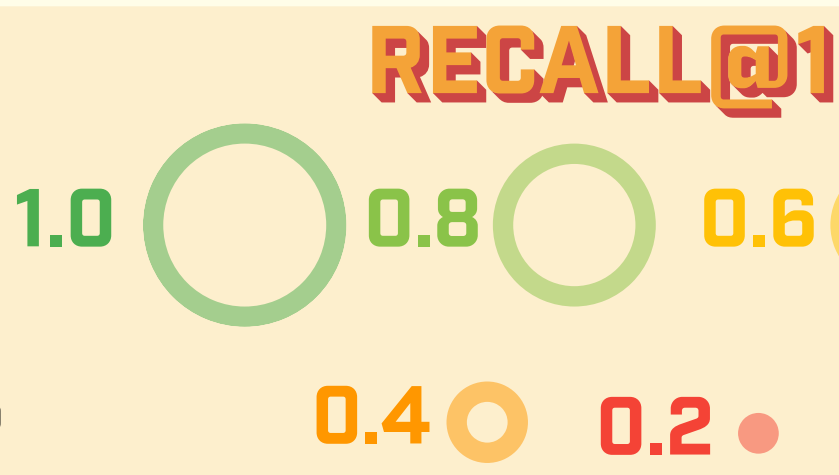


RESULTS

- IMAGES**
- ENSEMBLE-VPR
 - COSPLACE
 - EIGENPLACES
 - MIXVPR
- FRAMES**
- LENS
 - SPARSE-VPR
 - EVENTVLAD

IMPLEMENTED METHODS/DATASETS

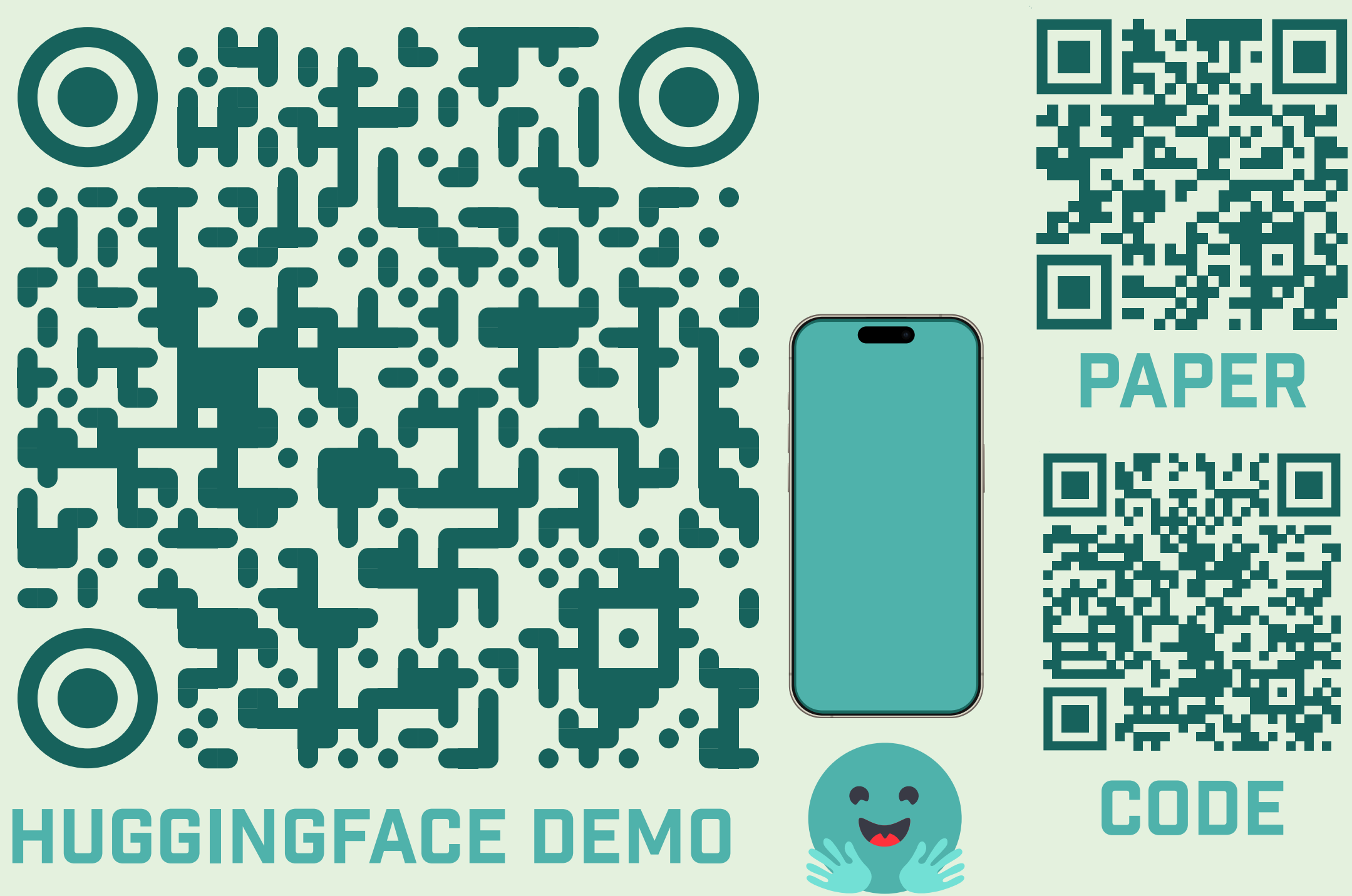
VPR Methods	
LENS	Hines et al. 2025 [2]
VPR-evaluation-methods	Berton et al. 2022 [3]
Sparse-Event-VPR	Fischer & Milford 2022 [4]
EventVLAD	Lee & Kim 2021 [5]
Ensemble-Event-VPR	Fischer & Milford 2020 [6]
VPR Datasets	
NSAVP	Carmichael et al. 2024 [7]
Fast-and-Slow	Nair et al. 2024 [8]
QCR-Event-VPR	Fischer & Milford 2022 [4]
Brisbane-Event-VPR	Fischer & Milford 2020 [6]



EXAMPLE SETUP TIMES FOR VARIOUS METHODS

Method	Dataset	Query	Ref.	Type	Events	Time (mm:ss)
Sparse	QCR	fast1	normal1	Count	25 000	01:01
MixVPR	Fast-Slow	q_low1	r_low1	Recons.	25 000	06:35
EventVLAD	NSAVP	R0_RN0	R1_DA0	Count	250 000	47:42

TRY IT FOR YOURSELF!



REFERENCES

[1] Fischer, T. et al. Pixi: Unified Software Development and Distribution for Robotics and AI
[2] Hines, A. et al. A compact neuromorphic system for ultra-energy-efficient, on-device robot localization
[3] Berton, G. et al. EigenPlaces: Training Viewpoint Robust Models for Visual Place Recognition
[4] Fischer, T & Milford, M. How Many Events do You Need? Event-based Visual Place Recognition Using Sparse But Varying Pixels
[5] Lee, AJ & Ayoung, K. EventVLAD: Visual Place Recognition with Reconstructed Edges from Event Cameras
[6] Fischer, T & Milford, M. Event-Based Visual Place Recognition With Ensembles of Temporal Windows
[7] Carmichael, S. et al. Dataset and Benchmark: Novel Sensors for Autonomous Vehicle Perception
[8] Nair, GB. et al. Enhancing Visual Place Recognition via Fast and Slow Adaptive Biasing in Event Cameras

SIMPLE CONTRIBUTIONS

- STANDARDIZED FORMAT
- FULLY DOCUMENTED
- INTERCOMPATIBILITY
- COMMUNITY DRIVEN

```
1 class EventBaselineMethod(EventBaseline):
2     def __init__(self, config):
3         super().__init__(config)
4         # Set config as class attribute
5         self.config = config
6         # Retrieve baseline method
7         self.url = "https://github.com/author/<baseline_method>.git"
8         if not os.path.exists(self.repo_path):
9             clone_repo(self.url, destination=self.repo_path)
10
11 # Load baseline specific configuration file
12 self.baseline_config_path = './baselines/<baseline>.yaml'
13 with open(self.baseline_config_path, 'r') as file:
14     self.baseline_config = yaml.safe_load(file)
15
16 def format_data(self, reference, query):
17     # Dataset formatting for baseline
18     pass
19
20 def build_executable(self):
21     # Builds executable command
22     pass
23
24 def run(self):
25     # Runs the executable command
26     pass
27
28 def parse_results(self, ground_truth):
29     # Performs standardized metrics
30     pass
31
32 def cleanup(self):
33     # File cleanup
34     pass
```

ACKNOWLEDGMENTS

