



# Real-Time Vision-Based Vehicle Detection in Duckietown

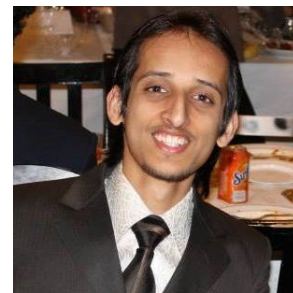
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Dr. Liam Paull  
Direct Supervisor



Prof. John Leonard  
Faculty Supervisor



Chandan Sharma Subedi  
UROP Course 2 Undergraduate



# Functionality

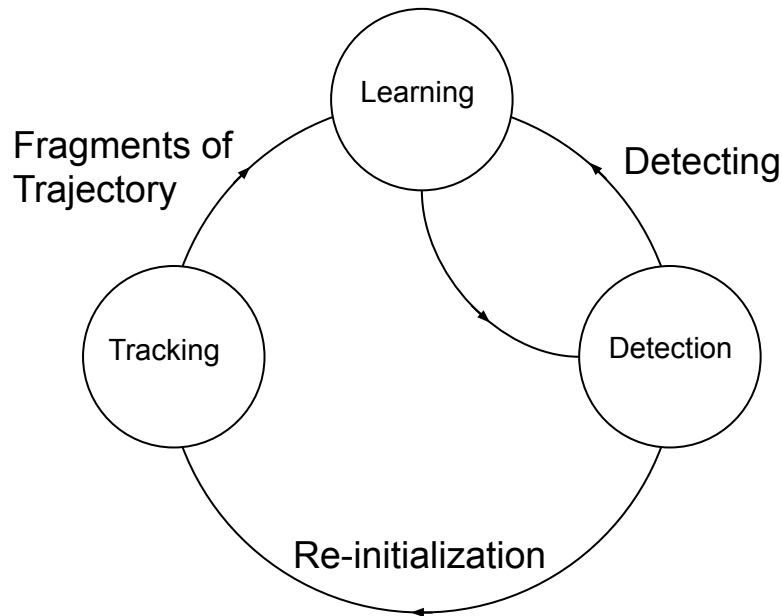
- Run on Raspi in real time
- Invariant to the size, shape, color and texture of the vehicle
- Improve overtime
- Invariant to lighting condition
- Detect multiple vehicle



# Performance

- Detection rate: at min 2Hz, 0.5 sec latency
- Detection range: 0.2-2.0 m
- Memory usage: at max 80% of one core

# Approach



## TLD Algorithm

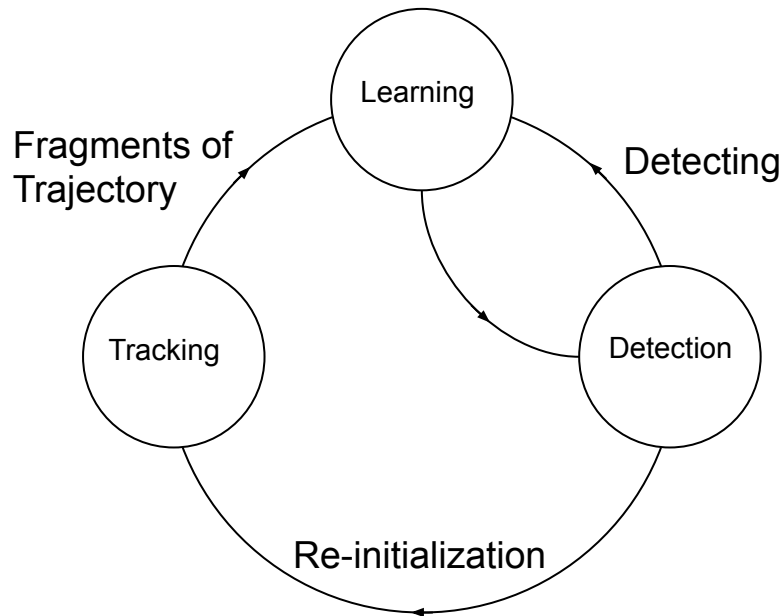
Zdenek Kalal, Krystian Mikolajczyk, and Jiri Matas. *Tracking-learning-detection*. *IEEE Trans. Pattern Anal. Mach. Intell.*, 34(7):1409–1422, 2012. 3, 4



# TLD

- Tracker estimates the object's motion between consecutive frames.
- Detector scans each image to localized the patches that have been observed before.
- Learning observes Tracker and Detector to estimate Detector's error and generates training samples to avoid future errors.

# Approach



## TLD Algorithm

Zdenek Kalal, Krystian Mikolajczyk, and Jiri Matas. *Tracking-learning-detection*. *IEEE Trans. Pattern Anal. Mach. Intell.*, 34(7):1409–1422, 2012. 3, 4



Why tracking when we want vehicle detection?





# TLD framework for Vehicle Detection

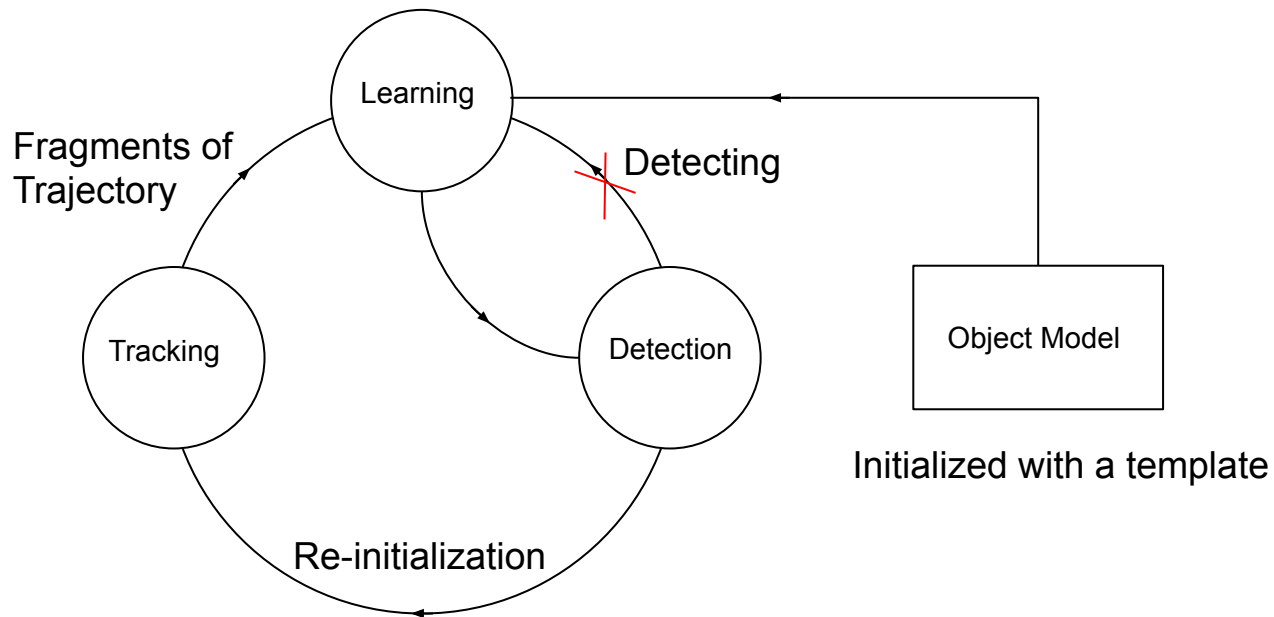
- Tracking can be used to generate training samples to train the Detector.
- Tracking is faster than Detecting.



# TLD framework for Vehicle Detection

- Give a template image to the algorithm that trains the Detector.
- Detector detects the vehicle and initializes the Tracker.
- At each successful tracking, algorithm updates the Detector.
- When Tracker fails, it re-initializes the Detector.

# TLD framework for Vehicle Detection





Thank You