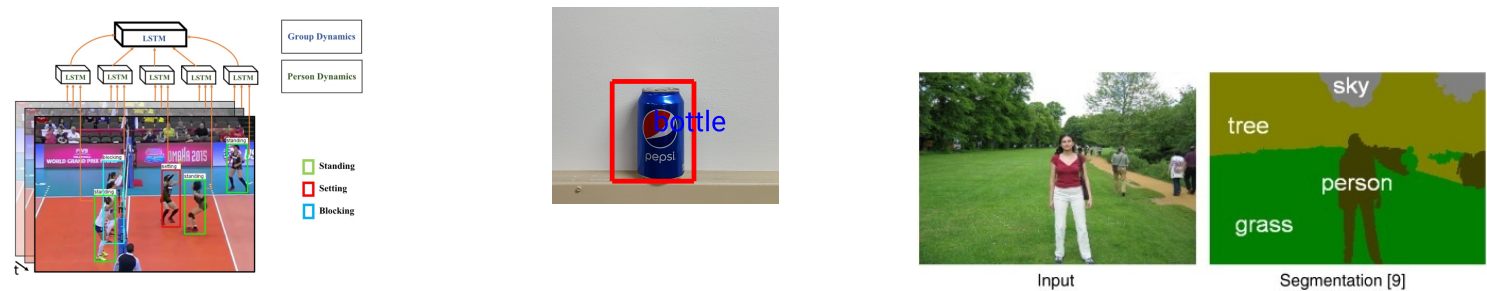


DeepFind: Sensor-driven Inference Acceleration for Continuous Deep Mobile Vision Applications

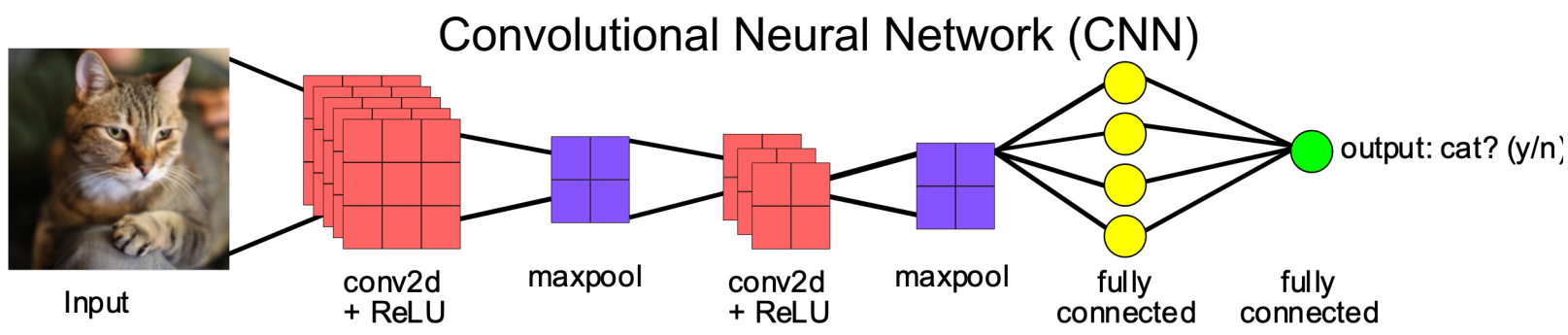
Chungkuk Yoo¹, Saiyma Sarmin², Inseok Hwang¹, Eric Rozner², Minsik Cho¹
¹IBM ²University of Colorado Boulder

Problem and Goal

- Continuous vision enables smart environments



- Deep learning CNNs obtain human-scale accuracy



- Problem: CNN inference computationally expensive

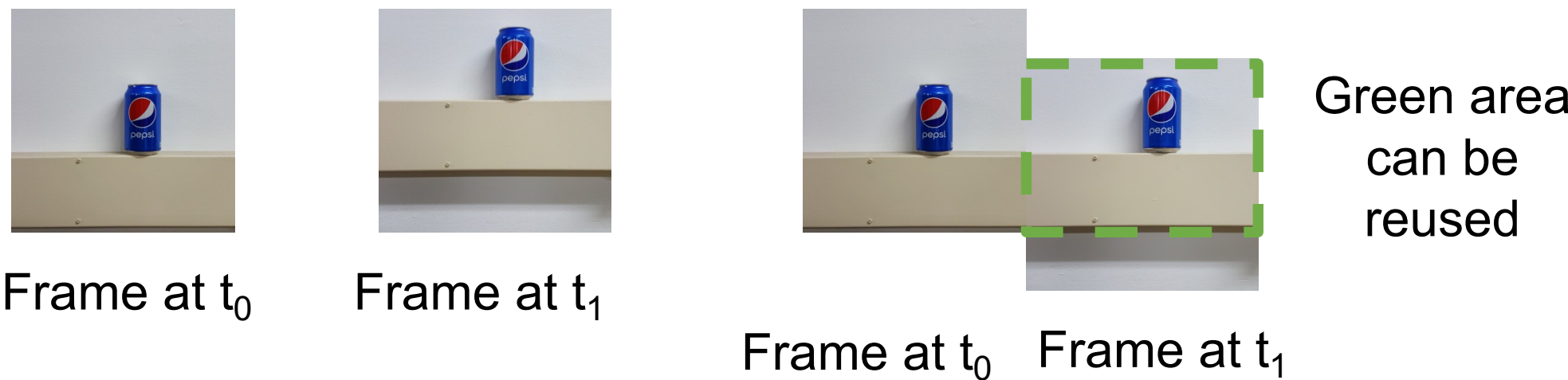


- Move data to cloud?
 - Privacy concerns
 - Network cost
- Move computation to edge?
 - Fewer resources than cloud (e.g., energy, computation)

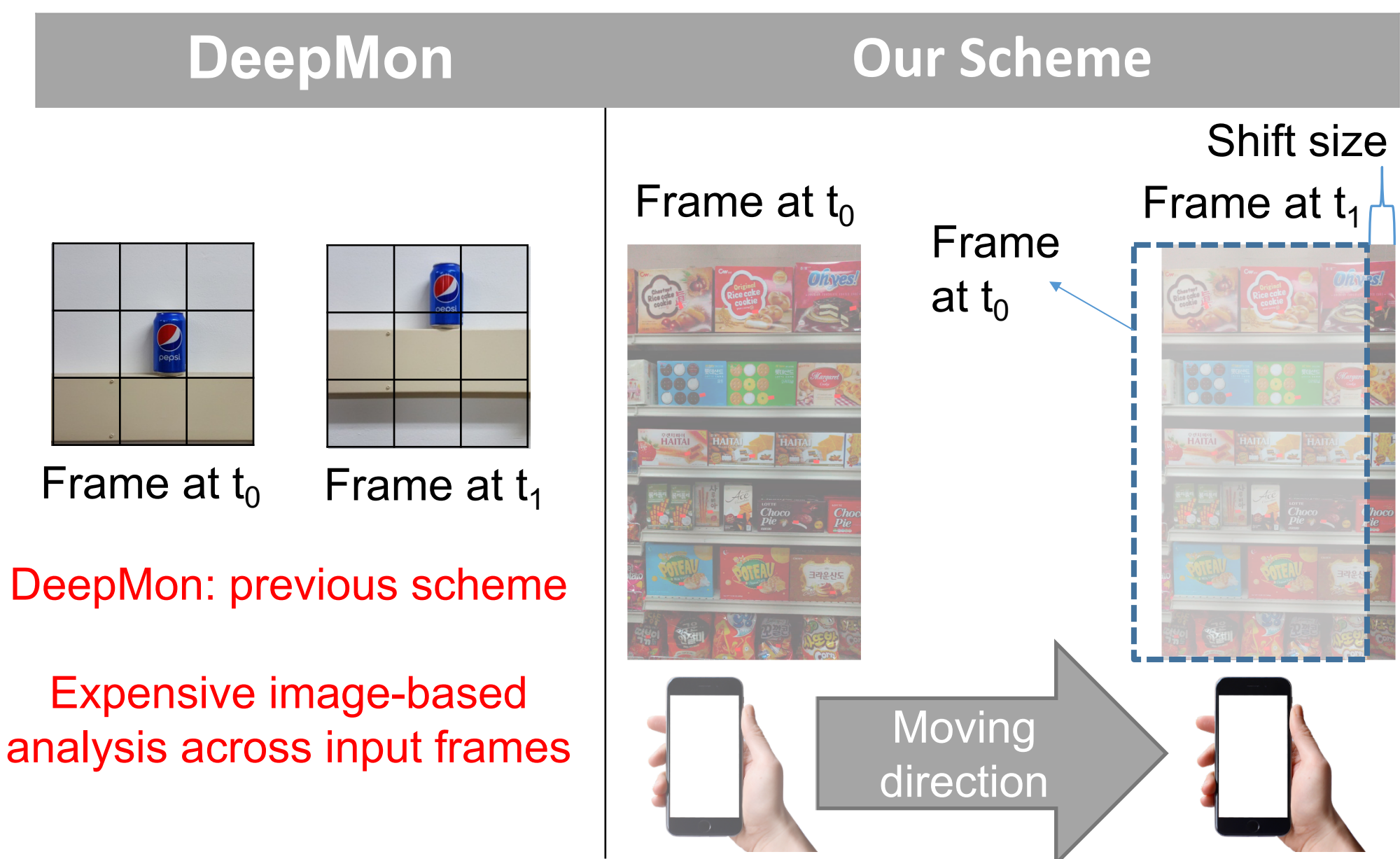
Goal: enable deep learning vision to run continuously and efficiently on mobile and embedded devices.

Approach

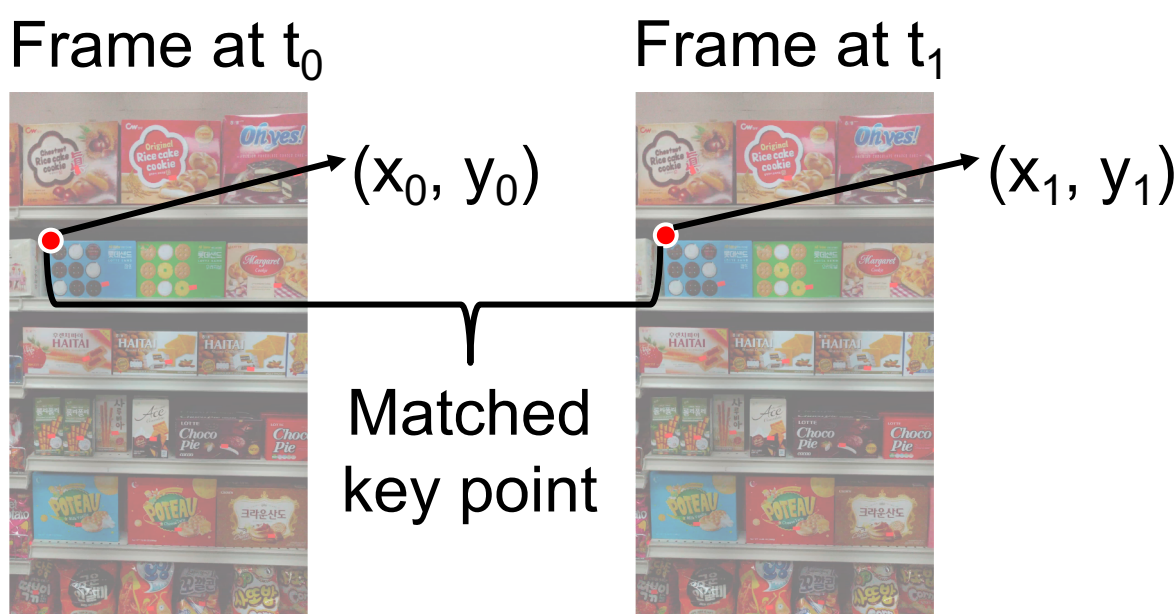
- Consecutive frames enable caching opportunities



- How to determine cacheable regions?

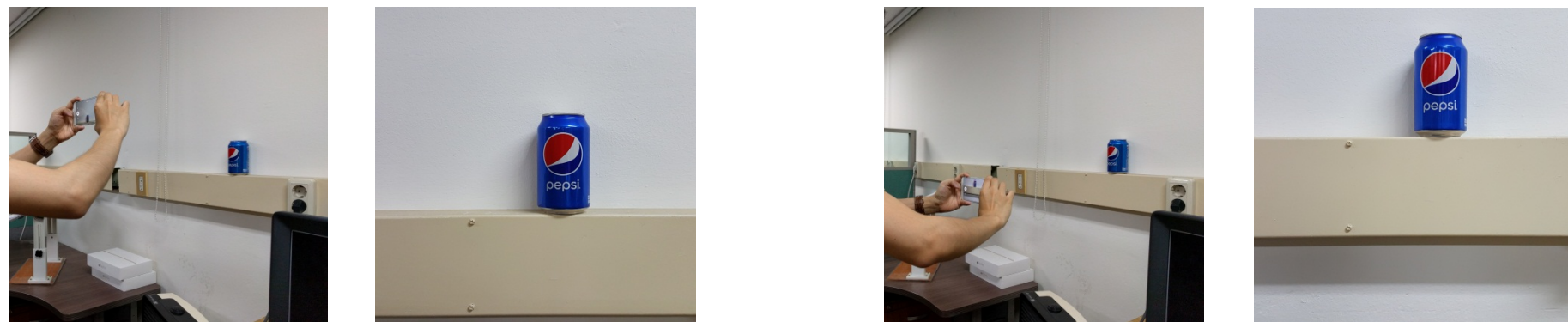


- Converting spatial distance Δx to pixel distance Δp

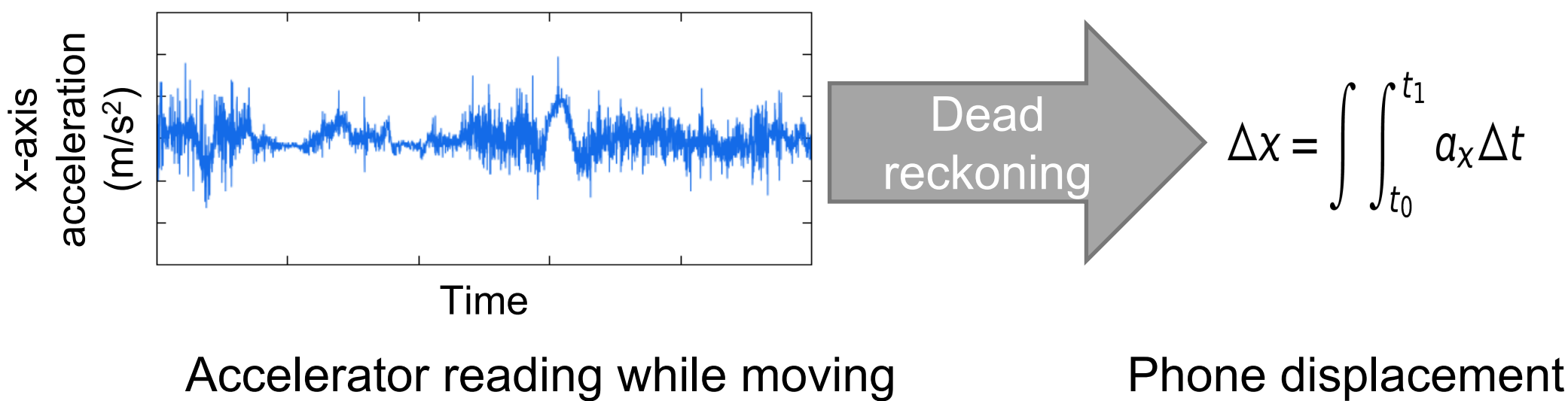


Contributions

- Accelerate CNN on mobile and embedded devices
- A caching mechanism to reduce CNN inference time
 - Exploits spatial/temporal similarities in CNN inputs

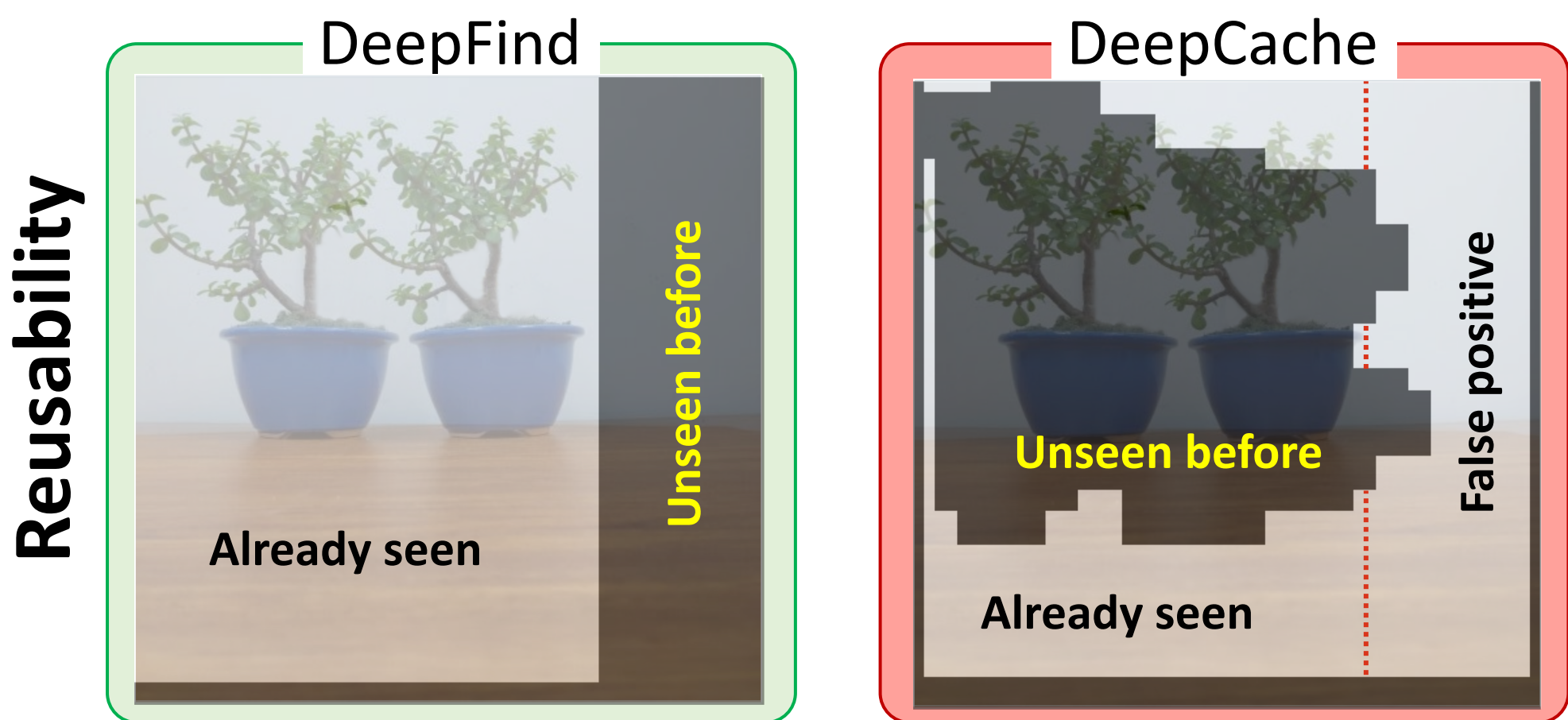
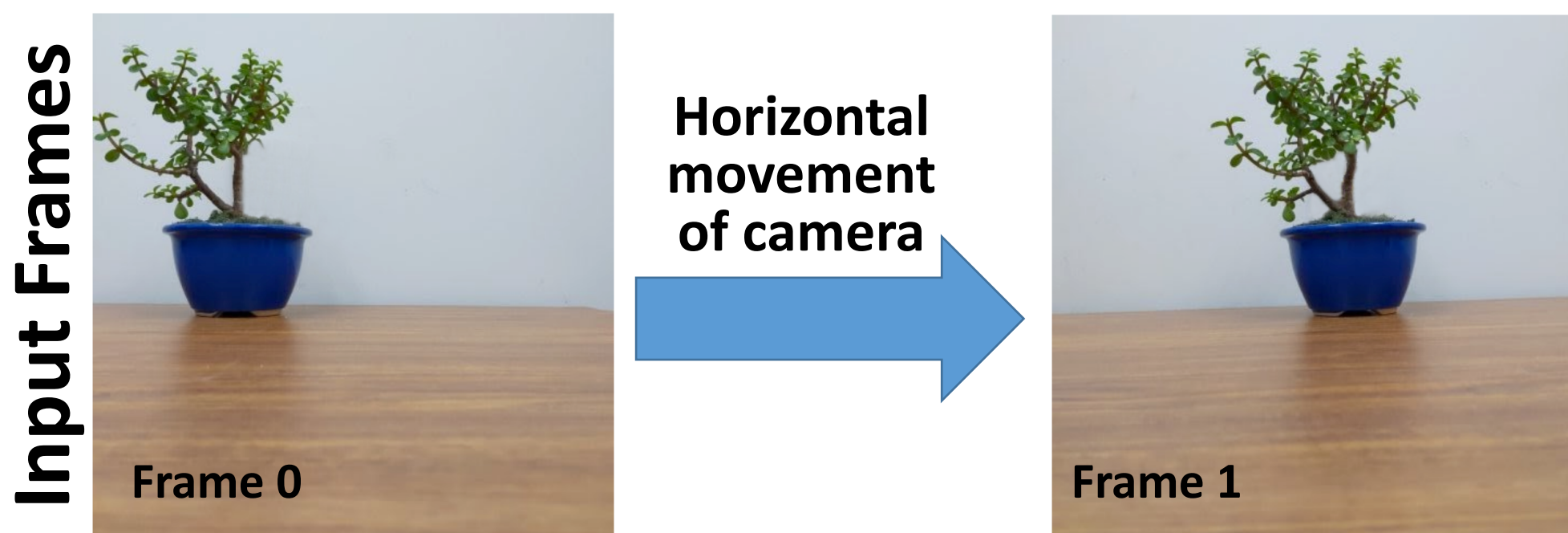
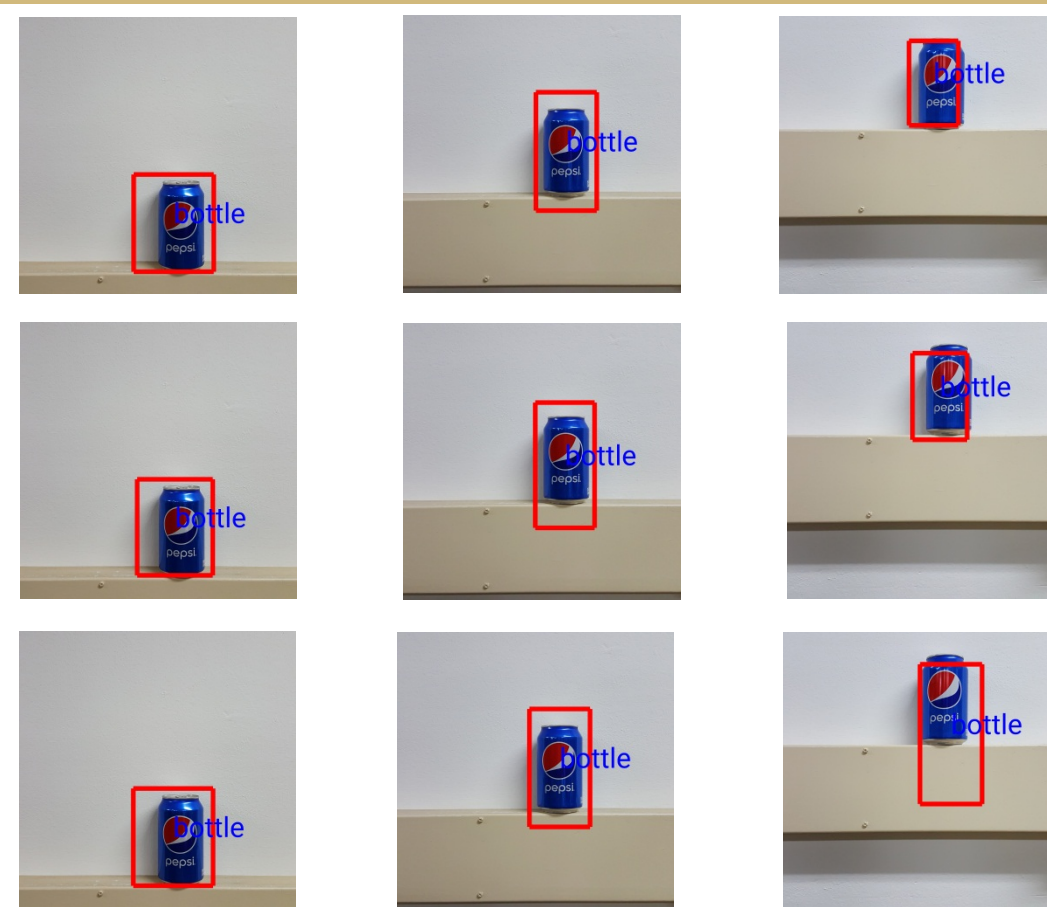


- Utilizes mobile sensors to determine similarities



Evaluation

- Original Tiny-Yolo
- DeepFind
- DeepMon



Time to determine cached region (per frame)

DeepFind	DeepMon	DeepCache
0.42 ms	6.0 – 18 ms	11 – 30 ms

Summary

- Continuous mobile vision important
 - Visual info provides context of users and environments
- Current deep learning algorithms are too expensive
 - Edge devices have less power, energy than cloud
- Our work makes efficient continuous vision on mobile and embedded devices a reality
 - Allows personalized intelligence to become truly pervasive