Vehicle tracking in video

Image Processing

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Outline

1. Introduction
2. Previous Work
3. Tracking-Learning-Detecting (TLD)
4. Results
5. Conclusions
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Problem statement

Goal

Track moving vehicles in real-time

Assumption

Vehicle has already been detected
Applications

- Military tracking of enemy vehicles
- Traffic surveillance
Difficulties

What makes tracking hard?

- Occlusion
- Shadowing
- Changing object size
- Moving camera
- Fast motion
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Method from class

Steps

1. Get average background image
2. Subtract from frame
3. Apply morphological operations
4. Blob detection
5. Track motion of centroid of bounding box

Limitation

Requires fixed camera
Other popular methods

<table>
<thead>
<tr>
<th>Methods</th>
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<td>Struck (Support Vector Machine)</td>
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Other popular methods

**Methods**

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Tracking-Learning-Detecting

Observations
- Long-term tracking is difficult
- Tracker can improve detector
- Detector can restart tracker
- Need way to balance the abilities of each

Methodology
Combine detection and tracking with a learning layer for correction
Tracker

- Media flow tracker
- Assume limited motion
- Assume object is visible
- Expect failure when object goes out of view
Detector

- Scan each frame
- Look for previously observed/learned patches
- Report all detections and confidence
Learning

4 Parts

1. Classifier
2. Training set
3. Supervised training
4. P-N experts
The experts

P expert
- Temporal structure
- Estimate current location from last position
- Create positive example when detector labels estimate negative

N expert
- Spatial structure
- Check detected possibilities against tracker guess
- Choose highest confidence
- Create negative example for patches not overlapping highest confidence patch
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Open view
Tracking
Behind Tree
False Positive
Precision Plot
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Final Thoughts

- Learning improves ability to track
- Dedicated tracking and detection algorithms may be better
- Explore other methods