Challenges in Time-Stamp Aware Anomaly Detection in Traffic Videos

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Computer Science & Engineering
Outline

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Introduction and Motivation

• The main intension of this paper is to find Time-stamp aware anomaly detection in traffic videos.
• Anomalies can be due to car crashes or stalled vehicles.
• Now a days, it became very difficult to know that an accident has occurred and to locate the
AI City Challenge 2019: Dataset
AI City Challenge 2019: Dataset

Track-1. City-scale multi-camera vehicle tracking

Track-2. City-scale multi-camera vehicle re-identification

Track-3. Traffic Anomaly Detection
AI City Challenge 2019: Dataset

- **Track 3 Traffic Anomaly Detection Dataset**

  **Train Videos:** 100 videos (approx. 15 min duration each)
  **Test Videos:** 100 videos (approx. 15 min duration each)
AI City Challenge 2019: Dataset

- To detect stalled vehicle there are multiple challenges with multi view cameras they provided data.

Illumination problem  
Cars in parking area  
Patch Problem

Slow vehicle problem  
Occlusions problem  
Construction vehicle background
Proposed System

Anomaly detection Framework

Input

Model

Conv

Relu

Pool

Output
Proposed System

1) Background Modelling
Eliminate moving objects so that only static object will remain in frame

2) Object Detection
Detection and localization of anomalous vehicle

3) Time Stamp Aware Anomaly Detector
Calculate the initial timestamp of anomalous vehicle.
Proposed System

Background Model

Object Detection Model

Algorithm

Anomaly Time stamp

Proposed System

Anomaly Time stamp

Conv

Relu

Pool

Background Model

Object Detection Model

Algorithm

Anomaly Time stamp
Proposed System

Background Model

The proposed deep background estimation network
Proposed System

Object Detection Model

The proposed one-stage object detector for anomalous object localization and classification.
Proposed System

Algorithm 1

**Input:** Vehicle detection response in background image. **Vid** contains the set of normal (no detection) and abnormal (some detection) label of a video.

*L:* length (**Vid**)

*N(Win_X):* Frequency of normal instances in Win_X

*A(Win_X):* Frequency of abnormal instances in Win_X

**Output:**

**Step 1:**

for *i* in *L*

Win_10 = **Vid** [i-5:i+5]  

If *(N(Win_10) > A(Win_10))*

**Vid** [i] = normal

end

**Step 2:**

for *i* in *L*

Win_20 = **Vid** [i:i+20]  

if *(N(Win_20) < 5)*

**Vid** [i:i+20] = abnormal

elif *(A(Win_20) < 5)*

**Vid** [i:i+20] = normal

end

**Step 3:**

for *i* in *L*

Win_5 = **Vid** [i:i+5]  

if *(N(Win_5) == 1)*

**Vid** [i:i+5] = abnormal

elif *(A(Win_5) == 1)*

**Vid** [i:i+5] = normal

end

**Initial Anomaly Timestamp:**

for *i* in *L*

if *(**Vid** [i] == abnormal)*

InitialTime = *i* * 3.3 sec

Break;

end

end
Qualitative and Quantitative Analysis

• Our method achieved 0.2641 S3-score on track-3 test videos of NVIDIA AI city challenge.
• It achieved 0.3838 F1-score and 93.61 RMSE respectively. The lowest S3-score is 0.0162
Qualitative and Quantitative Analysis

Sample Correct Results
Qualitative and Quantitative Analysis

Sample False Positive Results
Conclusion

- This paper presents a 3-stage pipeline for time-stamp aware anomaly detection in road/traffic videos.
- A two-stage method was proposed consisting of deep background modelling and one stage object detection, An algorithm for post processing was proposed to remove temporally inconsistent false positives to certain degree.
- An intuitive approach to anomaly detection was proposed and the challenges to solve the problem of NVIDIA AI city challenge track-3 were discussed.
Thank You