Challenges in Time-Stamp Aware Anomaly Detection in Traffic Videos

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Computer Science & Engineering

Outline

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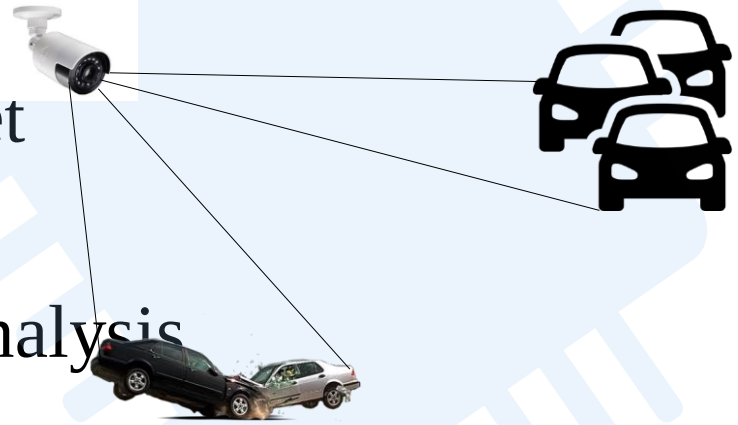
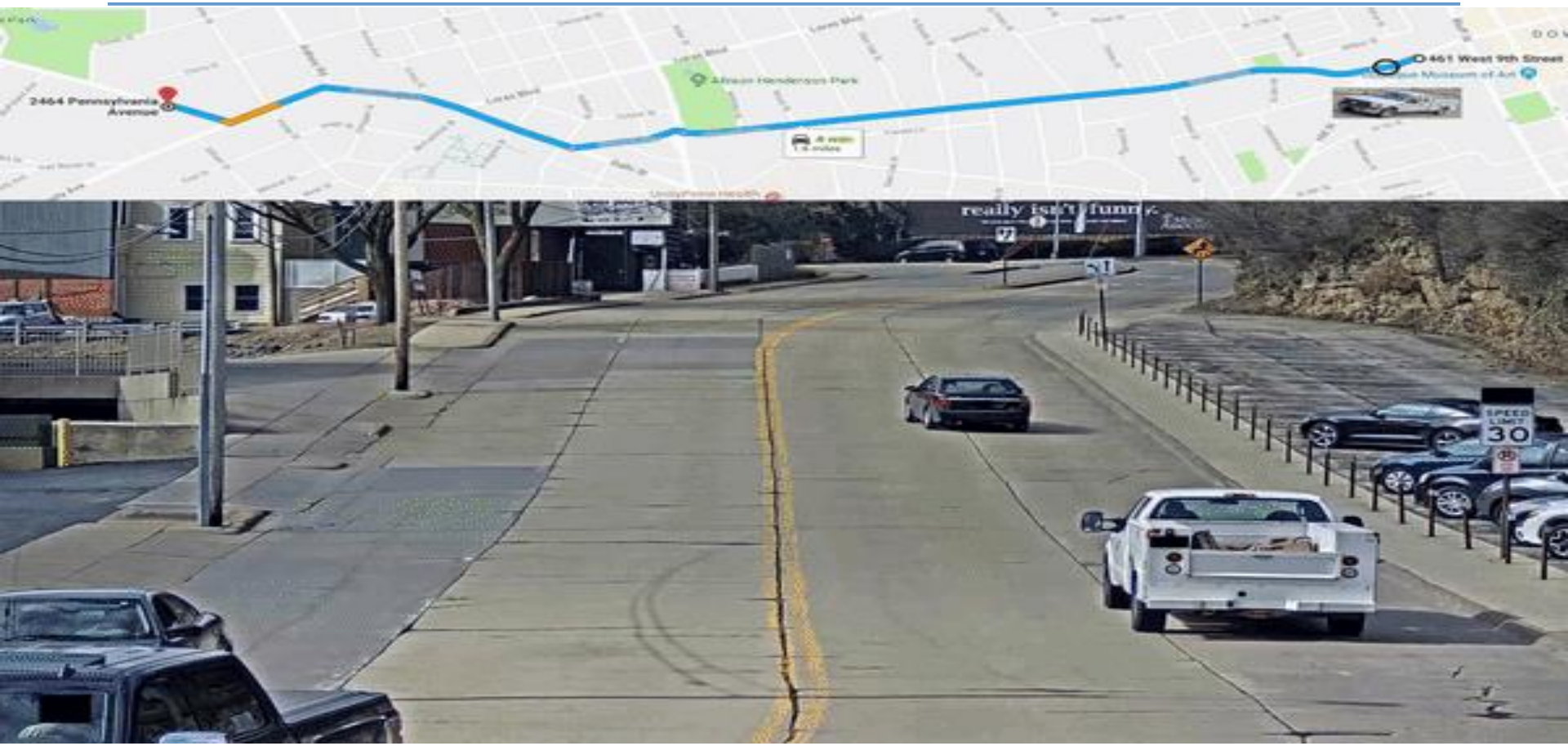


Introduction and Motivation

- 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

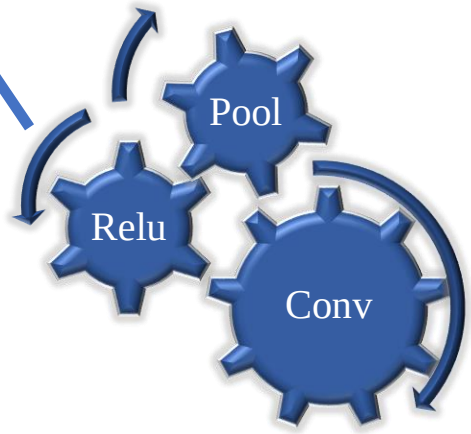
Occlusions problem

Construction vehicle background

Proposed System

Anomaly detection Framework

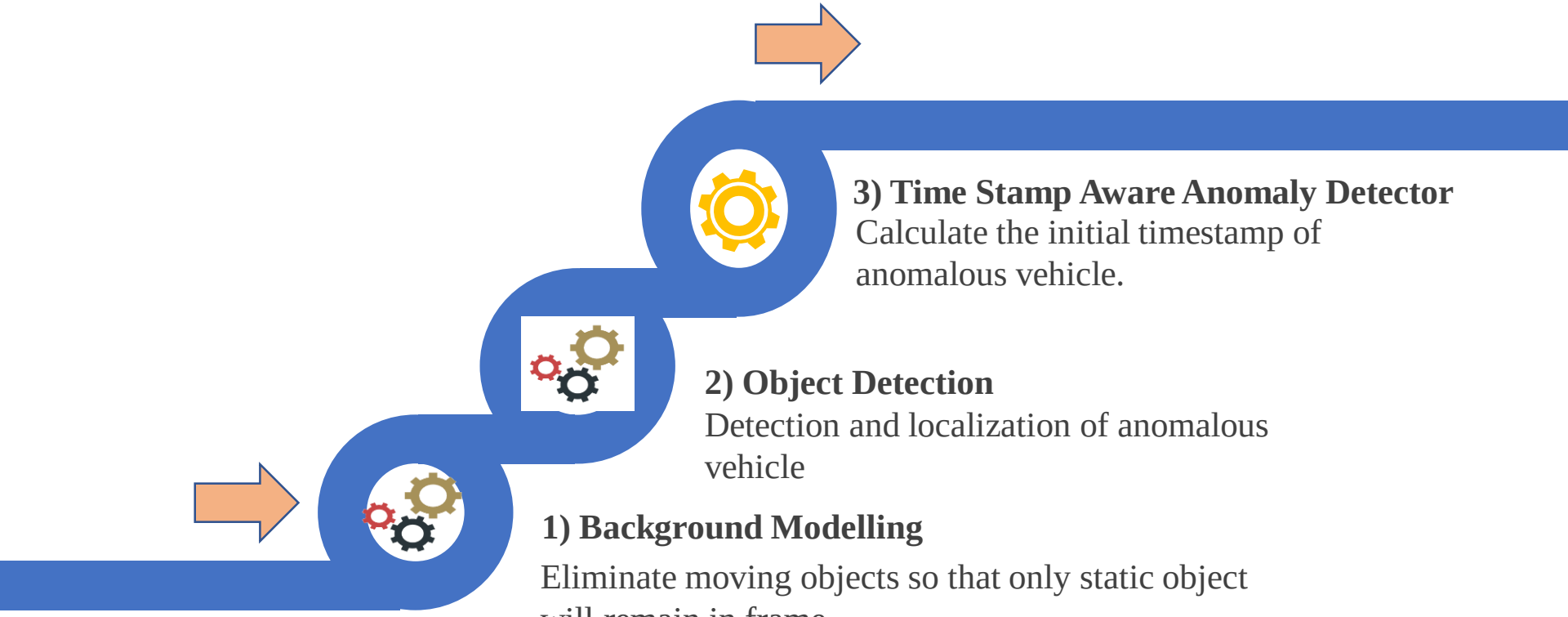
Input



Model

Output

Proposed System

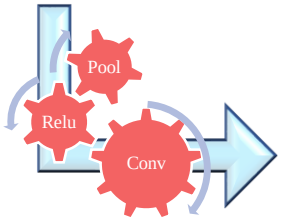


3) Time Stamp Aware Anomaly Detector
Calculate the initial timestamp of anomalous vehicle.

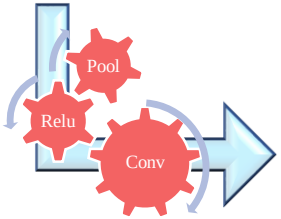
2) Object Detection
Detection and localization of anomalous vehicle

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

Proposed System



Background Model



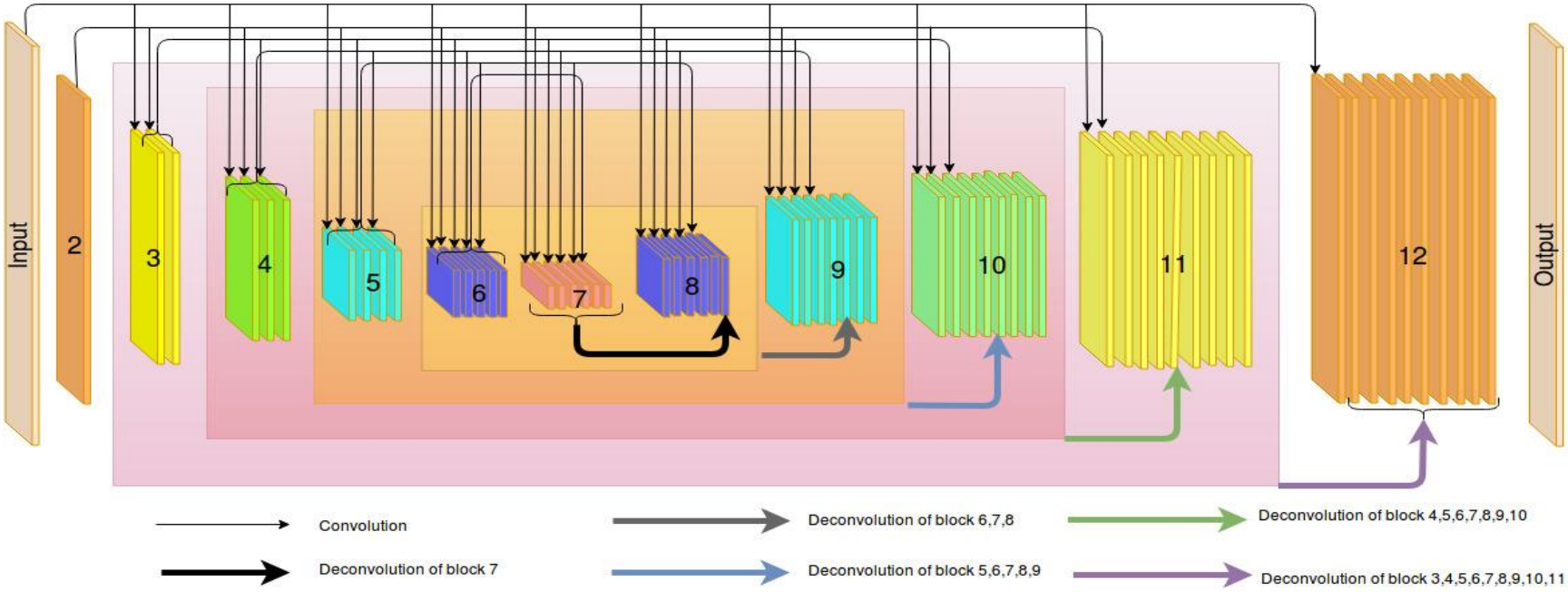
Object Detection Model

Algorithm

Anomaly Time stamp

Proposed System

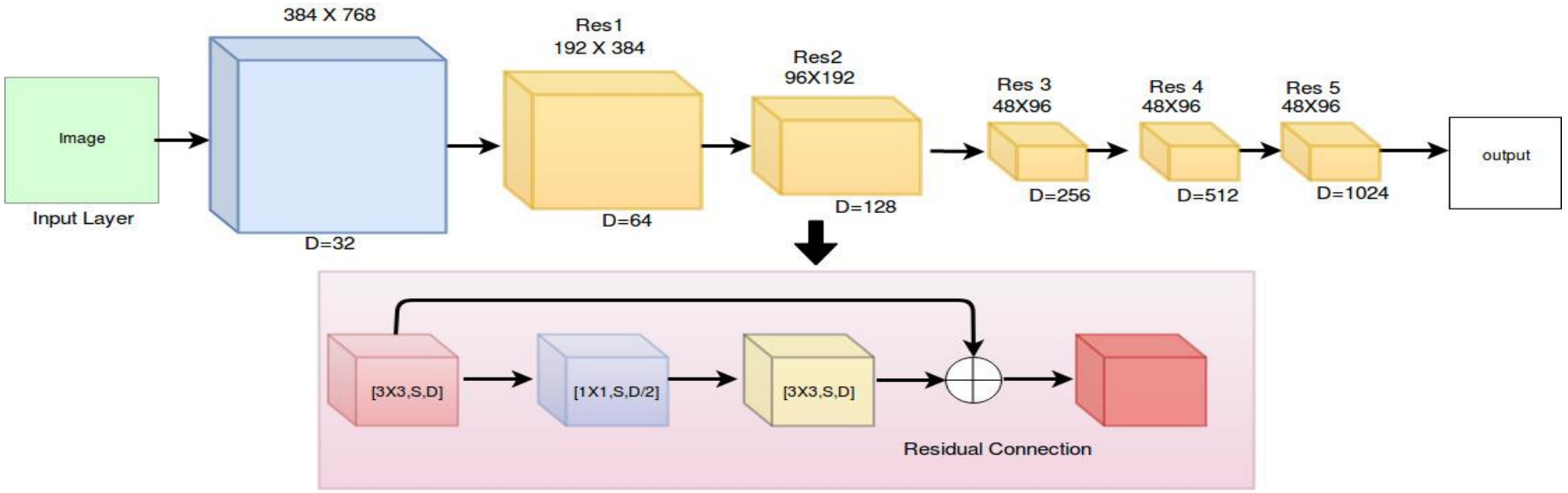
Background Model



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:

Step1:

for *i* in *L*

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

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

Vid *[i]=normal*

end

end

Step2:

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

end

Step3:

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

end

Initial Anomaly Timestamp:

for *i* in *L*

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

*InitialTime = i*3.3 sec*

Break;

end

end

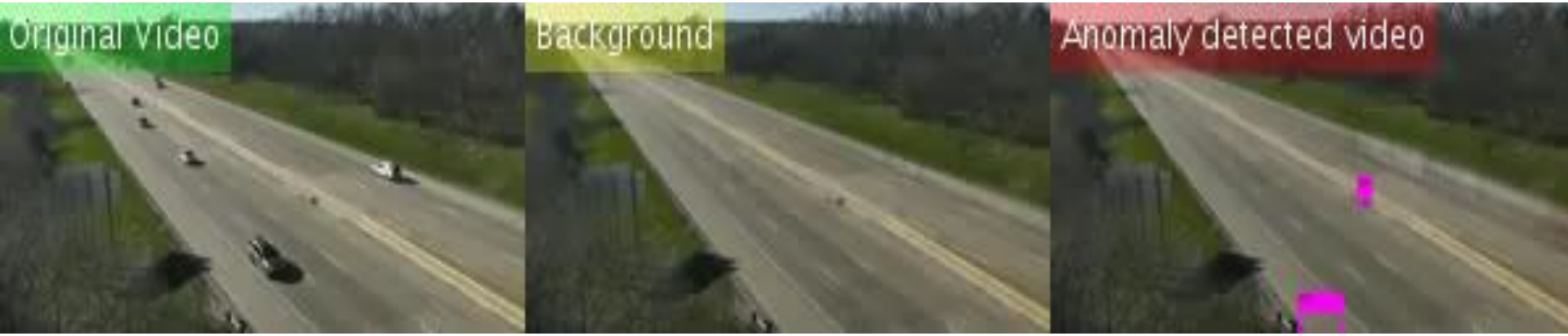
Qualitative and Quantitative Analysis

- 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. T
- he 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