Realtime Traffic Video Analysis Using Intel Viewmont Co-processer

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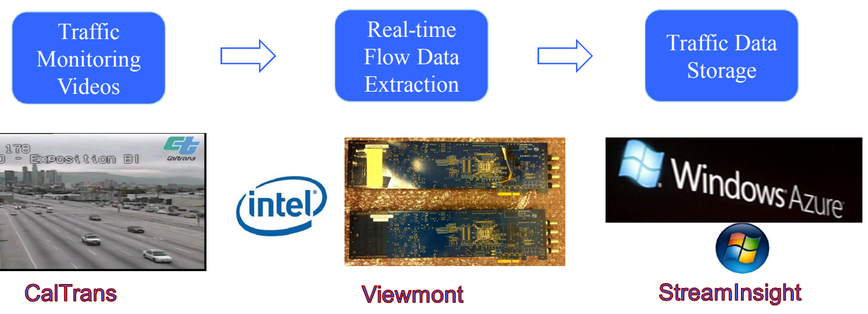
Introduction

•Verify operation of Intel Viewmont co-processor with SDK

•Implement vision-based algorithms to extract traffic flow data using Viewmont

•Demonstrate integration of Microsoft Streaminsight and Azure Cloud platform as part of end-to-end system



Related Work

•Video processing techniques for traffic flow

  •tripline, closed-loop tracking, data association tracking

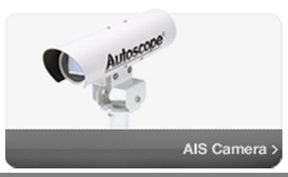
  •Solutions, limitations, problems have been studied

•Industrial products

  •Iteris, Autoscope, Traficon, etc.

  •Rack mounted dedicated systems and cameras

  •Data acquisition and event detection

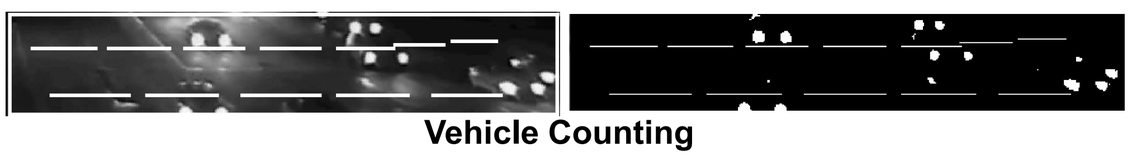


Vehicle Detection and Counting

Vehicle Representation

•Day-time: background subtraction, motion image generation, morphological operation, each car is presented as a complete block

•Night-time: headlight detection, based on luminance thresholding

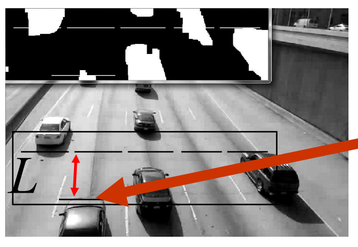


Vehicle Counting

•Calculate the percentage of motion points over each virtual line:

- If higher than predefined threshold, then car passing is detected

Speed Estimation

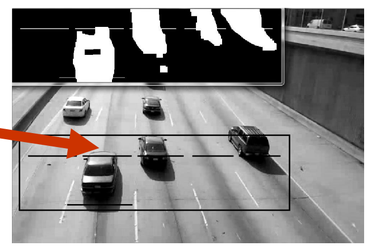


Moment that car is detected

T1 T2

$$\Delta T = T2 - T1$$

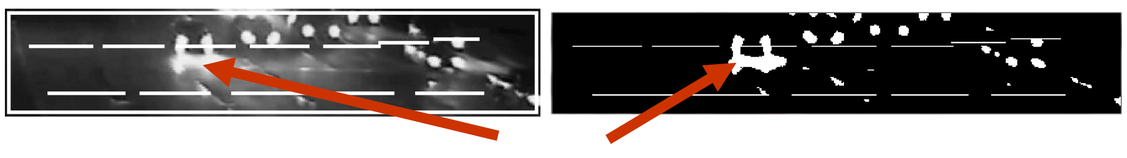
$$V = L / \Delta T$$



Challenges

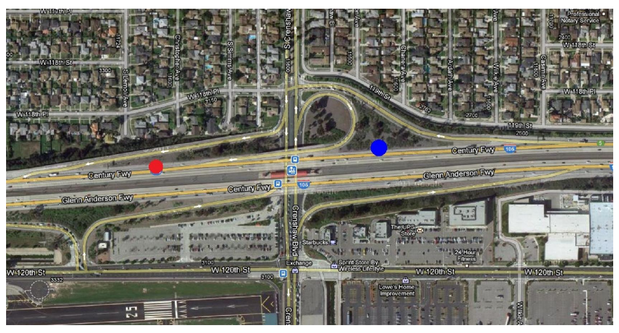
•Environmental impact on visual clarity: night, rain, shadow, wind, etc.

False car count: shadow, large vehicle



False car count: light reflection

•Comparison of results from loop detector



- Most locations of cameras and sensors are significant different to make the comparison hard
- Manual verification of most comparable location is time consuming

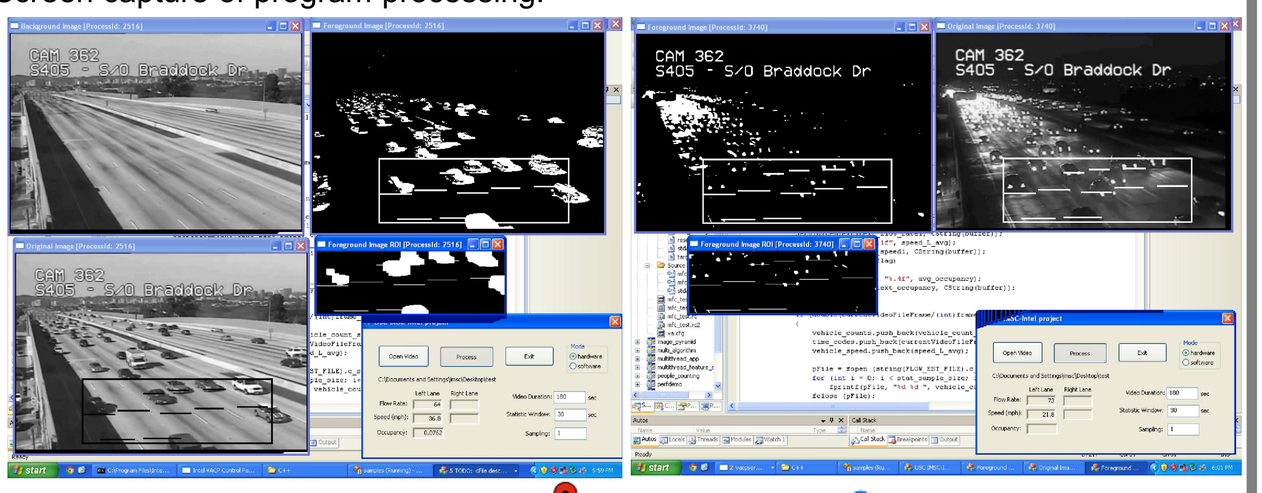
Experiments and Evaluation

•Experiments are done on videos captured from CalTrans live traffic monitors.

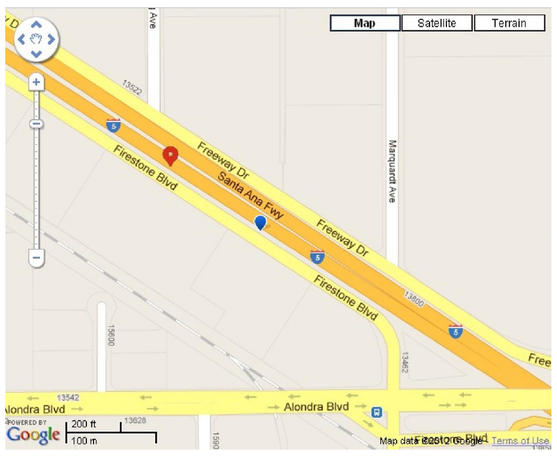
•Different weather and traffic situation are considered for robustness test.

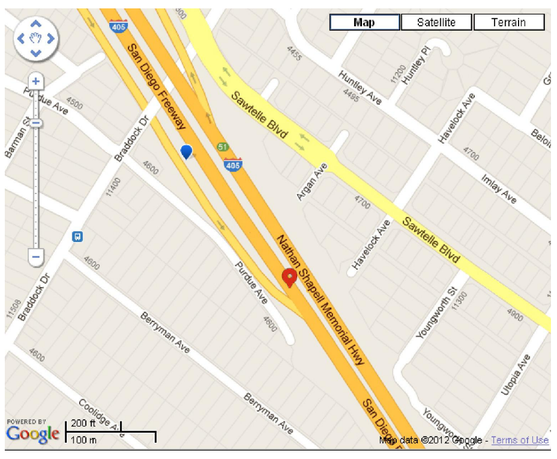
•Performance analysis is conducted by comparing data generated by our program, ground truth data and sensor data.

•Screen capture of program processing:



•Location pairs shown in Google map: sensor location, camera location.





•For counting number of vehicles, we can limit the error below 8% comparing to ground truth data. For estimating speed, the difference comparing to sensor data is averagely within 6 mph.

Conclusion and Future Work

•We can generate accurate vehicle counts and reasonable speed estimation for most cases.

•Future work includes:

- Develop new schemes to deal with more complex weather and traffic situations, such as bad environment and bad camera angles.
- Optimize program and workflow to reduce time cost for better real-time application.
- Propose and develop new functionality of traffic analyzing based on current approach, for example, to calculate ratio of big vehicles over normal cars, traffic accident identification and so on.

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