Realtime Traffic Video Analysis Using Intel Viewmont Co-processor

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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

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
- $\Delta T = T_2 - T_1$
- $V = L / \Delta T$

Challenges
- Environmental impact on visual clarity: night, rain, shadow, wind, etc.
- Manual verification of most comparable location is time consuming
- Comparison of results from loop detector
- False car count: shadow, large vehicle
- False car count: light reflection

Related Work
- Video processing techniques for traffic flow
  - Trilane, closed-loop tracking, data association tracking
  - Solutions, limitations, problems have been studied
  - Industrial products
    - Iteris, Autoscope, Trafcon, etc.
    - Rack mounted dedicated systems and cameras
    - Data acquisition and event detection

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.