Realtime Traffic Video Analysis Using Intel Viewmont Co-processor

Seon Ho Kim*, Cyrus Shahabi*, Jon Taplin** Daru Xu*, and Junyuan Shi*

*IMSC, Viterbi School of Engineering

**Annenberg School for Communication & Journalism

University of Southern California

Los Angeles, CA 90089

seonkim@usc.edu

USC Annenberg Innovation Lab

Bill Ford on the Connected Car

- "If we do nothing, we face the prospect of 'global gridlock,' a never-ending traffic jam that wastes time, energy and resources and even compromises the flow of commerce and healthcare. The cooperation needed between the automotive and telecommunications industries will be greater than ever as we prepare for and manage the future. We will need to develop new technologies, as well as new ways of looking at the world."

Objectives

- Define and verify a new market for Intel's Viewmont co-processor
  - Implement vision-based algorithms to extract traffic flow data using Viewmont
  - Compare results with those of the loop-detectors
  - Integrate into the CT pipeline

Video-Based Traffic Inference

- Opportunity
  - High maintenance of loop detectors (e.g., need to stop traffic for installation & maintenance)
  - High cost of installation

- Requirements
  - Compatible data collection (traffic volume/count, speed)
  - Comparable accuracy

- Extras
  - Vehicle classification, weight, length

Related Work

- Video processing techniques for traffic flow
  - <u>tripline</u>, 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

> The goal of our project is not to enhance video processing techniques nor device new techniques. We implement a technique on Intel Viewmont coprocessor and show its comparability to loop detector.

USC Viterbi School of Engineering   USC Annenberg *Innovation Lab*   IMSC Integrated Media Systems Center

Status

- Developed C++ based video analysis program using Viewmont SDK
- Developed GUI for flexible testing environment
- Used the simplest representation of vehicle movement to enhance the performance of video analysis
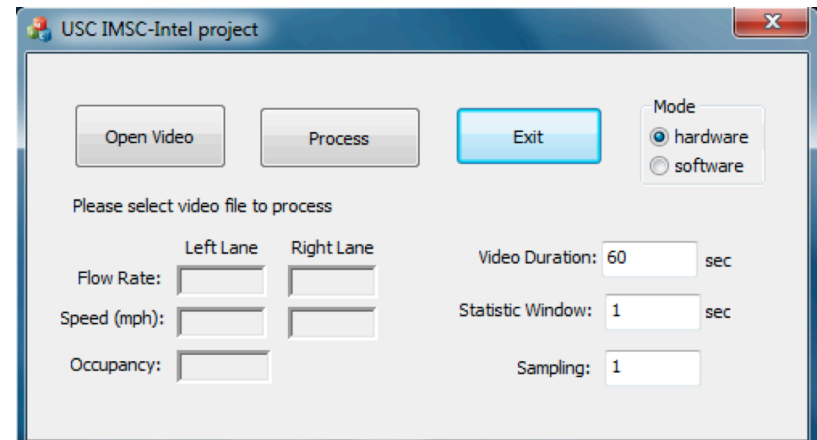
region of interest (ROI) ➡ *background subtraction* ➡ *morphological operation*

Analyze the movement of a car represented as a simple white block!
Extract traffic flow data: count and speed of passing cars

Preliminary Results (Examples)

Example 1: Daytime without shade
Counting No. of cars: 428/420 - 3.81%

Speed: 48.4 MPH (ours), 52.7 MPH
(sensor) No ground truth in speed.

Example 2: Rainy Daytime
Counting No. of cars: 343/324 - 7.72%

Red #: ground truth (manual counting)
Blue #: our result

Preliminary Results (Examples)

Example 3: Night with headlights
Counting No. of cars: 301/340 – 11.5%

Red #: ground truth (manual counting)
Blue #: our result

Example 4: Night with taillights
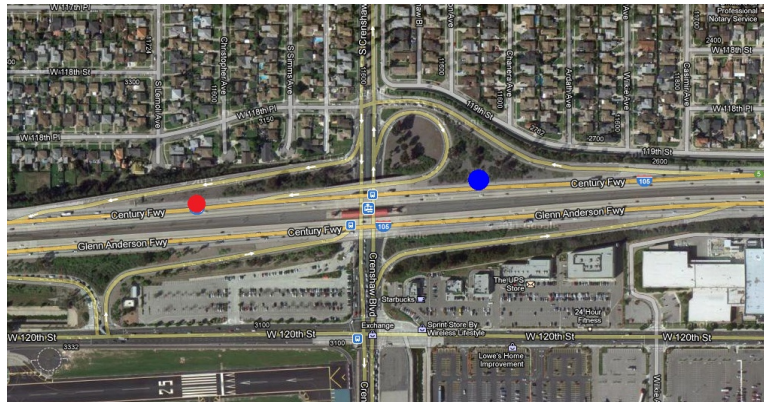Counting No. of cars: 231/218 - 5.96%

Remaining Challenges

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

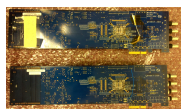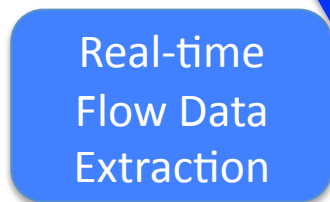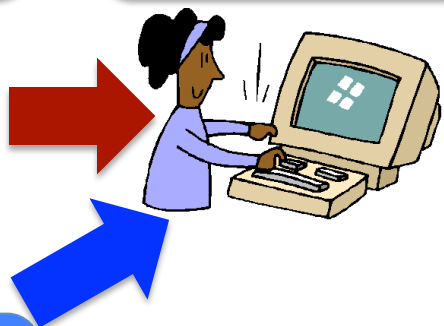- Comparison of results with loop detector

- Most locations of cameras and sensors are significantly different resulting in difficult comparison
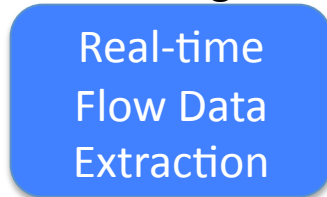- Manual verification of most comparable locations is time consuming

Remaining Challenges

Demonstrate integration of Microsoft Streaminsight and Azure Cloud platform as part of end-to-end system
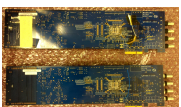
Future: Phase-II – Tight Integration & Telematics

Input Traffic Data	Data Processing	Storage	Querying Retrieval	Visualization

RIITS
Los Angeles County

Microsoft
StreamInsight

Traffic Monitoring Videos

Real-time Flow Data Extraction

Windows Azure

CalTrans

(intel) Viewmont

USCViterbi School of Engineering
USCAnnenberg Innovation Lab
IMSC Integrated Media Systems Center