Arterial Performance Measures Re-Identification Software Demonstration

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Presentation Description

A recorded demonstration was prepared explaining the purpose, development, framework, and potential uses of the developed open-source software described in the previous reports entitled, “Arterial Performance Measures Software” dated February 13, 2017, “Arterial Network Performance Measures Software” dated April 4, 2017, and “Arterial Trip Length Characteristics Software” dated June 30, 2017. The recorded presentation can be viewed at:

https://webmeeting.umd.edu/p3c5ymxjq97/?OWASP_CSRFTOKEN=e1c84f4446075128a4ceb0979ccc05c3c12da7eb212a4f14ca957d2e11c4514c

The PowerPoint slide deck included with this deliverable and all of the project reports can be accessed at: <https://tinyurl.com/ydz7dm3j>.

Arterial Performance Measures: Re-identification Software Demonstration

SMALL BUSINESS INNOVATIVE RESEARCH PROJECT
MAY 29, 2017 v15

Available Reports

Project Title: Sensor Fusion and Measure of Effectiveness Development for Off-line Traffic Analysis of Real Time Data

- ***Performance Measures of Interrupted-Flow Roadways using Re-Identification and Signal Controller Data***, C. Day and D. Bullock, May, 2015 - Full Report and Executive Summary
- ***Real-Time Monitoring Concepts for Arterials using Re-Identification and High-Resolution Data***, S. Young & D So Ting Fong, May, 2015
- ***Arterial Trip Length Characteristics***, S Young & D So Ting Fong, dated Sep, 2016
- ***Network Performance Measures for Arterials – a Systematic Level Perspective***, S Young, D So Ting Fong, D Bullock, & C Day, Jun, 2016
- ***Visualizations of Arterial Traffic Performance Measures: A Picture Book Approach***, S Young, D So Ting Fong, D Bullock, & C Day, Mar, 2016
- ***Assessing Longitudinal Arterial Performance and Traffic Signal Retiming Outcomes***, Slavrenz, C Day, D Bullock, W Smith, & J Sturdevant, Sep, 2015
- ***Traffic Performance of Arterial Highways and Driver Routing Characteristics During a Freeway Detour***, C Day, S Lavrenz, H Li, & D Bullock, Mar, 2016
- ***Arterial Performance Management System Lexicon***, S Young, D Bullock, & D So Ting Fong
- ***Common Data Formats for Re-Identification and High-Resolution Data***, S Young, D Bullock, & D So Ting Fong, Jun, 2015
- ***Arterial Performance Measures Software***, S Young & D So Ting Fong, Feb, 2017
- ***Arterial Network Performance Measures Software***, S Young & D So Ting Fong, Apr, 2017

Project Reports Available at: <https://tinyurl.com/ydz7dm3j>

Four Key Measures

Travel Time & Travel Time Reliability

- Based on sampled travel time from re-identification data
- Statistical distribution of travel time using overlay plots and cumulative frequency diagrams

Percent Arrivals on Green & Split Failures

- Based on High-Res Data
- Purdue Coordination Diagram & Green/Red Occupancy Ratio

Software Development Path

SBIR III

EVOLUTION OF BLUSTATS AND VPXPLORE

Development Motivation

Improvements in technology and methods are often accompanied by a confused and fragmented market.

- Initial vendor offerings are proprietary and often vertically integrated
- Custom/non-interchangeable data formats encourage vendor lock-in
- Results vary widely in implementation of both methods and visualizations

Market maturation is needed for:

- Consistent user experience: same output for identical input
- Standards based input/output

Software products developed to:

- Reference source for uniformity of analysis / visualizations
- Allow standards based data exchange
- Be used in bid specification/reference code
- Maximize users return on investment
- Encourage maturity and market growth

Accomplishments

A standard protocol for re-identification, CWS5200, was implemented. Sample analysis and visualization routines were coded in an open source visualization/analytics software.

Back-Office BluSTATs

- Traffax owned
- Closed source
- Custom data formats
- Compiled code distributed with hardware

Open Source VPXplore

- UMD/Traffax contributors
- Open source
- Open/standard data formats
- Matlab code can be distributed
- Reference implementations

Case Studies

Case Study 1: Maryland ICC

A tolled freeway in Maryland which connects Gaithersburg in Montgomery County and Laurel in Prince George's County. Opened Nov 22, 2011.

BluSTATs -> CWS5200 -> VPXplore

BluSTATs - Ingest Bluetooth Sensor Data

Name	Date modified	Type
SEP 2011 SBIR III SWDemo CS1 1270 to L..	5/22/2017 7:31 AM	MATLAB Data
SEP 2012 SBIR III SWDemo CS1 1270 to L..	5/22/2017 7:30 AM	MATLAB Data

CWS5200 Data Files

VPXplore - Ingest CWS5200 Data Files

Performance Measures and Visualizations

24 Hour Overlay Plot Comparison

24 Hour Overlay Plot Comparison

Before ICC – Sept 2011

After ICC – Sept 2012

Case Study 2: US 1 in Northern VA

Three mile long section of US-1
 From Kings Hwy to Mount Vernon Hwy
 11 Signalized intersections 3 lanes each direction
 Oct 2011 compared to Oct 2012

US 1 - Overlay Chart : 2011 vs 2012

US 1 - Overlay Chart : 2011 vs 2012

2011 Cumulative Frequency Diagram

2012 Cumulative Frequency Diagram

US-1 PM Peak, by the numbers ...

2011

Travel Time Index (TTI) 1.29

Planning Time Index (PTI) 3.18

Buffer Time Index (BTI) 2.45

Median Travel Time
3.17 min/mile
18.9 mph

Travel Time Reliability 0.46 P(85-15)/P50

2012

TTI 1.41

PTI 3.57

BTI 2.54

Median TT 3.43 min/mile
17.5 mph

TT reliability 0.45 P(85-15)/P50

	Focus Hr AM	Mid-day	PM	Custom	Units
Common					
TTI	1.18	1.23	1.25	1.29	1.38
PTI	2.40	2.11	3.36	3.18	3.45
BTI	2.03	1.71	2.70	2.45	2.51
25th	7.38	7.05	7.74	8.07	7.02 minutes
50th	8.48	8.02	8.80	9.41	8.67 minutes
75th	9.90	9.43	11.61	14.03	11.68 minutes
95th	17.23	13.75	23.76	23.09	21.75 minutes
IQR	2.51	2.38	3.87	5.97	4.66 minutes
Network					
Median TT	2.86	2.70	2.96	3.17	2.92 min/mile
	21.01	22.23	20.25	18.94	20.56 eqv mph
TT Reliability	0.52	0.64	0.52	0.46	0.61 P(85-15)/50

	Focus Hr AM	Mid-day	PM	Custom	Units
Common					
TTI	1.21	1.22	1.24	1.41	1.35
PTI	1.84	1.98	2.90	3.57	3.36
BTI	1.52	1.62	2.34	2.54	2.49
25th	7.85	7.38	7.92	8.17	7.18 minutes
50th	8.99	8.49	8.95	10.13	8.78 minutes
75th	10.40	9.98	10.82	14.47	11.72 minutes
95th	13.68	13.74	20.90	25.74	21.91 minutes
IQR	2.55	2.60	2.90	6.30	4.53 minutes
Network					
Median TT	3.05	2.88	3.03	3.43	2.98 min/mile
	19.69	20.85	19.78	17.47	20.15 eqv mph
TT Reliability	0.48	0.57	0.51	0.45	0.60 P(85-15)/50

Final Thoughts ...

Reference software is provided to:

- Implement research and recommendations in the SBIR III project
- More quickly mature the re-identification market
- Provide reference code to implement data standards, performance measures and visualizations
- Enable sharing of data, and consistency in use of arterial performance measures

Thank You!

For further information contact:

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Report Sponsor

The “Small Business Innovation Development Act of 1982” (Pub. L. No. 97-219), along with reauthorizing legislation (Pub. L. No. 99-443 and Pub. L. No. 102-564, the “Small Business Research and Development Enhancement Act of 1992”), seeks to encourage the initiative of the private sector and to use small business effectively to meet federal research and development objectives. To comply with statutory obligations of the Act, the U.S. Department of Transportation established the Small Business Innovation Research (SBIR) Program, which conforms to the guidelines and regulations provided by the Small Business Administration. Annually, small businesses are solicited to submit innovative research proposals that address the high-priority requirements of the U.S. Department of Transportation and that have potential for commercialization.

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Publication

This report is part of a series of reports published in collaboration with USDOT, Traffax, Inc., and Purdue University. The full report series is available for download at <http://docs.lib.purdue.edu/apmtp/>.

Open Access and Collaboration with Purdue University

The Indiana legislature established the Joint Highway Research Project in 1937. In 1997, this collaborative venture between the Indiana Department of Transportation and Purdue University was renamed as the Joint Transportation Research Program (JTRP) to reflect state and national efforts to integrate the management and operation of various transportation modes. Since 1937, the JTRP program has published over 1,600 technical reports. In 2010, the JTRP partnered with the Purdue University Libraries to incorporate these technical reports in the University’s open access digital repository and to develop production processes for rapidly disseminating new research reports via this repository. Affiliated publications have also recently been added to the collection. As of 2017, the JTRP collection had over 1.5 million downloads, with some particularly popular reports having over 20,000 downloads.