Advanced Traffic Visualization and Mining System (ATVMS)

Spatial Data Management Lab

Presented by Arnold P. Boedihardjo
Motivation

- Transportation Manager
  - How is the freeway performing today? Yesterday?
  - Which locations are worst performers?
- Traffic Engineer
  - Where are the congestions (in time and space)?
  - Which of these recurrent congestion?
  - Which loop detection are not working properly?
- Traveler, Commuter
  - What is the travel time on a route?
  - Will I make to destination in time for a meeting?
  - Where are the incidents and events?

Real-Time Analysis
ATVMS: At a Glance

- Tool for **real-time** monitoring and analysis
  - HOV/non-HOV traffic visualization
  - Traffic behavior prediction
  - Traffic comparison
  - Travel time estimation
  - Automatic incident detection
  - Detector status monitoring

- **High performance**
  - Quick response time: 3 seconds/query

- **Web-based user interface**
Main Web Interface
Time Plots
I-66 EB Station 121

Daily Pattern

Weekly Pattern

Monthly Pattern at 8:30 AM
Time Plots
I-66 WB Station 52

Composite View

Color-valued Plot
Spatial Plots
I-66 All stations

Single Day View (EB 8:30AM)

Composite Views (WB 6PM)
Spatiotemporal Plots
I-66 All stations in a given day

Spatial/Time Plot - Speed

Spatial/Time Plot - Volume

I-66 Saturday Accident

Spatial/Time Plot - Speed

I-66 Severe Inclement Weather
HOV vs. Non-HOV Lanes Time Plots

I-95 NB

Time Plot Avg Non-Hov

Time Plot Avg Hov
Spatiotemporal HOV Monitoring
Weekday, I-95 NB, Traffic Flow (All Stations)
Traffic Comparison and Detector Monitoring

[Image of traffic comparison and detector monitoring]

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Spatial Data Management Lab
http://spatial.nvc.cs.vt.edu/
Case Study: #3 Ranked Congestion
Weekday, I-95 NB, Dale Blvd and Prince William Pkwy (Milepost 157-161), 5-7AM
Case Study: #7 Ranked Congestion
Weekday, I-66 EB, between dulles toll and westmoreland st (milepost 64.8-68.7), 5-7PM

Spatial/Time Plot - Volume

Spatial/Time Plot - Speed

Spatial/Time Plot - Occupancy
Case Study: Highway Closure
2/8 (Wed), 2006 I-95 NB, Traffic Flow (All Stations), Incident 8-10AM:10-12PM, MP 153.8-157
Traffic Prediction

I-66 East bound traffic

I-66 West bound traffic
Travel Time Estimation

1) Please enter route end-points:

Starting Address
- Street: [Input]
- City: [Input]
- State: [Input]
- Zip: [Input]

Ending Address
- Street: [Input]
- City: [Input]
- State: [Input]
- Zip: [Input]

* Only states around the Washington, DC area are currently applicable. If and when more state DOTs make their data accessible to this service, additional states will be added. Note that the traffic information must be in a standard ODC WFS format.

2) Please enter travel options:

Approximate Travel Timeframe

Weekday: [Input]
Specific Date: [Input]
Departure Month: [Input]
Departure Hour: [Input]

3) Get Directions:

- Use statistical traffic data
- GET DIRECTIONS!

Calculated Route Information

- Distance: [Input]
- Time: [Input]
- Duration: [Input]

Driving Directions

- [Detailed driving directions]

Route Map

- [Map showing route with markers and distances]

Contact Information:
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- Asenova Bogomolova

Welcome to the AITVS Driving Directions Website! This site is a result of an Independent Study project by Asenova Bogomolova at the Computer Science Department at Virginia Tech University. This service provides driving directions and travel time estimates for any route within the United States. Routes that traverse the Washington, DC metro area highways are enhanced with data provided by the Virginia Department of Transportation. Specifically, historic and current traffic conditions are used to improve travel time estimations and visualize the expected congestion areas.

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Travel Time Estimation

Manassas -> Falls Church (8AM)

Falls Church -> Manassas (4PM)
Automatic Incident Detection

Traffic Model: Thursday-West Bound

Traffic Sample

Compare

No Incident

Traffic Model: Sunday-East Bound

Traffic Sample

Compare

Incident

Incident
ATVMS Architecture

Applications
- Traffic engineer
- Operation Manager
- Emergency Personnel

ATVMS
- Data Mining
- Visualization
- Database
- Data Pre-processing

Data Sources
- Interstate 66
- Interstate 95
- Interstate 395
- Interstate 495

- Quick response times
- Multiple visualization components

- Components and layers
- Real-time constraints
- Composite indexing
- Data caching

- Raw detector data
- Stored and compressed
Conclusion

- Multiple visualizations
- Support data mining tasks
- High performance
- Application: Operations
  - Routing and guidance for travelers and commuters
  - Ramp meter control (freeway operation)
  - Incident management
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