Advanced Methods for Transportation Data Collection

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Intro: Why Data?
Vehicle Detection
  - Freeway vehicle volumes/speeds
Pedestrian/Bicycle Tracking
  - Shared pathway analysis
Bluetooth Vehicle Tracking
  - Corridor travel times
Transportation is not highways + construction
- Cannot build out of congestion
  - Induced demand
  - Spatial/monetary constraints

Efficient operation and alternatives
- Can’t manage what you can’t measure
- Alternatives must be comparable
Vehicle Detection
  - Freeway vehicle volumes/speeds
Pedestrian/Bicycle Tracking
  - Shared pathway analysis
Bluetooth Vehicle Tracking
  - Corridor travel times
Surveillance Video Infrastructure

- Hundreds of available cameras
  - You’re on camera 10 times a day
- Mainly used for traffic surveillance
  - Many on intersections of arterials
- Low resolution
- Varying mounting angles
- Changing environments
- Why not use them for detection?
Why Surveillance Video? Aren’t loops OK?

- Cheap
  - Nothing proprietary, network already there
- Easy
  - No pavement damage, lane closures
- Verifiable
  - “See it in action”
Video Issues – Project Motivation

- Proprietary algorithms, equipment
  - High cost, limited deployment potential
- Extreme sensitivity to environmental impacts
  - Highly inconsistent error rate, depending on conditions
- Sensitivity to congestion
  - Occlusions between objects cause issues
Vehicle Tracking

- **Focus on:**
  - Counts
  - Occlusions
  - Night-time detection
  - Inclement weather
  - Camera vibration
  - Tracking

- **Ignore:**
  - Classification
  - Volume/Occupancy
  - Headway
  - Speed
Spatiotemporal Maps

- Capture pixels along scan-line
Spatiotemporal Maps

- Append to previous captured scan-line pixels
Spatiotemporal Maps

- Vertical scan-lines accumulated every frame
Adverse Conditions
Presentation Overview

- Pedestrian/Bicycle Tracking
  - Shared pathway analysis
- Bluetooth Vehicle Tracking
  - Corridor travel times
Shared Pathways

- Important alternatives to driving
- Routes to transit

- Mostly bikes and pedestrians
  - Big difference in modes
    - Purpose
    - Ability

- Safety concerns
  - Perceived
  - Real
Pathway Characteristics

- Mode Split

- Pedestrian Speed Distribution
  - Max pedestrian speed?

- Cyclist Speed Distribution
  - Max bike speed?
Bike-Ped Interactions

- Speed Difference
  - What’s the difference in bike and pedestrian speeds?

- Oncoming speed
  - How fast and how close?

- Passing Events
  - How many, how close and how often?
Detecting Objects

- Appearance Characteristics
  - Size, Proportion
- Behavioral Characteristics
  - Location (Zone Restrictions)
Distinguishing Peds

- Speed is not always a good assumption
  - Joggers/Runners
  - Slow bikers
- Paths left by bikes are smoother
- Analyze “jaggedness” of path
  - How much longer is this path than a line?
Pathway Results

83% Crossing Detection
3% Mode Split Error
Presentation Overview

- Bluetooth Vehicle Tracking
  - Corridor travel times
Most people have mobile devices
- Some have Bluetooth
  - Some broadcast their MACs – unique device names
- Listen to MACs at Point A
- Listen to MACs at Point B
- Subtract timestamps
- Obtain travel time
Device Basics

Device manufacturing  Current device version  Mounted device
Live Travel Time Info

Calculate Travel Time
Strip MACs
Filter Results

DRIVE NET

Users

MAC

via GSM

MAC

via GSM

via GSM
User Interface

DRIVE Net | Digital Roadway Interactive Visualization and Evaluation Network
Tested Configurations
Travel Time Data Comparison

SR-522 Travel Times Eastbound

- BT_5min_Avg
- ALPR_5min_Avg
Detection and Matching Rates

Eastbound Detection Rate (Normalized)

Eastbound Matching Rate (Normalized)
## Preliminary Results

<table>
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<tr>
<th>Configuration</th>
<th>Detection Rate</th>
<th>Match Rate</th>
<th>ALPR Volume (avg # vehs/5 min)</th>
<th>Avg. BT Travel Time (mins)</th>
<th>Avg. ALPR Travel Time (mins)</th>
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Data is important in transportation

Technology is making data acquisition easy

Someone will have to collect/analyze it...