Smart Personalized Routing in Navigation
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Smart Routing Characteristics
- Estimate real-time flow for all links (traffic data not available for all links)
- Incident detection
- Predict link flows in case of events
- Driver style
- Driver preferences

Structure of the System

Driver Style
Dynamic and Static Data
Smart Routing
VISUM
HMI

Incident Detection
- Measurements: Speed, Flow, Occupancy

Events

On-Road events:
- Accident
- Road closure
- Construction

Off-Road events:
- Sport events
- Concerts

Extreme events:
- Natural disasters
- Terrorist Attack

Flow Generation Methodology

Initial Estimation
Four-Stage model

Trip Generation
Production of zone i
\[ p(i) = \sum_{j \in \text{zones}} \beta_i(j)p_i \text{j} \]
Attraction of zone j
\[ A(j) = \sum_{i \in \text{zones}} \gamma(i)A_i \]

Trip Distribution
\[ t_{ij} = \alpha(i,j)p(i)A_j \]

Modal Split
- Car
- Bus
- Truck

Traffic Assignment
- Incremental assignment

Off-Line Estimation
Off-Line estimation is based on the historical data as well as the results from initial estimation.

\[ \min p(v) = a_1 \sum_{r \in \text{routes}} (\bar{v}_r - \rho_{r,r}v_{r,r})^2 + a_2 \sum_{r \in \text{routes}} c_{r,r}v_{r,r} \]
subject to \( \bar{v}_r \geq 0 \)

\( \bar{v}_r \): Average link flow \( l \)
\( v_{r,r} \): Volume of route \( r \) connecting OD \( s \)
\( c_{r,r} \): Cost of route \( r \) connecting OD \( s \)
\( \rho_{r,r} \): Decision variable
\( 0 \leq \rho_{r,r} \leq a_1 \)

On-Line Estimation
On-Line estimation is based on the off-line estimation and real-time flow.

\[ \min f(v) = \beta_1 \sum_{r \in \text{routes}} (v_{r,r} - \bar{v}_r)^2 + \beta_2 \sum_{l \in \text{links}} (v_{l,A} - \bar{v}_l)^2 \]

\( v_{r,r} \): Real-time volume of link \( r \)
\( v_{l,A} \): Historical volume of link \( l \)
\( \bar{v}_r \): Estimated linkflow
\( 0 \leq \beta_2 \leq \beta_1 \)

Driver Style
Driver style has impact on the travel time estimation and classified into three categories:
- Fast
- Moderate
- Slow

Interfaces

Web-Based
Car Interface
Smart Phone Apps

HMI

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