LECTURE 6: [PART1] SPECIAL TOPICS

(TRAVEL TIME VARIABILITY & MODELLING ROAD TRAFFIC)

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SPECIAL TOPICS
(INTRO)

Travel
Let’s suppose that I have to arrive to a meeting at 11am and I want to decide the latest time I can leave my home and still have a high probability of arriving on time.
Let’s suppose that I have two ways for getting from work to home either by train or car.

- Train: Travel time 50 minutes
- Car: 11% of the time is 60 minutes and 89% of the time is 30 minutes. Average 
  \[
  (0.11 \times 60 + 0.89 \times 30) = 33 \text{ minutes}
  \]
- 90th percentile is 60 minutes.

Always leave work at 6pm and my objective is to spend maximum time with my kids before bed time. Hence, I will care only about the average time and my choice will be driving all the time.
SPECIAL TOPICS
(TRAVEL TIME)

DEFINITION 6.1: Travel time

Travel time is usually refer to the period of time spent in travelling from an origin location to a destination location.

Travel time = free flow time + systematic delay + unexplained delay

Affecting factors

• Average demand level
• Physical characteristics of the roads – capacity
• Speed-flow relationship

Dissimilarity is confusing since it depends on how much we know about the journey – subject to perspective.
Travel time variability is an indicator of the variability of travel time from an origin to destination in the transportation network (including any model transfer or en-route stops).

To describe travel time variability, the standard deviation is commonly used as statistical descriptor for the variability of random variable.
SPECIAL TOPICS
(TRADEL TIME VARIABILITY)

VARIABILITY ACTORS:

- Demand variation through the day
- Unforeseen incident
- Weather conditions
- Random perturbations to traffic flow
SUMMARY 6.1:

Travel time variability is a metric that permits us to have an understanding of the reliability and variability of travel time of specific journey.

Indicators:

- Mean Travel Time (MTT)
- Standard Deviation of Travel Time (SDTT)
- The 95th Percentile Travel Time (95th PTT)
- Buffer Index (BI)
- Planning Time Index (PTI)
Mean travel time:

\[ T_l = \frac{1}{n} \sum_{i=1}^{n} t_{li} \]

\( T_l \) is equal to the sum of the travel times collected by a number of floating cars (\( n \)), traveling on link “\( l \)”. 
Standard deviation of travel time:

\( \sigma_l \) is the measure of the dispersion of travel times which can be formulated as follows:

\[
\sigma_l = \sqrt{\frac{\sum_{i=1}^{n} (t_{ii} - T_l)^2}{n - 1}}
\]
The 95% percentile travel time:

How to compute percentile:

Approach 1: the % of the data that is below the amount in question

Approach 2: the % of the data that is at or below the amount in question

Let’s assume we collected the number of hours of daily driving of 14 drivers each one is represented by square
The 95% percentile travel time:

What is the percentile rank for the driver with a daily driving time of 6 hours?

How to compute percentile:

Approach 1: the % of the data that is below the amount in question

Approach 2: the % of the data that is at or below the amount in question

Let’s assume we collected the number of hours of daily driving of 14 drivers each one is represented by square
The 95% percentile travel time:

What is the percentile rank for the driver with a daily driving time of 6 hours?

How to compute percentile:

Approach 1: the % of the data that is below the amount in question

\[
\frac{7}{14} = 50\%
\]

Approach 2: the % of the data that is at or below the amount in question

Let’s assume we collected the number of hours of daily driving of 14 drivers each one is represented by square
The 95% percentile travel time:

What is the percentile rank for the driver with a daily driving time of 6 hours?

How to compute percentile:

- **Approach 1:** the % of the data that is below the amount in question
  
  \[
  \frac{7}{14} = 50\%
  \]

- **Approach 2:** the % of the data that is at or below the amount in question
  
  \[
  \frac{12}{14} = 85\%
  \]

Let’s assume we collected the number of hours of daily driving of 14 drivers each one is represented by square.
The 95% percentile travel time:

How to compute percentile:

Approach 1: the % of the data that is below the amount in question

Approach 2: the % of the data that is at or below the amount in question

Let’s assume we collected the number of hours of daily driving of 14 drivers each one is represented by square

REMARK 6.1:
The difference between the 95th percentile travel time and mean travel time is called buffer time.
Buffer Index:

\( B_l \) is the extra time that a traveler should add to the Mean travel time to ensure on-time or earlier arrivals.

\[
B_l = \left( \frac{T_{95\%} - T_l}{T_l} \right) \times 100\%
\]
Planning time Index:

The planning time index compares the longest travel time against a travel time incurred by free-flow traffic.

$$P_I = \left( \frac{T_{95\%I}}{T_{Fl}} \right) (100\%)$$
THANK YOU FOR YOUR ATTENTION

— Intelligent Transportation Systems - MTAT.08.040 - Lecture 6 [Part1]