

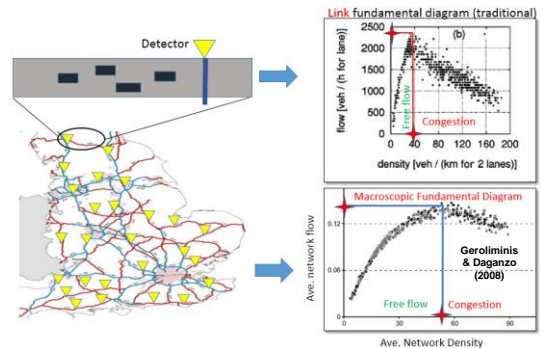
A Cluster Analysis for the Variation of Macroscopic Fundamental Diagram: A Case Study in Tokyo Metropolitan Areas

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What is Macroscopic Fundamental Diagram?

Macroscopic Fundamental Diagram (MFD) describes a functional relation between **average network flow** and **density** within a network. Network performance can be maximized by control the output flow at free-flow regime.

In this study, we want to find what factors that could impact MFD variation to select an **appropriate MFD** for **traffic control** purpose in different condition of demand and supply.



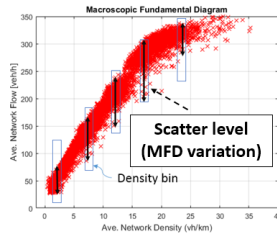
MFD Variation

Free-flow regime MFD:

Important factors : ODs demand pattern

Congestion regime MFD:

Important factors : congestion pattern, capacity, traffic light coordination



Mechanism of traffic between **free-flow** regime and **congestion** regime is different

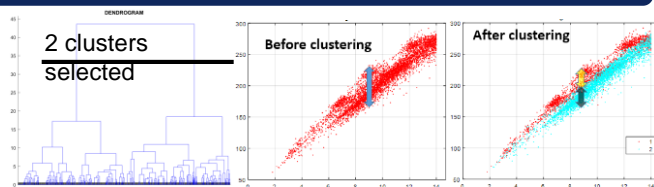
Objective: Evaluate MFD's properties at free flow regime

Data

- Long-term data (1 year, 2012) observed by fixed detectors in 51 Tokyo Metropolitan areas
- Hourly aggregated data: vh/km and vehicle accumulation
- Total network length of streets/avenues: ~515 km



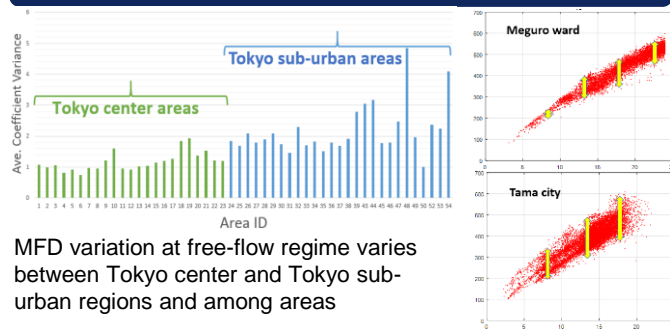
Cluster Methodology



Expectation:

- Group "similar features" of MFD into separated sub-MFDs
- Reduce scatter levels in sub-MFDs
- Able to find causes of various scatter levels at MFD's free-flow regime
- Area has sub-MFDs with significant difference in mean value is chosen for composition analysis**

Variance Analysis



MFD variation at free-flow regime varies between Tokyo center and Tokyo sub-urban regions and among areas

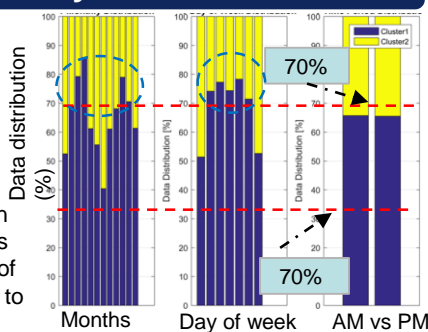
Composition Analysis

Tentative factors:

- Monthly
- Days of week
- AM vs PM

Purpose:

- Evaluate distribution of data in sub-MFDs
- Interpret existence of tendency regarding to tentative factors



Chiyoda ward: Season and weekday effect

Summary of Results

- Cluster analysis works successfully in Tokyo Metropolitan areas (sub-MFDs are significantly different)
- Time period is the strongest factor that effects MFD's variation at free-flow regime
- Most data outliers mainly come from weekends and typical months
- MFD's variance at free-flow regime in center Tokyo areas is lower than in Tokyo sub-urban areas. This could be explained by difference of the network structures within these two regions