Double parking is a common occurrence in dense urban areas. This study introduces a data-driven framework based on machine learning techniques including the LASSO, stability selection and random forest to identify influential factors and to estimate the frequency of double parking events. Parking violation tickets, 311 service requests, social media information and street characteristics are utilized in the study.

In addition, this study adopts a comprehensive modeling approach to estimate the impact of double parking with two typologies of models: 1) an M/M/∞ queueing model to estimate double parking's effect on the average travel time; and 2) a micro-simulation model to study individual and combined effects on travel time with different levels of travel demand, double parking locations, frequency, and durations.

This study provides transportation agencies with a novel methodology to quantify the impact of double parking in a large-scale network and to predict potential double parking hotspots for better policy-making, enforcement, and management.

**Abstract**

**Motivation**

- Double parking is one of the key contributors to traffic congestion and safety in dense urban areas.
- Collecting double parking data is usually difficult and very labor intensive.

![Figure 2. NYC double parking violation tickets, 2014 July to October.](Image)

- The system is designed with two server states "Failure (F)" or "Normal (N)". Let \( r \) denote the rate of DP clearance time and \( / \) the frequency of DP events. The system will be in state \((\text{F}, \text{F})\) if there are \( 1 \) vehicle in the system that are interrupted by double-parked vehicles, while the system will be in state \((\text{N}, \text{I})\) if there are \( i \) vehicles in the system that are travelling without interruption.

**Figure 3. State transitions for M/M/\(\infty\) model with two server states**

- Microsimulation model is an effective approach to compute average travel time under double parking conditions.
- Micro-simulation is more powerful than the M/M/\(\infty\) queueing model for evaluating congested scenarios and can be used to examine individual and combined effects of various explanatory variables.
- This study provides an alternative model to estimate street-level double parking activities based on tickets issued for parking violation, 311 service requests, and surrounding street characteristics that are relatively easier to acquire at the city level.
- Feature selection algorithm has shown to succeed in identifying the most influential factors.

**Conclusions**

- The random forest model achieves 85% prediction accuracy of double parking occurrences for 50 study locations in Midtown Manhattan, New York.