Consumer Data Research Centre

An ESRC Data Investment

Sainsbury's

Detecting Local Congestion on Store Access Routes

Chloe Mow[1], Sarah Wise[1], Tim Rains[2], Harriet Jack[2]
[1]University College London, [2]Sainsbury's

Abstract

Traditionally the selection of store type and location for Sainsbury's has relied on factors related to local community demographics, population estimates, addressable market, and competitor locations. However, this approach did not consider micro-location factors such as the effect of traffic congestion on store access roads and the surrounding area at different times of day across the year which may influence consumer appetite.

This study looked at detecting traffic congestion on store access routes at three periods of time during the year at different times of the day within a 0.5km radius of Sainsbury's stores; specifically, Summer, Term and Christmas. The main hypothesis predicts higher levels of congestion closer to store access routes with congestion being defined by increased travel time and lower speeds. Work zone categorizations from COWZ-UK were utilized to define and understand the nature of congestion outside stores.

The primary research questions were 1) how speed changes across the three time periods outside stores, 2) what extent does work zone classification explain traffic congestion outside stores, and 3) what predictions can be made regarding speeds around stores?

The scope of the study is the entire UK, with case studies analyzing Manchester and Bristol plus a further highlight on the Portishead store in Bristol. The different area lenses aim to show the influence of the methodology on traffic detection. The methodology was visualizing store access points alongside the chosen road nodes within 0.5km of stores, creating heat maps, applying two clustering techniques: Density-based spatial clustering algorithm (DBSCAN) and Hotspot Analysis, followed by Kernel Density Estimation (KDE) with a Gaussian bandwidth to predict probability of certain speeds around store access routes.

The results were unable to comprehensively address the research questions due to the lack of sensitivity in the data. Results for the DBSCAN showed strong clusters in London and North of Bristol at the UK level; however, there were many overlapping points. DBSCAN also did not show any significant clustering patterns when performed on the case studies cities, with singular points placed on work zone areas but without obvious spatial patterns.

In the Portishead example, there was insufficient data for DBSCAN; therefore, a hotspot analysis was performed. From applying work zone categories to the visualization, hotspots were found on roads classified as Highly Qualified and Professional Services, Principally Residential Suburbs, and Business Parks. Some results contradicted the heatmap visualizations, which could point to the lack of granularity in the data available for analysis.

Notwithstanding the limitations mentioned above, consistent with the hypothesis the results generally showed an increase in speed further away from store access points. Work zone classifications were also found to be a useful indicator of areas prone to increased congestion but further understanding of road classification is required to develop a full picture of traffic behavior outside stores.

Subsequent research will require more granular and consistent data for intricate predictions and clusters using additional algorithms such as K-DBSCAN or DBSCAN-GM, as well as Supervised Learning algorithms such as Support Vector Machines/Regression, to more comprehensively answer the questions raised in this paper. Addressing these questions may provide further insights into driver behavior, consumer decisions, and route choice forecasting.