Using Detector Information to Determine Turning Movement Proportions in Shared Lanes

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Background

Obtaining turning volume counts from detectors in shared lanes is a major challenge, thus multiple detectors are often needed to track the turns [1, 2]. One detector is unable to produce turning movement counts in shared lanes so another detector should be placed at departure lane. However many states do not use departure detectors. Current practice is gathering such information through manual counts which is very costly. The purpose of this paper is to provide three methods to estimate turning movement proportions in shared lanes without using departure detectors.

Research Question

How can turning volumes be estimated in shared lanes using “only” stop bar detector data?

Proposed Methods

Three methods are proposed in this study to estimate turning volumes in shared lanes without using departure detectors:

1) Network Equilibrium (NE): In this method unknown movement is estimated based on equilibrium of volume in two intersections.

2) Volume and Queue Length of Shared Lanes (VQ): The main idea of this method is that if there are more vehicle in shared lane compared to adjacent lane(s), then probably new entered cars to shared lane decide to turn.

3) Flow Characteristics of Shared Lanes (FC): In this method turning proportion is estimated based on headway of vehicles, position in the line, etc.

Modeling Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
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<tr>
<td>Regression</td>
<td>User must specify the structure of the model</td>
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<tr>
<td>Genetic Programming (GP)</td>
<td>GP automatically evolves both the structure and the parameters</td>
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Considerations

- Departure detector: Not applicable in Nevada
- Network Equilibrium (NE): Useful if there is not significant trip generator between intersections
- Volume and Queue Length of Shared Lanes (VQ): Useful if downstream intersection is not close to study intersection
- Flow Characteristics of Shared Lanes (FC): Not applicable if left turn is not protected, Not applicable if there are many pedestrian, Not applicable if turning radius is large

Case Studies and Results

Three intersections in Reno, NV, were chosen for validation of methods. Results show that Mean Absolute Percentage Error (MAPE) of Hourly Average of all case study intersections are less than 15 percent. Also GP produces better prediction models compared to conventional regression.

Research Summary and Conclusion

In this study, three different methods are proposed to calculate the proportion of turning vehicle movements in shared lanes at signalized intersections. These methods, wherever conditions are met, are easy to apply and do not need considerable investment. The methods were applied at three intersections in Reno, NV. Results determined that these methods can be applied to produce accurate counts. Genetic Programming (GP) was used for modeling, and proved its accuracy in generating models compared to conventional regression.

Quick Presentation

For more detailed information please scan this image and watch the video that I made based on this research. At this presentation you would see the methods in detail and steps that data were prepared and modeled.

References


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