I-95 CC – Volume & Turning Movement Project
Webinar on Accurate Estimates of Traffic Volume - anywhere, anytime – from GPS Probe Samples
May 23, 2018

Question and Answer Summary:

- **Alan Warde: For the Florida example, was the INRIX data filtered to remove speeds less than 3 mph, such as is currently done with the NPMRDS? If not, do you have any thoughts on how such filtering would impact your results?**
    - o Zach Vander Laan: The INRIX data was not filtered to remove speeds less than 3mph. It's hard to know the exact impact it would have without testing, but we wouldn't expect it to change the results much, as we're focusing on 1-hour time periods and don't encounter it often.

- **Clay Packard: Is the performance metrics broken down by functional class and time period, or is the model itself also broken down by functional class and time/hour period?**
    - o Zach Vander Laan: Just the performance metrics

- **Steven Lavrenz: Is there a theoretical justification or other examples of using EMFR in practice? I'm not very familiar with this particular error measurement tool**
    - o Zach Vander Laan: Measuring error relative to capacity can be useful at times when there aren't many vehicles on the road - otherwise errors can seem artificially high if measured relative to observed volumes. EMFR uses "practical capacity" for comparison, using the max observed flow as the capacity value
    - o The original perspective of ETCR (error to capacity ratio) was from a highway operations perspective. It is critical to understand volumes as they near capacity as that is where flow breakdown occurs. Having a large percentage error during overnight low flow conditions is not critical, where as volume errors as traffic nears capacity on a freeway can impact accurate estimate of flow breakdown point. When the measure was carried to arterials, calculation theoretical capacity was not practical, so the ratio was altered to that of maximum flow.

- **Benjamin Jacobs: Has this error been checked against places without stations? In other words, have you checked the extrapolations to the non-covered areas?**
    - o Zach Vander Laan: We're currently working on doing this with short term count data
    - o Note that in all the work (UMD and NREL) – 'blind error measures' were calculated, meaning that if data from a particular count station or 48 hour count were used, that corresponding data was not used in the Machine Learning process.

- **Li Jin: Did you consider the car crash accident impact in this model?**
    - o Zach Vander Laan: This current model does not use incident information, although this is something that we've been looking at incorporating.
    - o If there was an accident within the time span of the training data, it was included in the model.

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- **Thomas Chase: Was there any naive or simple model used as a benchmark to see the marginal benefit of using an ANN?**
    - o Zach Vander Laan: Yes, we did quite a bit of initial work in this area, comparing the ANN with basic regression models and other machine learning models as well. We actually used simpler models to investigate which features are important explanatory variables, before eventually landing at the current model architecture.

- **Li Yan: For the Florida dataset, I am interested in how well the model react to special cases. Does the experiment cover any days with special events? E.g., festivals, riot, natural catastrophe.**
    - o Kaveh Sadabadi: I assume there are weather events in the time frame we had data for and it should be reflected in the weather data we used as input. However, we did not focus on any specific event. The training was performed using all datasets.
    - o Stan Young: Our future work will include a focus special events and weather events.

- **Nick Compin: Have you been able to estimate in any way the number of baseline volume counts (Continuous or other) that are necessary to draw from to build the estimated volumes using the model? I am assuming that some level of validated volumes are necessary.**
    - o Kaveh Sadabadi: Good question. This can be done using existing datasets. However, in all cases we include every count station that is available.
    - o Venu Garikapati: While we have not done any analysis on the 'minimum number of observed stations' required to build volume estimation models, we certainly saw improvements in model performance as the number of observations (or the observed stations) increase. To an extent, this depends on a case-by-case basis (data availability, data quality, and desired model precision), but we will keep this as an area for future research as state's might benefit greatly from knowing this information.

- **Harun Rashid: In the machine learning process, were seasonal variation in ADTs considered, for example, summertime when schools are not in session vs. fall time with school traffic?**
    - o Venu Garikapati: For the lower functional class model estimation for Colorado, the data used spanned the months of Jan-Sep, 2017. So, seasonal variations in traffic volumes are accounted in model estimation. Also, the use of temperature as a dependent variable takes 'aberrant weather days', like snow on a summer day (which is not unusual for states like Colorado).

- **Joerg Rosenbohm: just a dumb question: for non-highways, can existing data from detectors associated with signalized intersections not be considered 'permanent count stations' - at least for Volume determination purposes?**
    - o Stan Young: We investigated this earlier in the process, but agencies seem to have lower confidence in those sensor results than those used for HPMS. For instance, weather events may knock them out of calibration.
    - o Venu Garikapati: Separate models were developed for freeway and non-freeway volume estimation for Colorado. The data for non-freeway volume estimation came from 48-hour short-term counts while the data for freeway volume

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> estimation came from permanent count stations. The non-freeway estimation did not include any data from permanent count stations.
>   - o In short, count data from any source can be used to train the models, but fidelity of the source data used in the model should be considered.

- **Alan Warde: are the presentations available for download?**
    - o Joanna Reagle: Yes, it will be sent to the email address you used to register.

- **Li Yan: For the Florida dataset, from the estimation comparison results, it seems the results during rush hours (i.e., around 8:00-17:00) are relatively more inaccurate than those during nights. This is maybe caused by the lack of penetration of probe vehicles. So the model may be biased due to this. Is it possible to consider a dynamic model that considers the temporal change of probe vehicle penetration effect?**
    - o Kaveh Sadabadi: I believe you refer to R^2. As I mentioned that's not the best measure to look at. Look at MAPE and EMFR. They are better indicators of quality of estimates.
    - o Note that the fundamental predictability of roadway volumes has similar patterns. Breakdown in traffic from either from capacity constraints or incidents (and thus fluctuations in volume) is more common during rush hours than off-peak. As a result, the challenge of accurately estimating volume during peak hours can be more challenging.

- **David Heller: Please explain what "XG Boost" is, and how it relates to linear regression and the AADT-based method. Is "XG Boost" the methodology you are describing, and the latter two are other, more typical methods for building/ calibrating models? For instance, while I don't know the specific details, all the algorithms in our existing travel demand model are based on a regression analysis.?**
    - o Stan Young: XG Boost refers to a tree learning methodology. I think of it similar to a variant or class of regression models in classical least squares approaches. Yi Hou and/or Venu Garikapati should be able to provide a more detailed explanation. The AADT method referred to in the presentation was developed by TTI. It uses templates for various roadways to estimate typical hourly volume. Yi or Venu would have to comment on the particulars of the linear regression technique that the result was compared against.

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