LEVERAGE CROWDSOURCED DATASETS FOR TRAVEL DEMAND ANALYSIS

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SCOPE

For decades, transportation planners and researchers have relied on traditional methodologies and experience-based surveys to analyze transit demand.
[1] Problems of this approach:

- Mobility Service providers not willing to share their data
- Users misbehavior on travel surveys

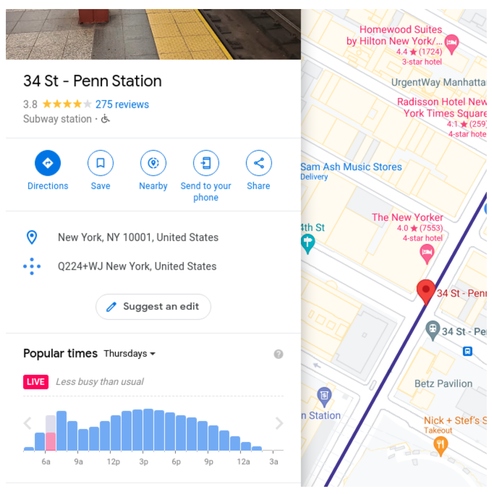
Crowdsourced data-driven approaches may provide novel solutions in this direction.[2]

PREDICTION OF LOCAL BUSINESSES ATTRACTIVENESS

We leverage crowdsensed data to enforce highly-accurate estimation of passengers demand at subway stations, this information can reach low level of aggregation not easily accessible for traditional tranist dataset.

DATASET USED

Google Popular Times(GPT)

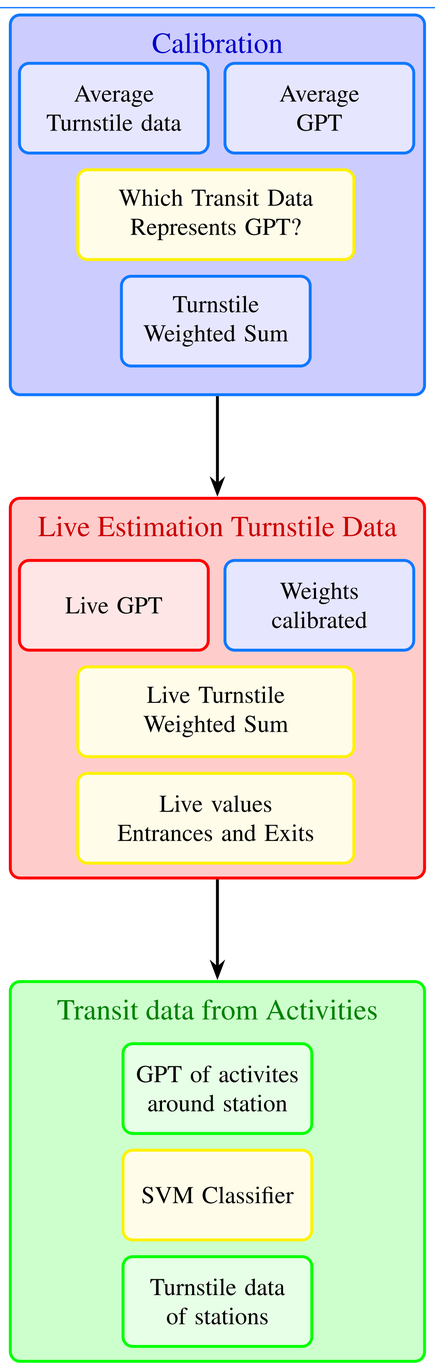


- How busy is a certain Business
- Between 0-100
- Live Value of Popularity

Turnstile Data

- Manhattan metro stations
- Entrances and Exits
- Granularity every 4 hours

METHODOLOGY



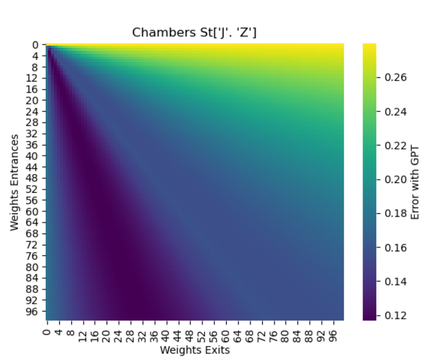
- We compare GPT of Stations and Turnstile data of previous month
- We compute a weighted sum $wsum = a \cdot \text{Entrances} + b \cdot \text{Exits}$
- We find the optimal a and b that minimize the error between $wsum$ and GPT

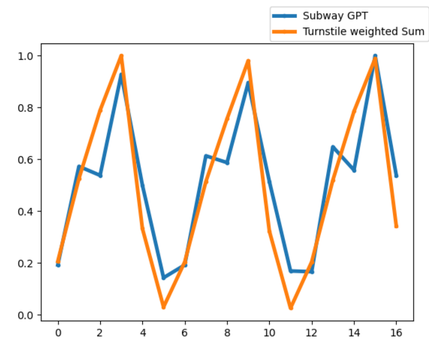
- We apply a and b calibrated before on Live GPT of the station
- We compare such data with the turnstile data of the same week
- Using the proportion computed on calibration phase, we reconstruct the real amounts of Entrances and Exits

- We create a profile of the GPT around the station (Fingerprint)
- We Use a SVM classifier with:
  - **Inputs**: Intervals of the fingerprint of the area of the station
  - **Outputs**: The transit demand at the station on the corresponding interval

RESULTS

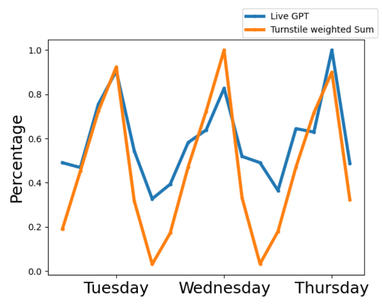
Calibration

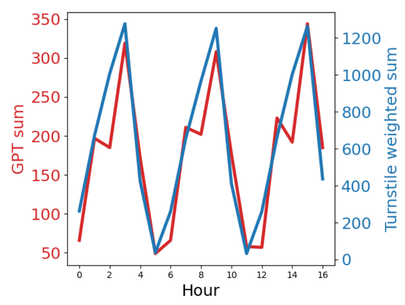




- We calibrates the weights of wsum for each station
- The majority of stations have higher weights for entrances than exits (passengers entering the station have to wait the subway)
- Wsum is a good representation of GPT of stations

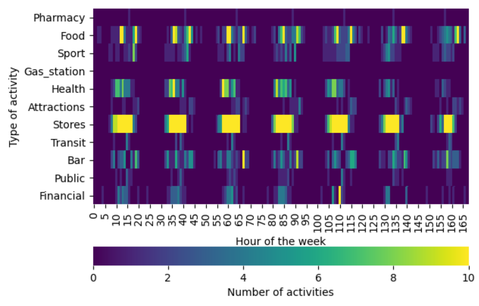
Live Estimation Turnstile data through Live GPT (Transit)





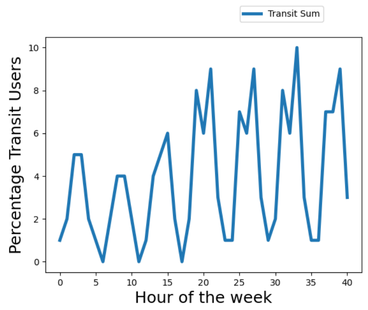
- First we try to replicate Wsum on Live GPT of a specific week
- We obtain a similar profile but with a lower accuracy than calibration phase
- Then using the live GPT we reconstruct the real number of passengers using the proportion between GPT and Turnstile computed during calibration

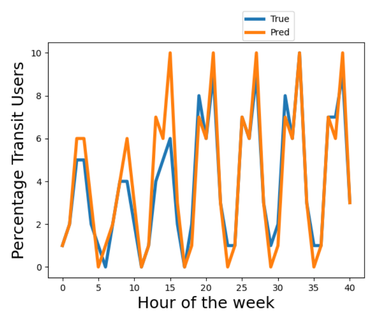
Estimation Turnstile data through GPT of Local businesses



- The heatmap represents the behavior of activities around the station
- Lighter colors mean higher popularity for a specific category
- We use slices of this heatmap as Input for a SVM Classifier

- We extract the tunrstile behavor on the interval of the heatmap
- We use slices of this data as output class for SVM





- The SVM estimate the Turnstile data with a high accuracy

ACKNOWLEDGEMENT

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REFERENCES

[1] Marie-Pier Pelletier, Martin Trépanier, and Catherine Morency. “Smart card data use in public transit: A literature review”. In: *Transportation Research Part C: Emerging Technologies* 19.4 (2011), pp. 557–568.

[2] Andrea Capponi et al. “Crowdsensed Data Learning-Driven Prediction of Local Businesses Attractiveness in Smart Cities”. In: *IEEE Symposium on Computers and Communications (ISCC), Barcelona, Spain, 2019*. 2019.