Optimizing Evacuation Routes using Real-Time Traffic Information

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Mapping systems have come a long way since the first in-car navigation systems, and most drivers have begun to rely on apps like Waze, Google Maps or Apple Maps. While these apps generally do well at providing optimal routes between destinations, they often do not rely on real-time data.

With this project we are aiming to leverage social media, in this case Twitter, in order to build a classification model to determine if a tweet references a road closure. By extracting geolocations from these tweets we will be able to construct a map and plot these closures as they occur.


Hurricane Laura

Workflow

01. Data Acquisition → 02. EDA/Modeling:NER

02. EDA/Modeling:NER → 03. EDA/Modeling: Spacy & AdaBoost

03. EDA/Modeling: Spacy & AdaBoost → 04. Geolocation/Mapping

01.

Data Collection

Twitter

- 13K Tweets
- Louisiana Transportation Accounts and accounts around Lake Charles, LA
- Between August 24 and September 1, 2020

LA DOTD

- 17K data points
- Scraped Louisiana Department of Transportation and Development website for closure reports
- From 2013-2020

HERE API

- 116 data points
- Scraped HERE website for live traffic updates

02.

Modeling:
NER

Louisiana Department of Transportation and Development

- Updates from the Louisiana DoT can be scraped in real time or historically
- LA DoT contains over 17,000 historical records of road closure updates, dating back to 2013
- For this project, updates were only scraped from the last 3 months or so to be used for prediction

DOTD

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

Image source: https://bossierpress.com/a-message-from-louisiana-department-of-transportation-and-development/

Stanford Named-Entity Recognition

- Stanford's Natural Language Processing Group releases public software for NLP models
- The NER model takes a sequence of words (phrase, sentence, paragraph) and returns labels for each word
- Labels include Location, Person, and Organization

Image source: http://web.stanford.edu/class/cs224n/

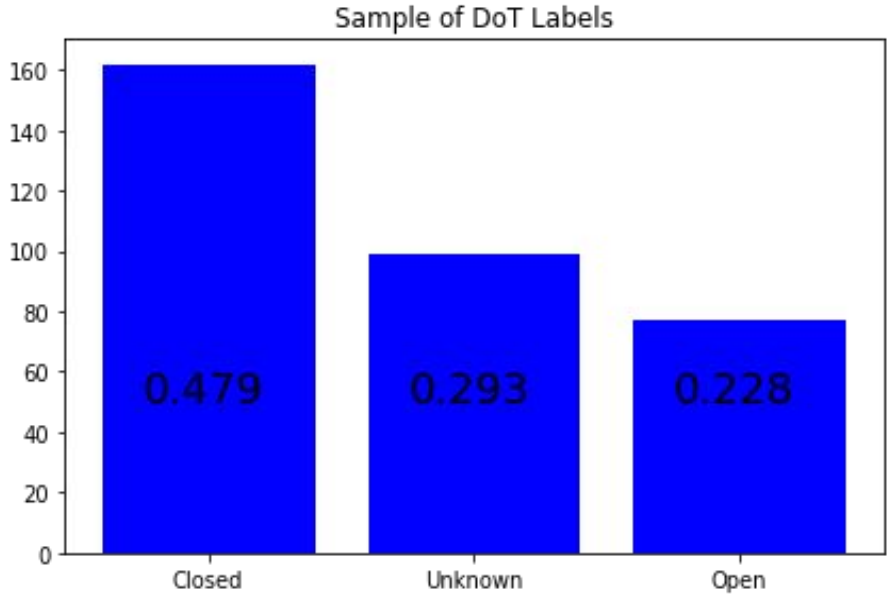
Stanford NER on LA DoT Updates

"I-10 Eastbound and Westbound from MM 103 (I-49) to MM 109 (**LA 328** – **Breaux Bridge**), **Lafayette**/**St**. **Martin Parish** – Intermittent Short Term Lane Closure"

(**LA**, **ORGANIZATION**)
(**328**, **ORGANIZATION**)
(**Breaux**, **ORGANIZATION**)
(**Bridge**, **ORGANIZATION**)
(**LafayetteSt**, **ORGANIZATION**)
(**Martin**, **ORGANIZATION**)
(**Parish**, **ORGANIZATION**)

Identifying Closures from LA DoT

- Not every update from LA DoT announces a closure
- A model was trained on manually labeled DoT updates
- Classifying DoT updates allows us to access only road closures



03.

NLP and Modeling with Twitter Data

Using Twitter for Information Collection

Advantages:

- Many sources in one website
- Works for any location
- Can provide new information not yet available anywhere else

Disadvantages:

- Lots of "noise" to filter out
- Location data hidden
- Tweets are not formatted consistently

NLP with Twitter Data

- NLP with Spacy, using custom entity rulers, part-of-speech tagging to identify tweets that are likely referencing a street or highway.
- Many tweets are from local news sources or government entities, but sometimes they are from regular people who have noticed a problem.
- Extracted road names, exit numbers, and mile markers from text for easier geocoding.
- Model to classify tweets discussing closures.

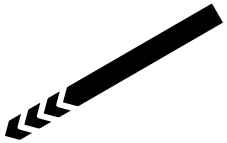
Modeling to Find Road Closures

- The group members identified and labeled tweets referencing road closures.
- This data was fed into various models to find a good model for identifying road closures.
- Accuracy is important, because we want as much information as possible, but so is precision, because we do not want false positives.
- AdaBoost Model performed well with nearly 90% accuracy on test data.

Tweet Data Process

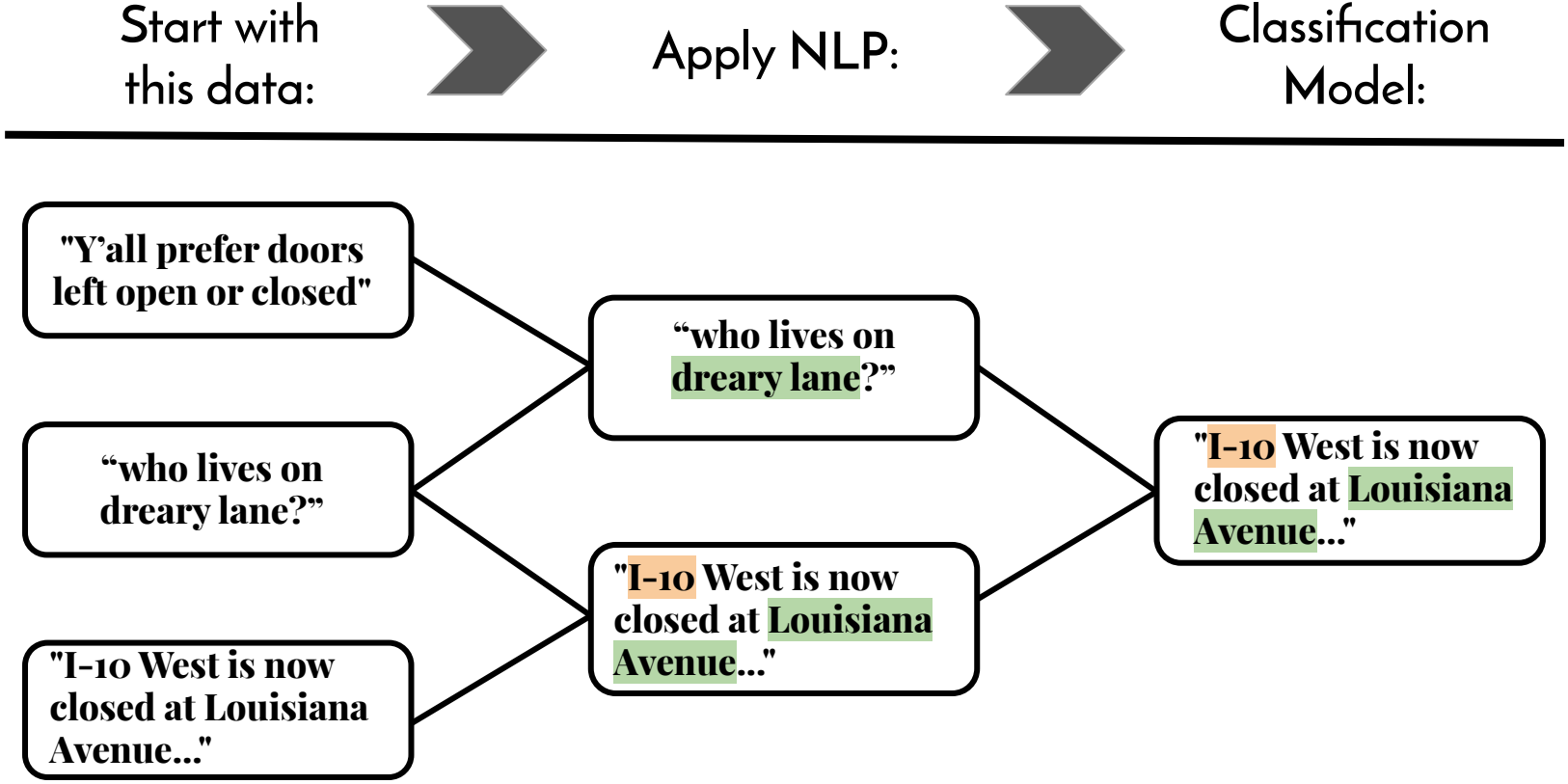
01. Scrape tweets with keywords

02. Spacy NLP to find road names



03. Use model predictions to find closures

04. Use location text to map closures


Start with this data:
Apply NLP:
Classification Model:
"Y'all prefer doors left open or closed"
"who lives on dreary lane?"
"I-10 West is now closed at Louisiana Avenue..."
"who lives on dreary lane?"
"I-10 West is now closed at Louisiana Avenue..."
"I-10 West is now closed at Louisiana Avenue..."

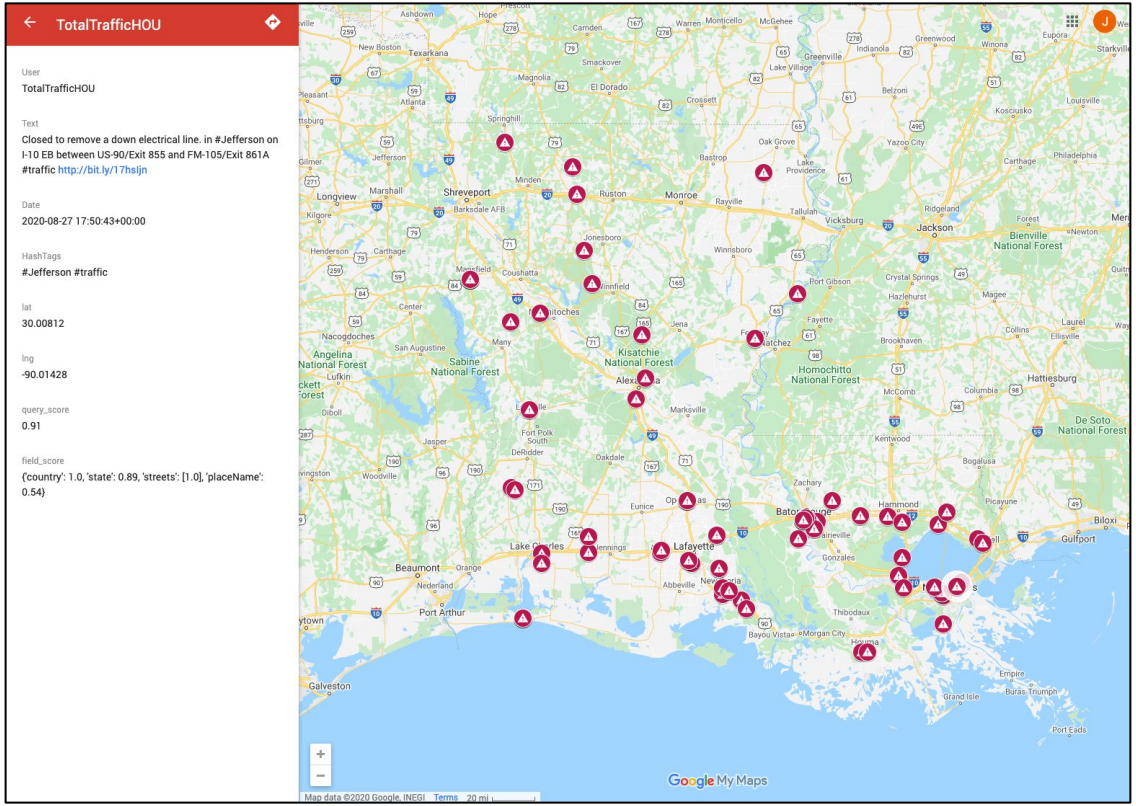
04.
Mapping

Geocoding with the Here API

Geocoding and Search API v7 to retrieve the lat & lng

Average Query Scores
- Twitter: 64%
- LADOT Feed: 23%

Image Source



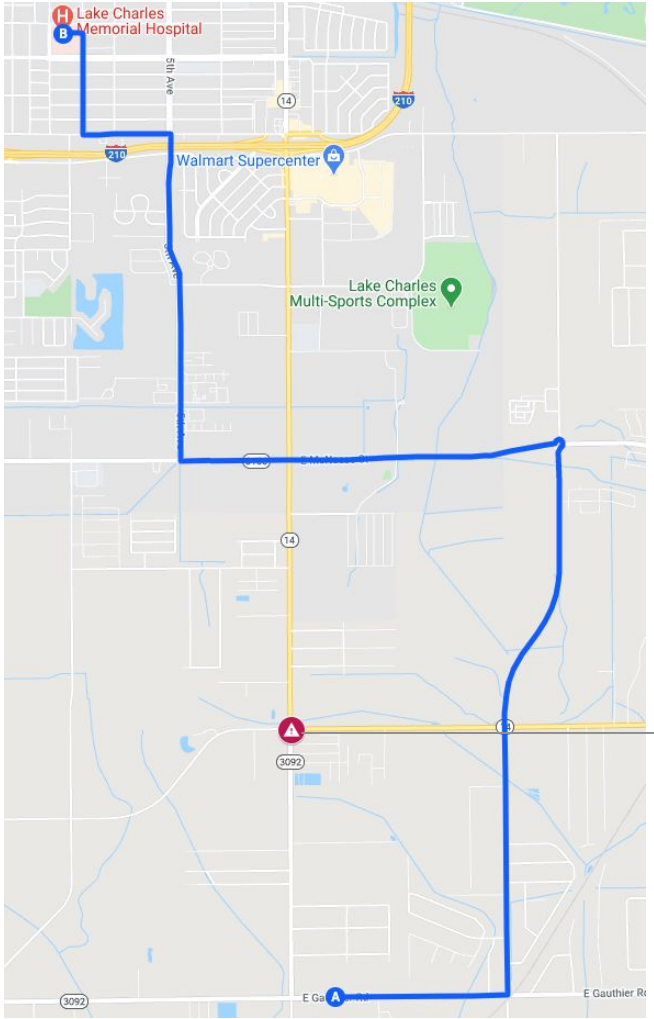
[View in Web Browser]

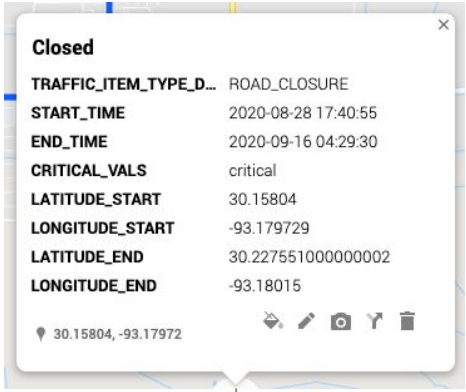
Mapping With Google Maps

Hurricane Laura Road Closures From 8/27-8/29

- Here API Feed
- Twitter Feed
- LADOT Feed

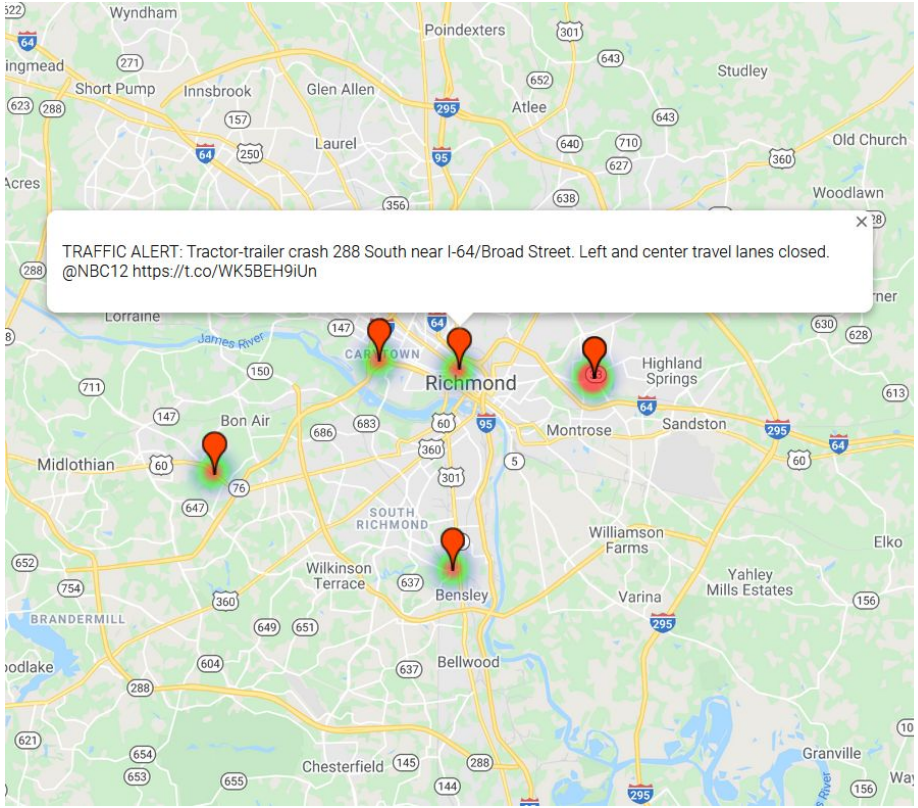
Future Use Cases





Real-Time Navigation

Emergency vehicles must avoid road closures to get injured civilians to the hospital in the **most efficient route as possible.**



New Locations

Our script pulls recent tweets from a location inputted by the user, our model determines which are road closures, and plots them on a map in real-time.

THANKS!

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