Wait Time Prediction for Airport Taxis at O'Hare International Airport (ORD)

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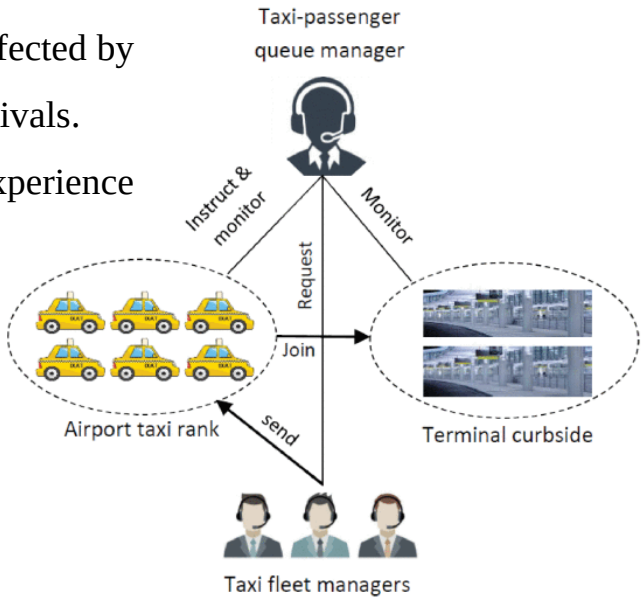
Introduction & Problem Statement

➢Taxi queue wait time prediction at airport is a challenging task which is highly affected by many heterogeneous contexts including the dynamic of taxis, weather and flight arrivals.

➢The human error in manual taxi demand estimation causes taxi drivers to experience unexpected wait times at the airport taxi rank, also :

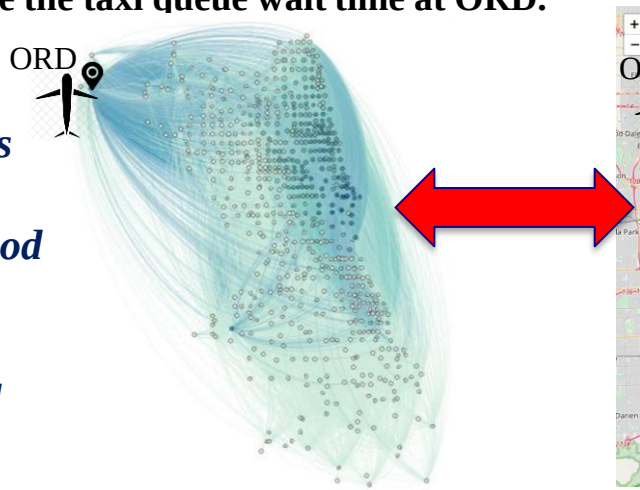
- Long queues of taxis cause traffic congestion.
- Taxi drivers not to make an airport trip.
- Consequently: long queue wait times for the passengers.

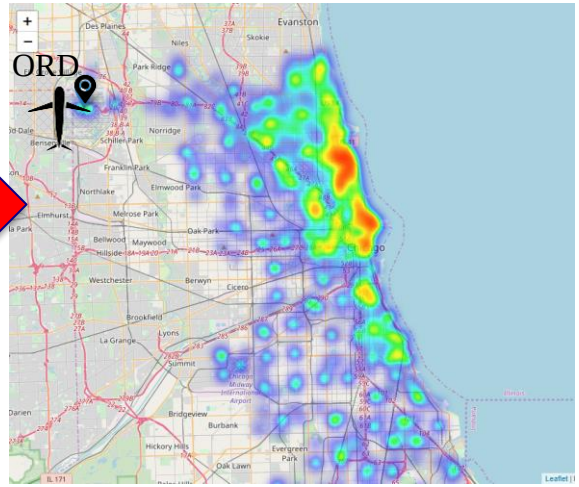


➢ORD is one of the busiest airports in the US, and it is one of the high taxi pickup locations in Chicago. **Therefore, it is essential to develop a model that can estimate the taxi queue wait time at ORD.**

Aims :

- ***The factors that impact the wait times will be detected and analyzed.***
- ***Develop a ML based regression method to predict taxi queue wait time by considering contextual features, e.g. time, weather, flight information and taxi trips.***





1. Rahaman, M.S.,et al., 2018. IEEE, 6,74660-74672.
2. Chen, Y., et al., 2018. Trans Res Rec, 2672(48),.127-138.
3. Wang, L., et al., 2019.. J Trans Eng, Part A: Systems, 145(7), 04019026.

Dataset Design

➢To prepare the airport taxi driver queue wait time dataset, we will fuse three real-world datasets: Chicago taxi trip data, the airport data and the weather condition data.

ORD airport data

- Number of flights
- Passenger arrivals
- Delay of flights
- Passengers wait time

Chicago taxi trip data

- Pickup location
- Drop off location
- Pickup time
- Drop off time
- Distance of the trip
- Fare and tip amount
- Taxi ID

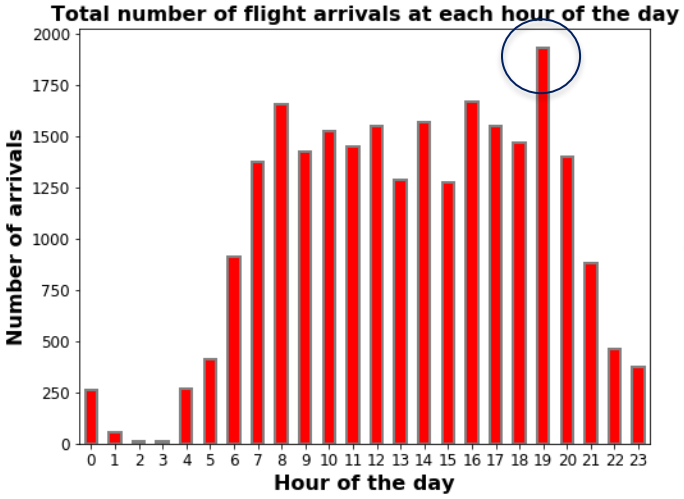
Weather data

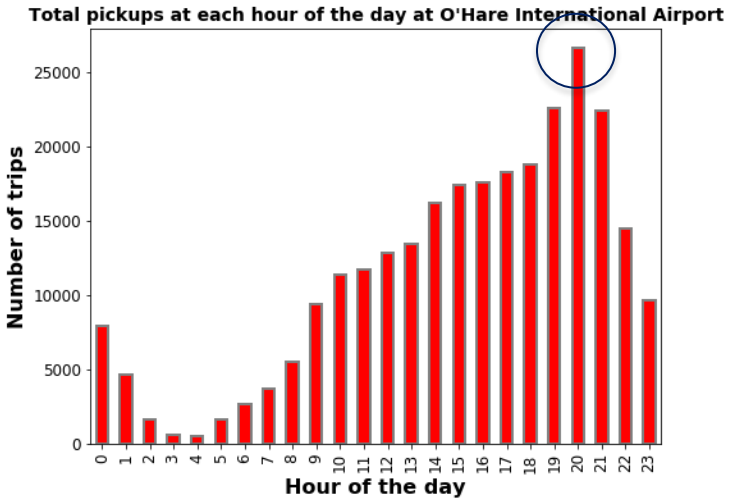
- Precipitation
- Temperature
- Humidity
- Wind Speed
- Clear
  Cloudy
  Fog
  Rain
  Snow
  Thunder

https://data.cityofchicago.org/Transportation/Transportation-Network-Providers-Trips/m6dm-c72p
https://www.transtats.bts.gov/Tables.asp?DB_ID=120
https://www.wunderground.com/

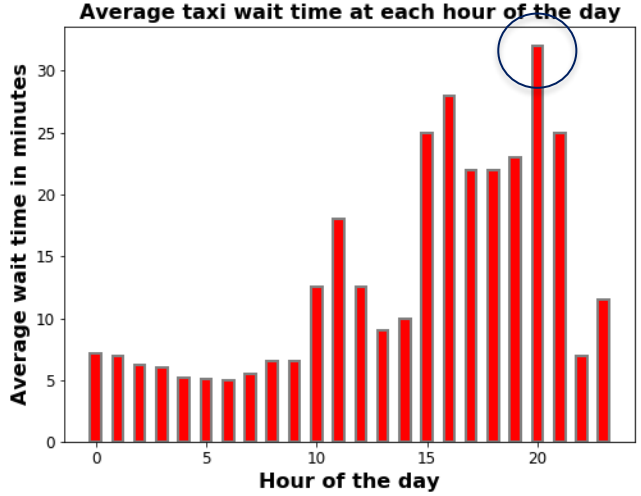
Preliminary Data Analysis

- The maximum number of taxi pickups and highest wait time happen at 8 p.m. which is related to the maximum number of flight arrivals at O'Hare International Airport occurring at 7 p.m.



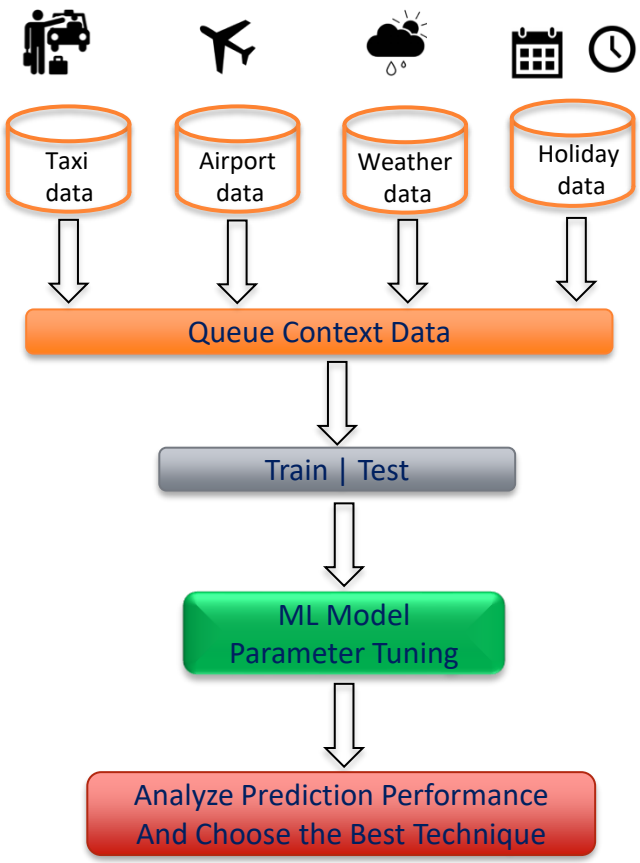



```
/* ti and tj are the start and end time of the time window
Input: an hourly time window of a day (ti, tj), Ax[]
Output: Hourly average taxi queue wait time τ
Initialize: trip_count=0;
Procedure hourly Average Taxi Queue Wait Times(Ax[],ti, tj)
for each tx ∈ Ax[] do
    if ti < tx. Trip_end_dateTimes() < tj then
        if minLat < tx.Next_Trip_start_lat() < maxLat and
           minLong < tx.Next_Trip_start_long() < maxLong then
           Tarr ← tx. Trip_end_dateTime();
           Tdep ← tx.Next_trip_start_dateTime();
        w ←  Tarr – Tdep; // taxi queue wait time
        trip_count++;
        end if
    end if
end for
Return τ ←  sum(w)/trip_count;
end procedure
```



Future Work

- The following ML models will be investigated:
  - XGBoost (XGB)
  - k-NN
  - Deep Learning
- Development of an interactive platform for users :



	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Data wrangling								
ML model development								
HTML platform								
Testing/Report								

Applications of the Developed Method

- This study provides a queue context prediction model which can be applied to not only airports but also:
- Shopping malls
- Ferry platforms
- Hospital wait times
- Dynamic bus arrival time

Thank You For Your Attention