



# Doctor Who? ER Wait Time Predictor

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## Average ER Wait Times

(Time in minutes)

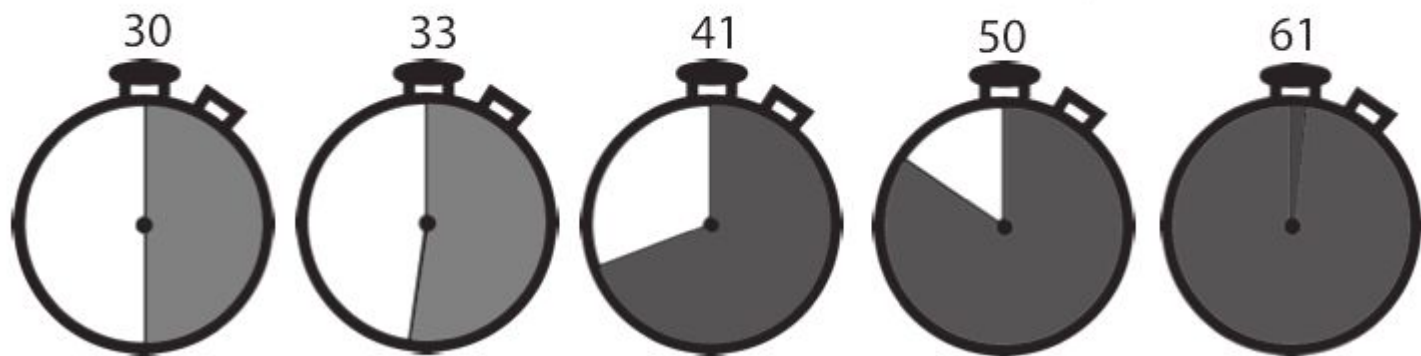
National Average

Illinois Average

Evanston Hospital

Northwestern  
Memorial Hospital

St. Francis Hospital



Source: medicare.gov

# Introduction

People hate waiting

Project Goal:

- Predict wait time and get current driving time for closest Emergency Departments
- Give information about closest Urgent Care



## When to Visit Urgent Care

## When to Visit Emergency Room



Rash



Tooth Pain



Sprains  
& Strains



Cuts Needing  
Stitches



Sore  
Throat



Lower  
Back Pain



Pink Eye



Animal or  
Insect Bite



Cold & Flu  
Symptoms



Stomach or  
Chest Pain



Allergic  
Reactions



Eye or  
Head Injuries



Serious  
Burns



Stroke  
Symptoms



Trouble  
Breathing



Heart Attack  
Symptoms



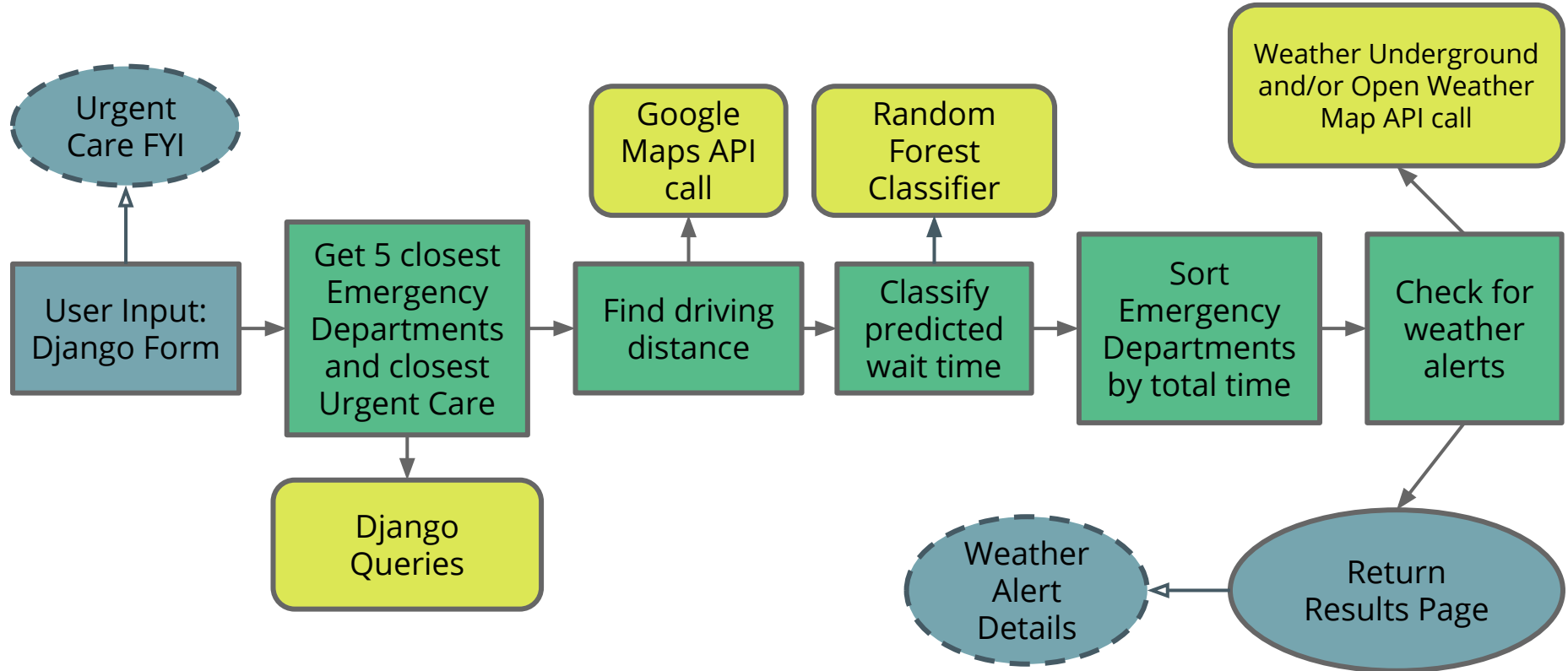
High  
Fever



Possible Drug  
Overdose or  
Poisoning

92% of patients wait 30 minutes or less at urgent cares and most of the time are less expensive than an Emergency Department Visit.

# Django Application Overview



# Demonstration

- Django based web application that uses sqlite3 and python API calls

# APIs

- Weather Underground API
- OpenWeatherMaps
  - weather alerts
- Google Maps API
  - Calculate current driving time to the 5 closest hospitals



# Algorithm

Regression Analysis: OLS, logit, kernel etc..

$$\begin{aligned} \text{Wait\_time}_{it} = & \beta_0 + \beta_1 \text{Arrival\_time}_i + \beta_2 \text{Avg\_wait}_t \\ & + \beta_3 \text{Pain\_scale}_i + \beta_4 \text{MSA}_t + \beta_5 \text{Month}_i + \beta_6 \text{week\_day}_i + \mu_{it} \end{aligned}$$

→ OLS score for test and train: 0.0838      0.0987





# Algorithm

Regression Analysis: OLS, logit, kernel etc..

$$\begin{aligned} \text{Wait\_time}_{it} = & \beta_0 + \beta_1 \text{Arrival\_time}_i + \beta_2 \text{Avg\_wait}_t \\ & + \beta_3 \text{Pain\_scale}_i + \beta_4 \text{MSA}_t + \beta_5 \text{Month}_i + \beta_6 \text{week\_day}_i + \mu_{it} \end{aligned}$$

→ OLS score for test and train: 0.0898      0.0970

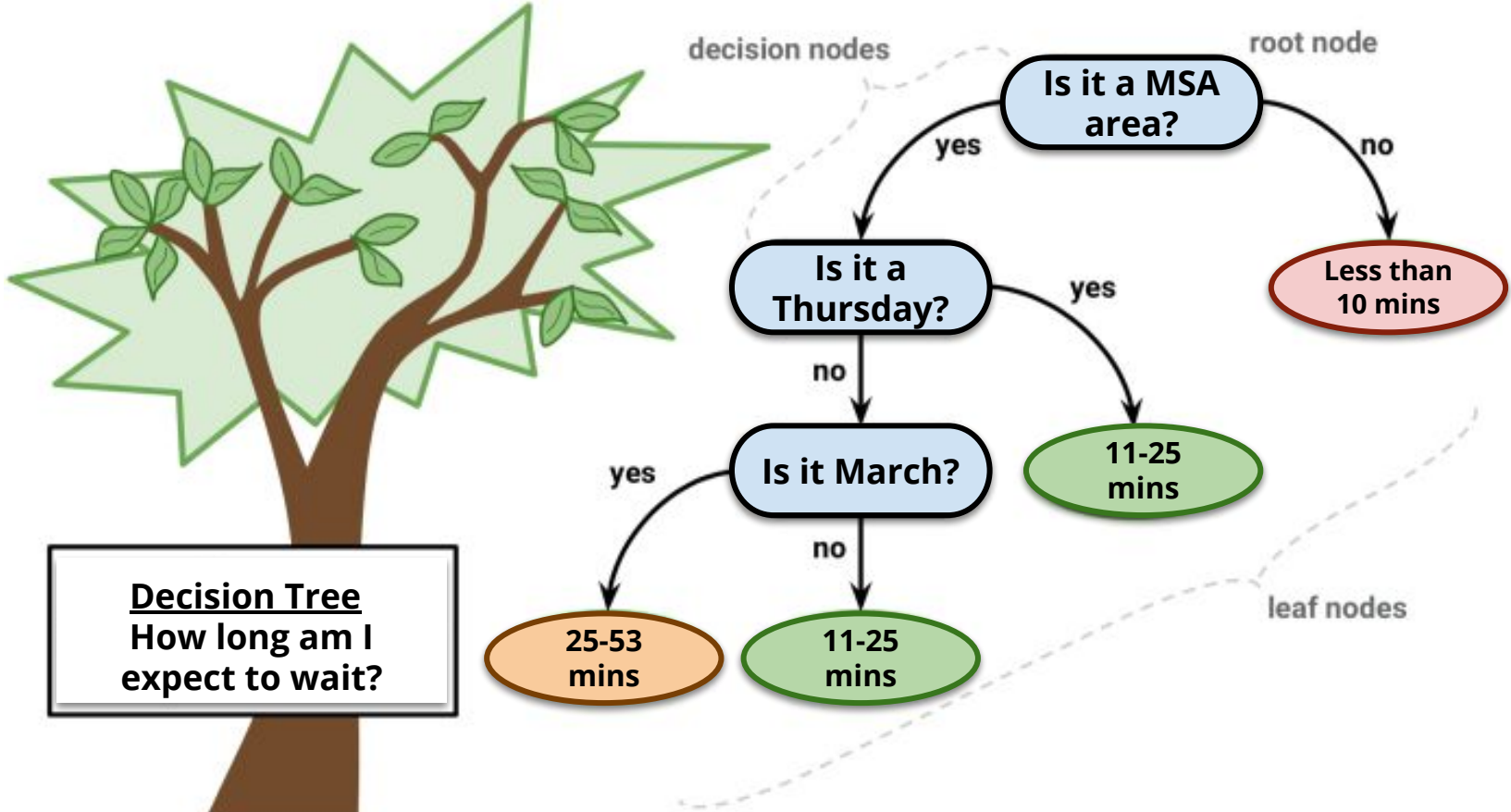
Random Forest Classifier

→ RF score for test and train: 0.3872      0.4163

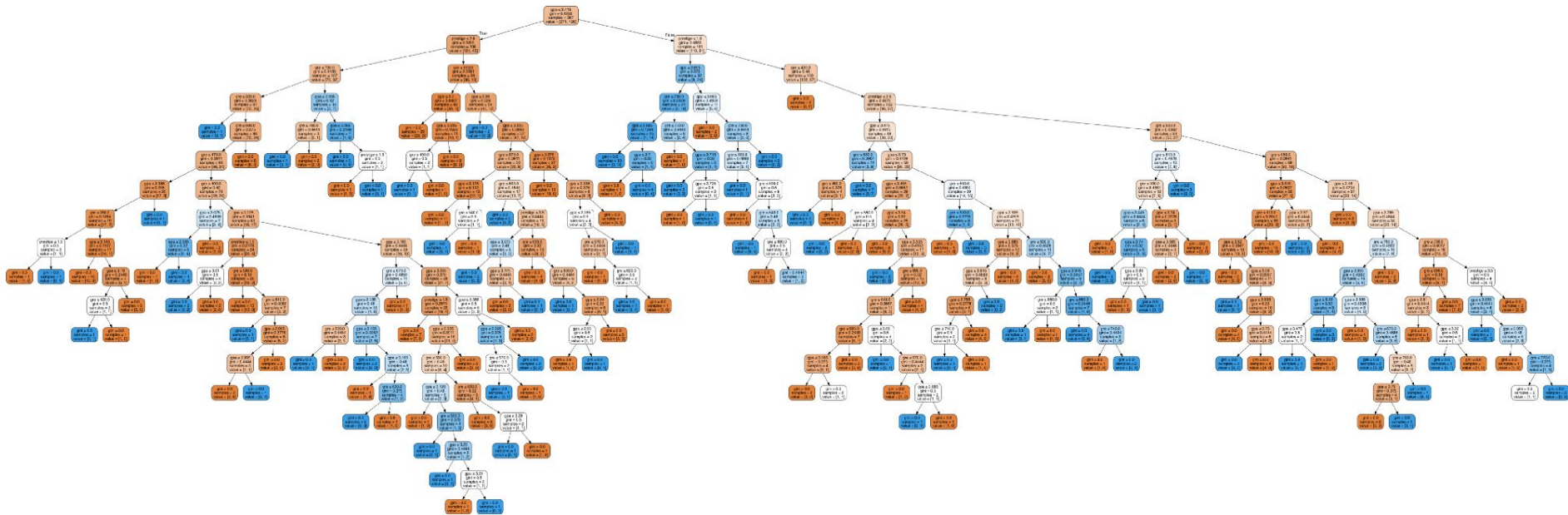


machine learning in Python

# Decision Tree



# Random Forest Classifier



# Summary

- Goal: Give potential patients more information about choosing an Emergency Department based on its location and wait times as well as their Urgent Care options.
- Databases: Medicare.gov's Hospital Compare, Census MSA and ZCTA files, and National Hospital Ambulatory Medical Care Survey Data
- APIs: Weather Underground, OpenWeatherMaps, and Google Maps
- Final product: Django web application displaying information for the five closest Emergency Departments sorted by fastest total time and closest Urgent Care



THANK YOU  
ANY QUESTIONS?

# Databases:

Medicare.gov: Hospital Compare:

- Timely and Effective Care - Hospital
  - average wait time for being seen by a medical professional in the emergency department
- Hospital General Information
  - location, contact information, as well as ratings of hospitals.

National Hospital Ambulatory Medical Care Survey Data (NHAMCS):

- ED visit data including wait time, time of day, patient pain level, day of the week, and date

Homeland Infrastructure Foundation-Level Data (HIFLD):

- Urgent Care Facilities

# Database Challenges

Needed to get Metropolitan Statistical Areas and Latitude/Longitude for Emergency Departments

MSA: Have County, State abbreviation

- Census Delineation files: Metropolitan Statistical Areas (County, State full name)
- Github: jasonong: List of US states (State full name, State abbreviation)

Latitude/Longitude: Have zipcode

- CivicSpace Labs: zipcodes
- Census, US Gazetteer Files: Zip Code Tabulation Areas

# Database Lessons Learned

- How to clean data sets
- What to do with null values
- How to connect datasets together
- How to combine different datasets
  - How to use sqlite3 to join datasets
  - What values to use to join datasets
- How to adapt to datasets that are missing information you would like



# Django Challenges

- Wanted to query using a calculation that we defined, but also use filter()
  - Used a custom QuerySet as Manager
  - Two functions: first returned filtered query, second did calculation
- Sqlite3 doesn't have math functions
  - Needed to extend sqlite3 to include functions from math python library
- Needed to sort model instances
  - Defined `__lt__` function that `sorted()` calls to use model attributes
- Needed to load data into models from csv files
  - Django-adaptors
  - Ran code from shell to load csv line by line
- How to link to a new template while passing arguments
  - Arguments need to be included in the url

# Django Lessons Learned

- How to structure the models
- What databases to include as a model
- How to use url search patterns
- Relationship between urls.py, views.py, and templates
- How to format html templates
- How to create a form for user input