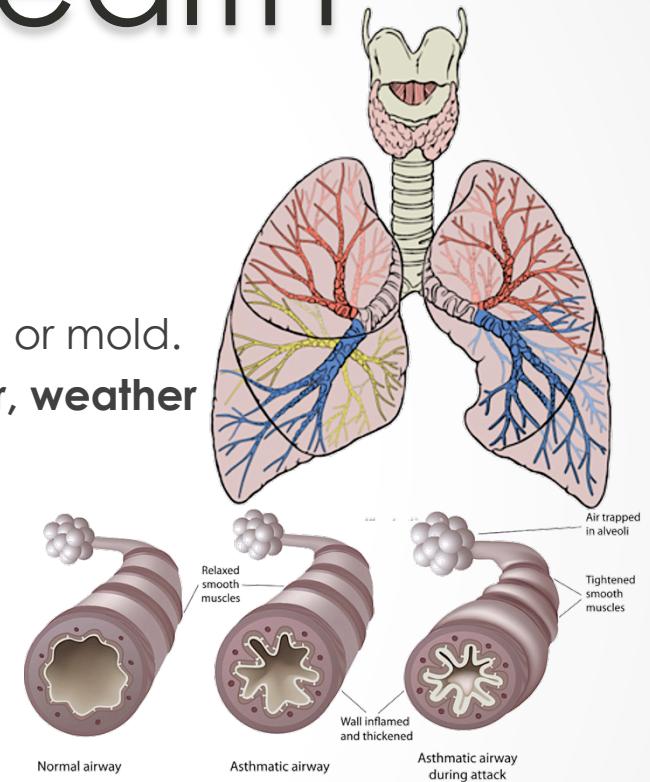


PREDICTING THE NUMBER OF ASTHMA PATIENTS VISITING THE EMERGENCY DEPARTMENT

HENG-RU MAY MERKLE-TAN

Motivation: Health

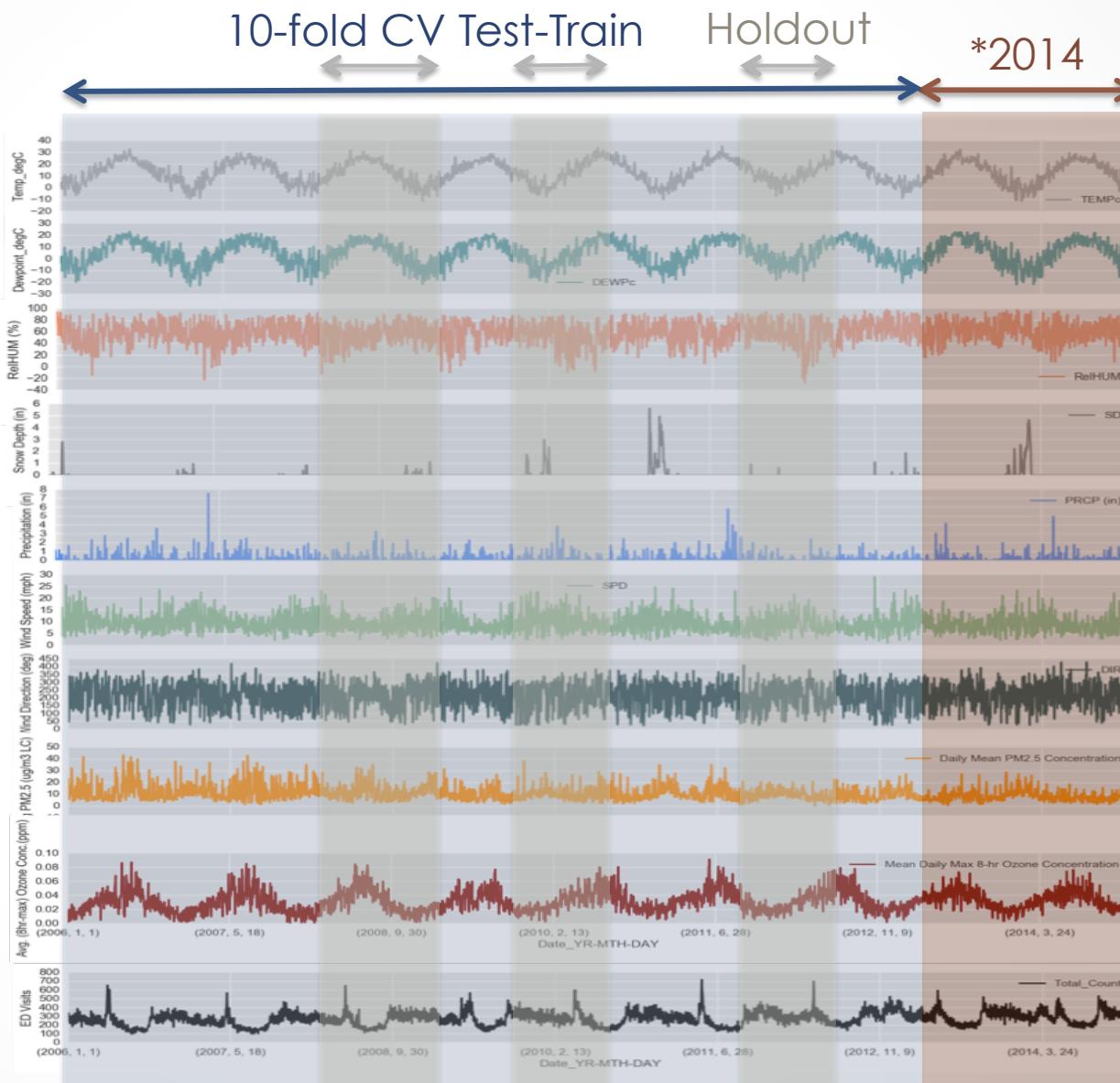
- Asthma – inflamed airways:
 - TRIGGERs of Asthma attacks (excess mucus):
 - Allergens e.g. pet dander, dust mites, pollen or mold.
 - Non-allergens e.g. **smoke, pollution, cold air, weather changes**
 - US Prevalence: CDC (2016) – 1 in 14
 - US Mortality (CDC, 2013):
 - 10 per day
 - 3,630 per year
 - **Many avoidable with proper treatment and care**
 - 3rd leading cause of children's hospital stays (CDC, 2010)



Motivation: Service

- Hospital Emergency Department:
 - **Unplanned** patient attendance
 - Provide initial treatment for a broad spectrum of illnesses and injuries:
 - Non-life threatening
 - Life-threatening: immediate attention.
 - Important entry points for those without other means of access to medical care.
 - The annual cost of asthma ~\$56 billion; ~\$50 billion (direct; *Hospital stays**) (CDC, 2012)
- Need for resource management:
 - **Staffing needs**
 - **Drug/ Prescription inventory**
 - **Facility units**
- Could we predict when the ED will have above median visits for asthma?

Methodology



CDIAC
Climate Diurnal Information Analysis Center

NOAA

HUMIDITY (%)

SNOW (IN)

PRECP (IN)

WIND_SPD (MPG)

WIND_DIR (°)

PM2.5

OZONE

EPA

NYC
Health

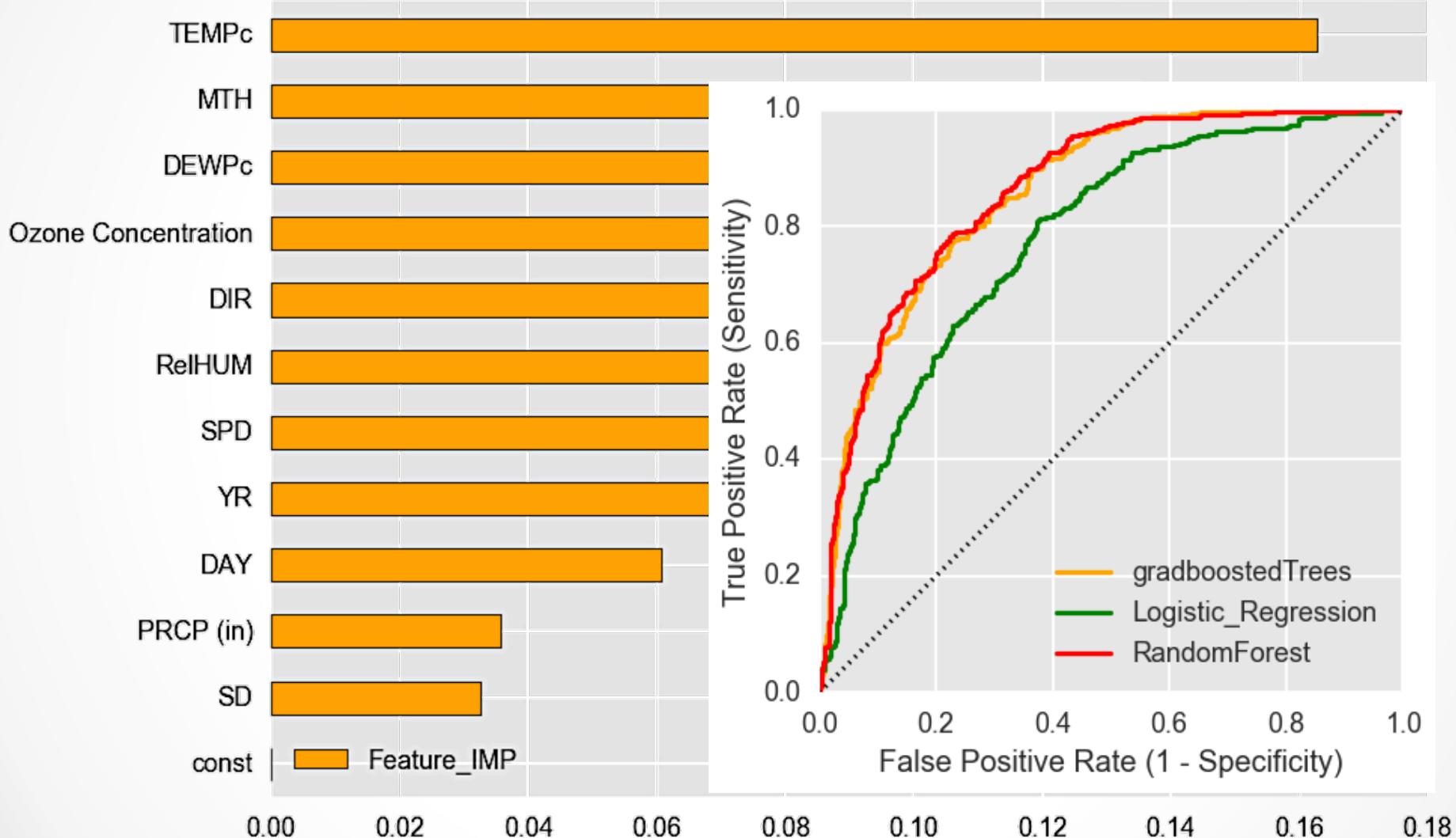
ED VISITS

2006

DATE

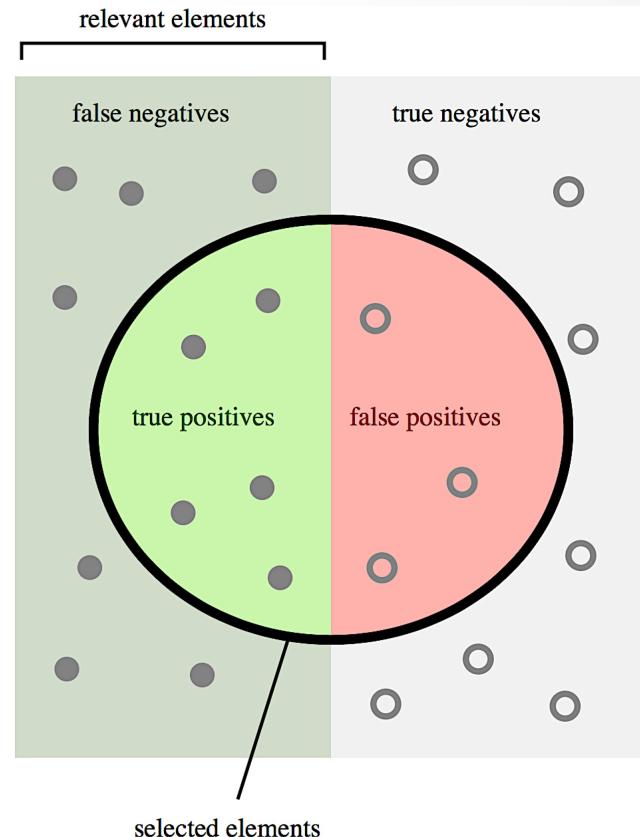
2015

Features of importance



Precision & Recall

GBTrees		Precision	Recall
Training_Test	0	0.73	0.75
	1	0.74	0.72
avg / total		0.74	0.74
Holdout	0	0.79	0.77
	1	0.76	0.78
avg / total		0.77	0.77
Testing_2014	0	0.80	0.74
	1	0.86	0.90
avg / total		0.83	0.82



How many selected items are relevant?

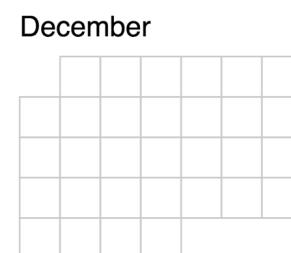
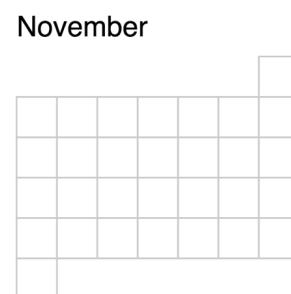
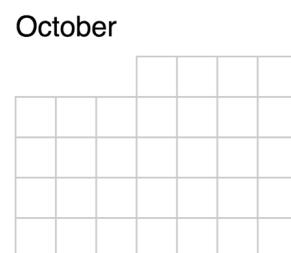
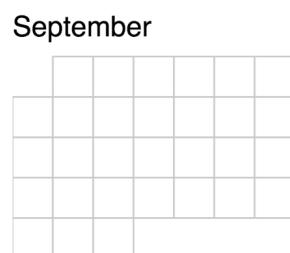
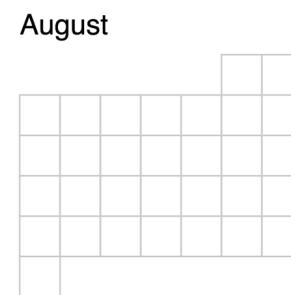
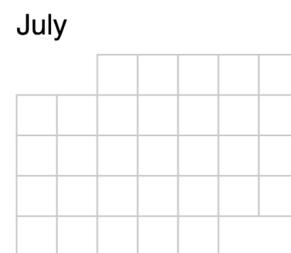
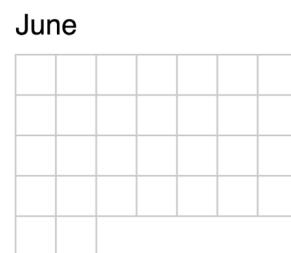
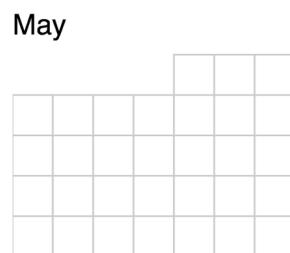
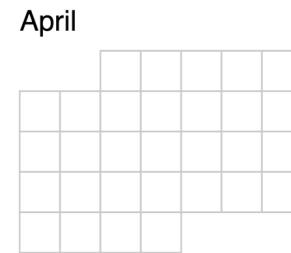
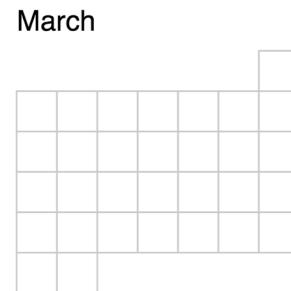
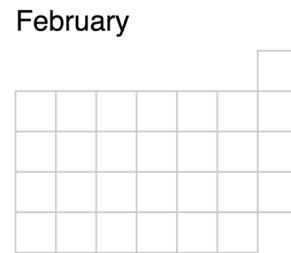
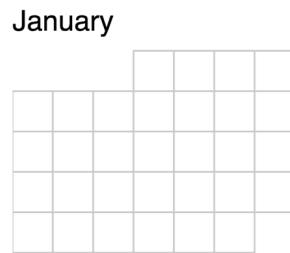
$$\text{Precision} = \frac{\text{true positives}}{\text{true positives} + \text{false positives}}$$

How many relevant items are selected?

$$\text{Recall} = \frac{\text{true positives}}{\text{true positives} + \text{false negatives}}$$

A calendar chart app. for prospective resource management

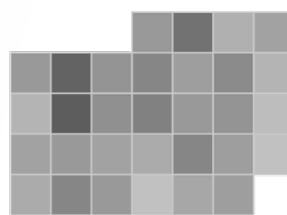
2014



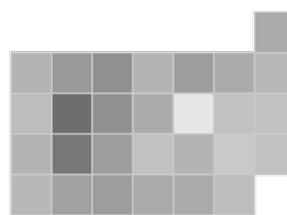
A calendar chart app. for prospective resource management

2014

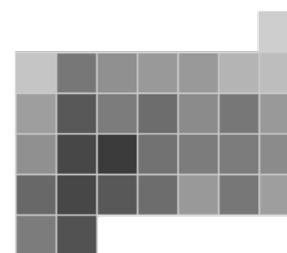
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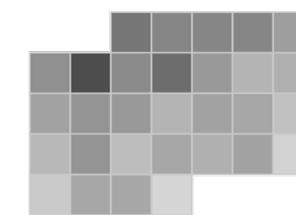
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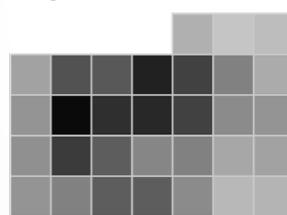
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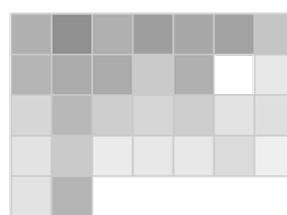
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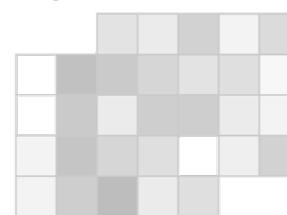
May



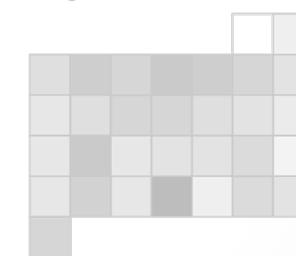
June



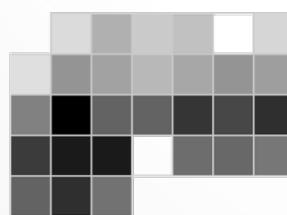
July



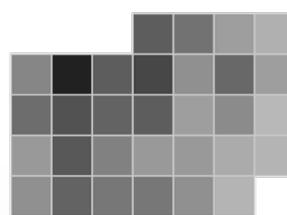
August



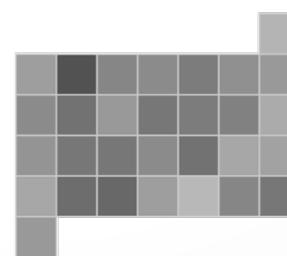
September



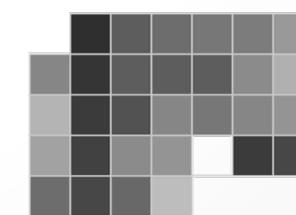
October



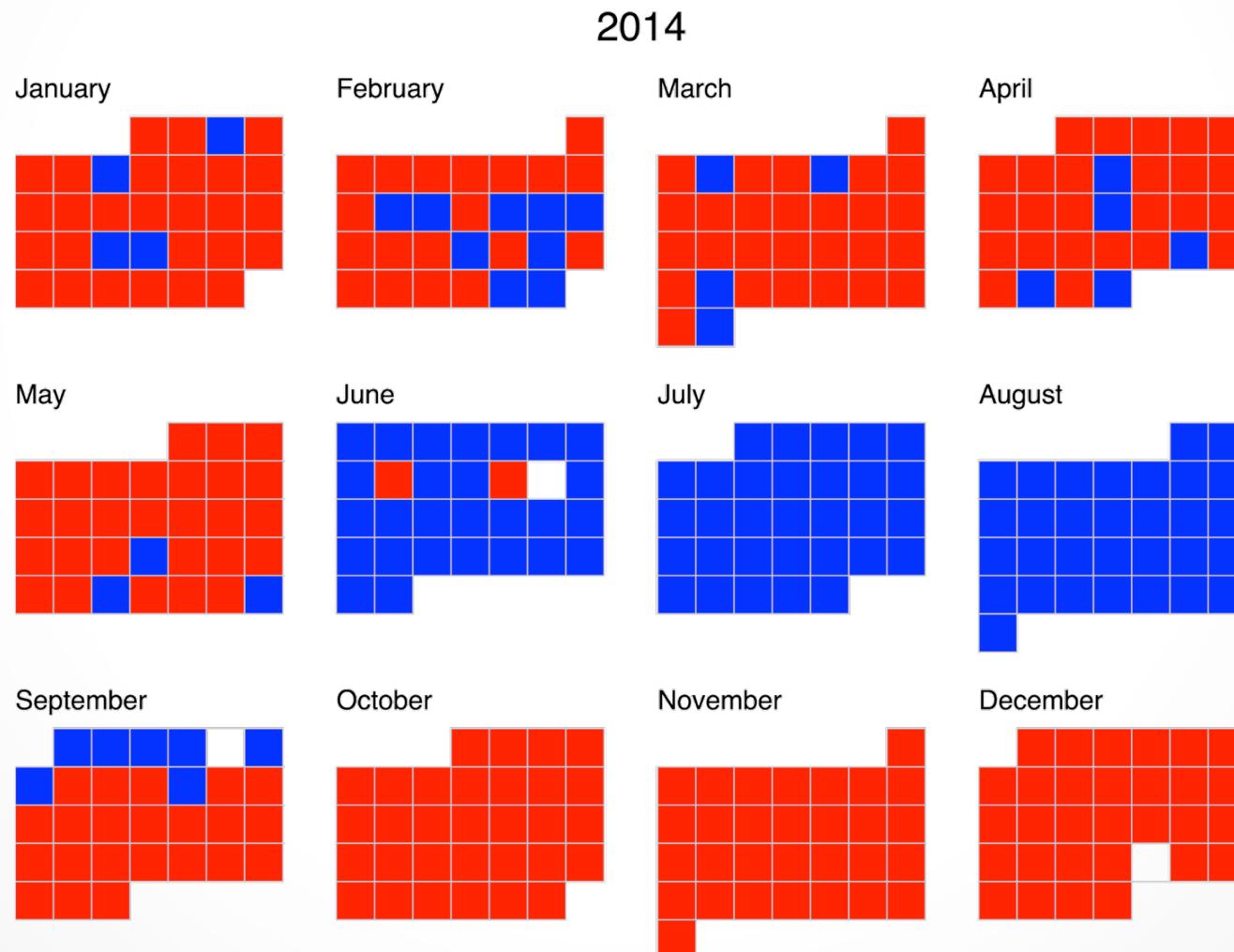
November



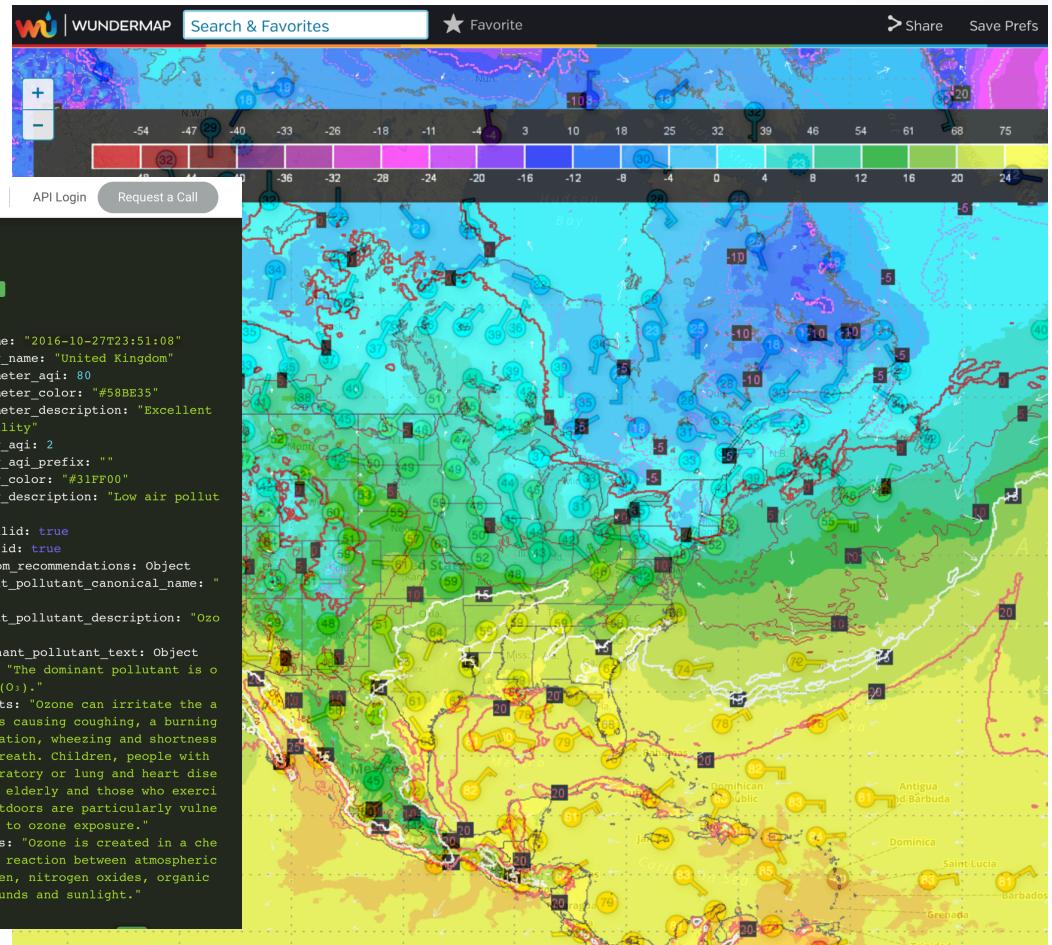
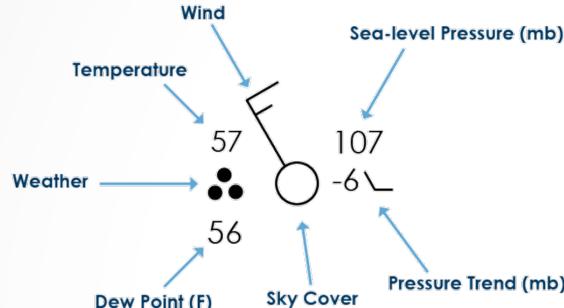
December



Online model updating when data is available to improve prediction



Integrating weather + air quality forecasts in the modeling:



BreezoMeter

API

- Real Time Air Quality API Requests
- Air Quality Index by Address
- Customize Your API Request

History API

Response Data Fields

Response Codes

BreezoMeter's Widget

Heat Map

Call us: 1 415 636-7357

[Schedule a call](#)

BreezoMeter API V1

This document is intended for website and mobile developers who want to use air quality data provided by one of the BreezoMeter APIs.

A proper BreezoMeter API request must be of the following form:

```
https://api.breezometer.com/baqi/?parameters
```

To access the BreezoMeter API over HTTP, use:

```
http://api.breezometer.com/baqi/?parameters
```

While making an API request some parameters are required while some are optional. As is standard in URLs, parameters are separated using the ampersand (&) character.

Real Time Air Quality API Requests

Get BreezoMeter Air Quality Index by Latitude and Longitude (Geocoding) You can get air quality data by Latitude and Longitude (Geocoding), simply by concatenating the following API request:

```
https://api.breezometer.com/baqi/?lat={latitude}&lon={longitude}&key=YOUR_API_KEY
```

Required parameters:

- lat – Latitude is a geographic coordinate that specifies the north-south position of a point on the Earth's surface. Range between -90 to 90 ([WGS84 standard](#))
- lon – Longitude is a geographic coordinate that specifies the east-west position of a point on the Earth's surface. Range between -180 to 180 ([WGS84 standard](#))
- key – Your BreezoMeter API key. This key identifies your account for purposes of quota management and features access.

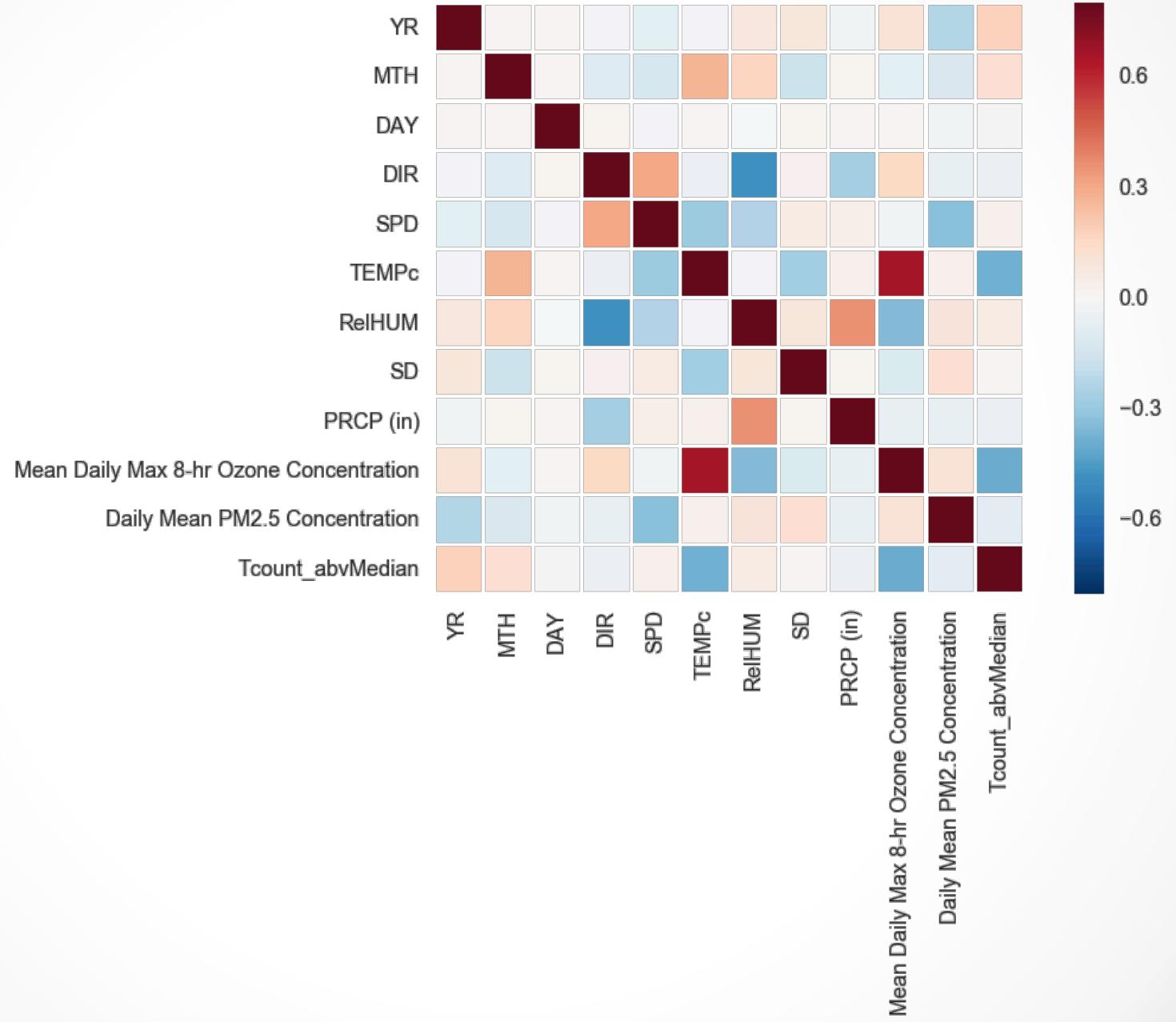
Further work + extension

- Working with weather experts in modeling weather data and forecasting:
 - Ozone and particulate matter may interact in complex ways to act as irritants.
- ED visits for different age-groups – varying needs.
- Extending this to other counties/cities/countries/ fields.
- May also provide suitable precautionary alerts for those with asthma or respiratory diseases.

PREDICTING THE NUMBER OF ASTHMA PATIENTS VISITING THE EMERGENCY DEPARTMENT

HENG-RU MAY MERKLE-TAN

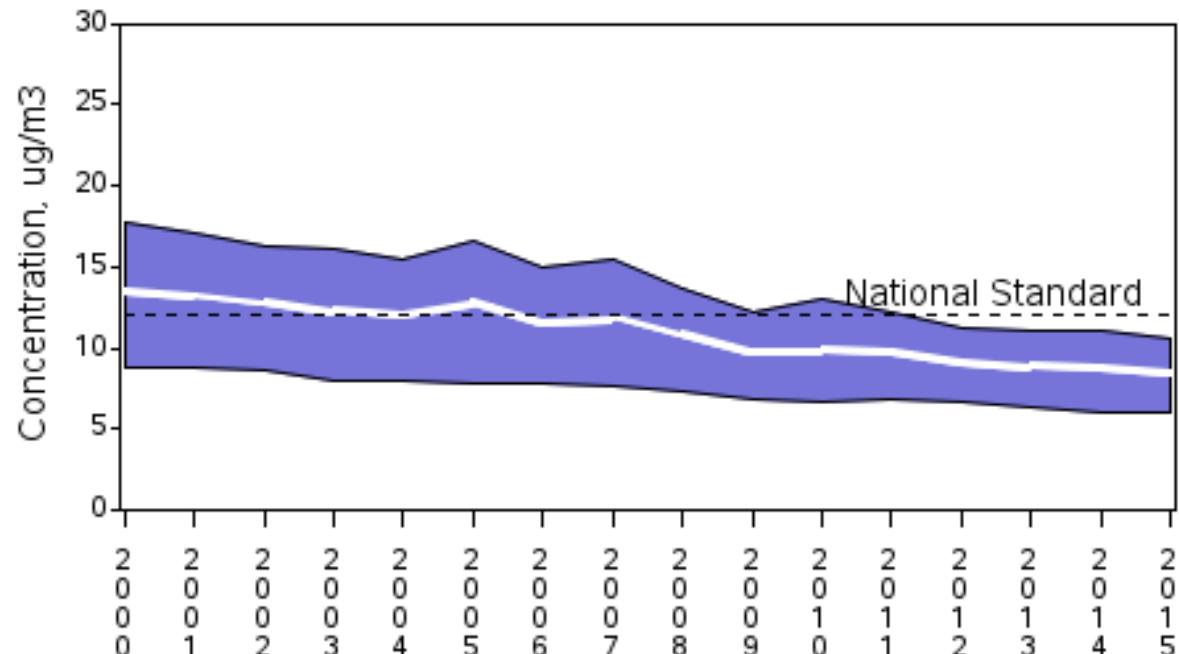
HENGRUMAY@GMAIL.COM



PM2.5 Air Quality, 2000 - 2015

(Seasonally-Weighted Annual Average)

National Trend based on 480 Sites



2000 to 2015 : 37% decrease in National Average