Data Science Applications

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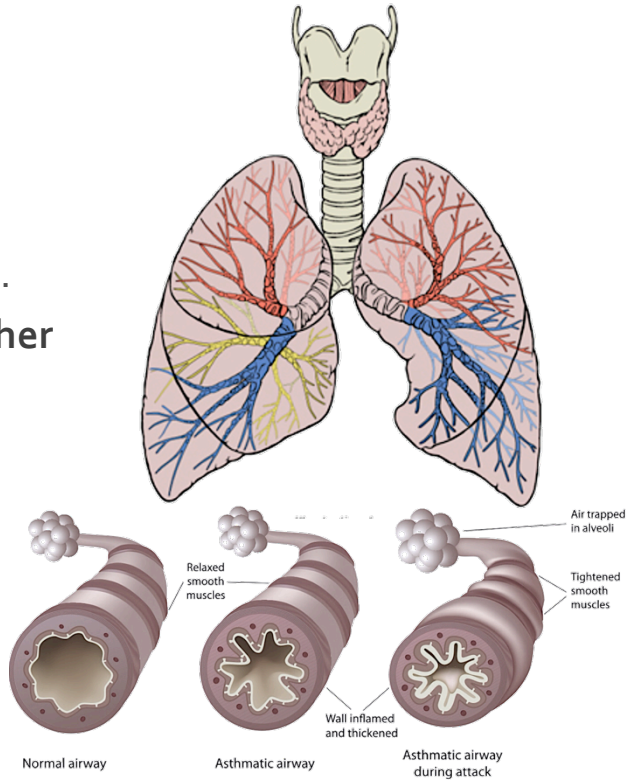
Predicting hospital ED visits with weather data

Prospective management of asthma patients

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

10-fold CV Test-Train

Holdout

*2014

CDIAC

NOAA

TEMP

DEWP

HUMIDITY (%)

SNOW (IN)

PRECP (IN)

WIND_SPD (MPG)

WIND_DIR (°)

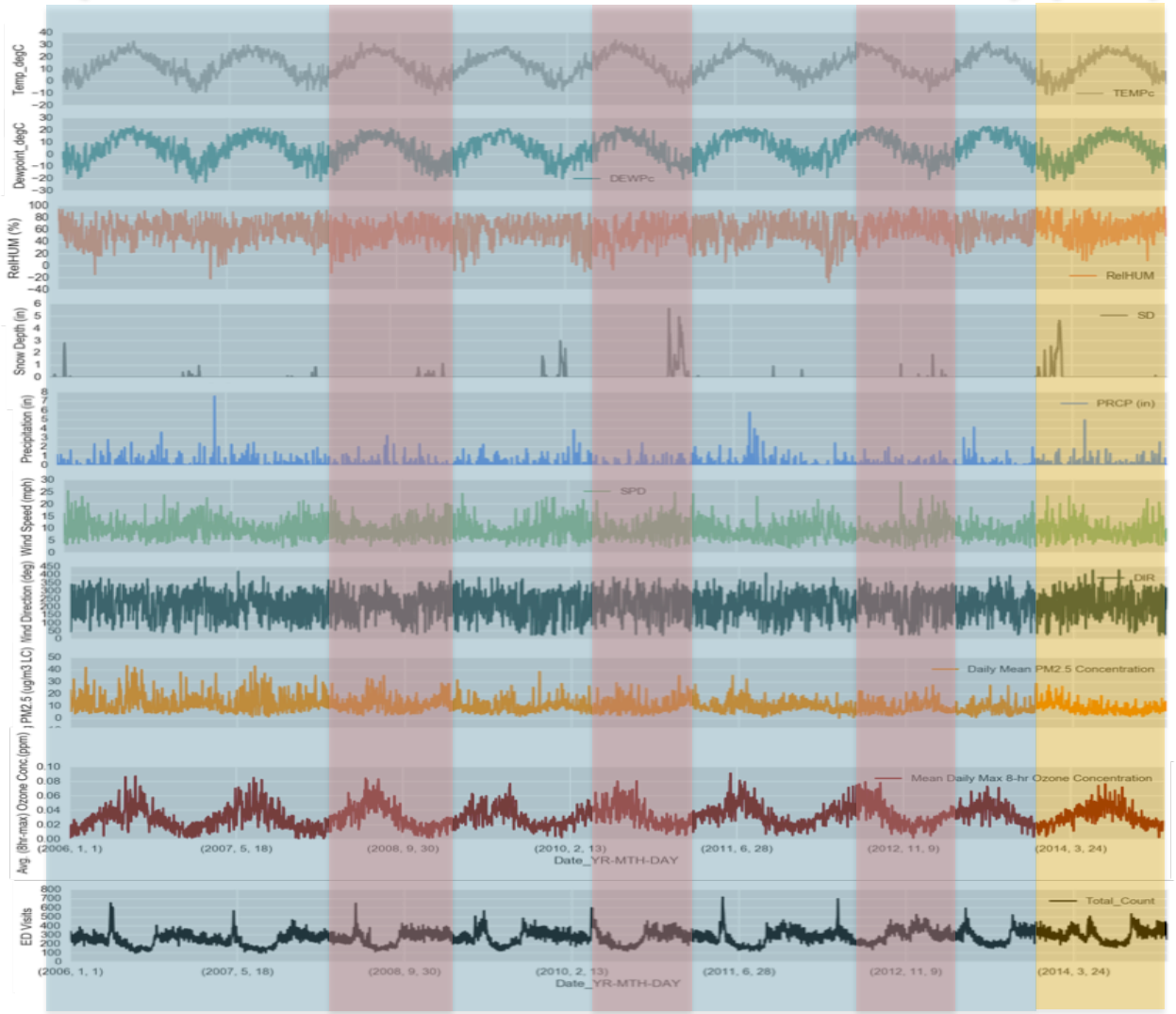
EPA

PM2.5

OZONE

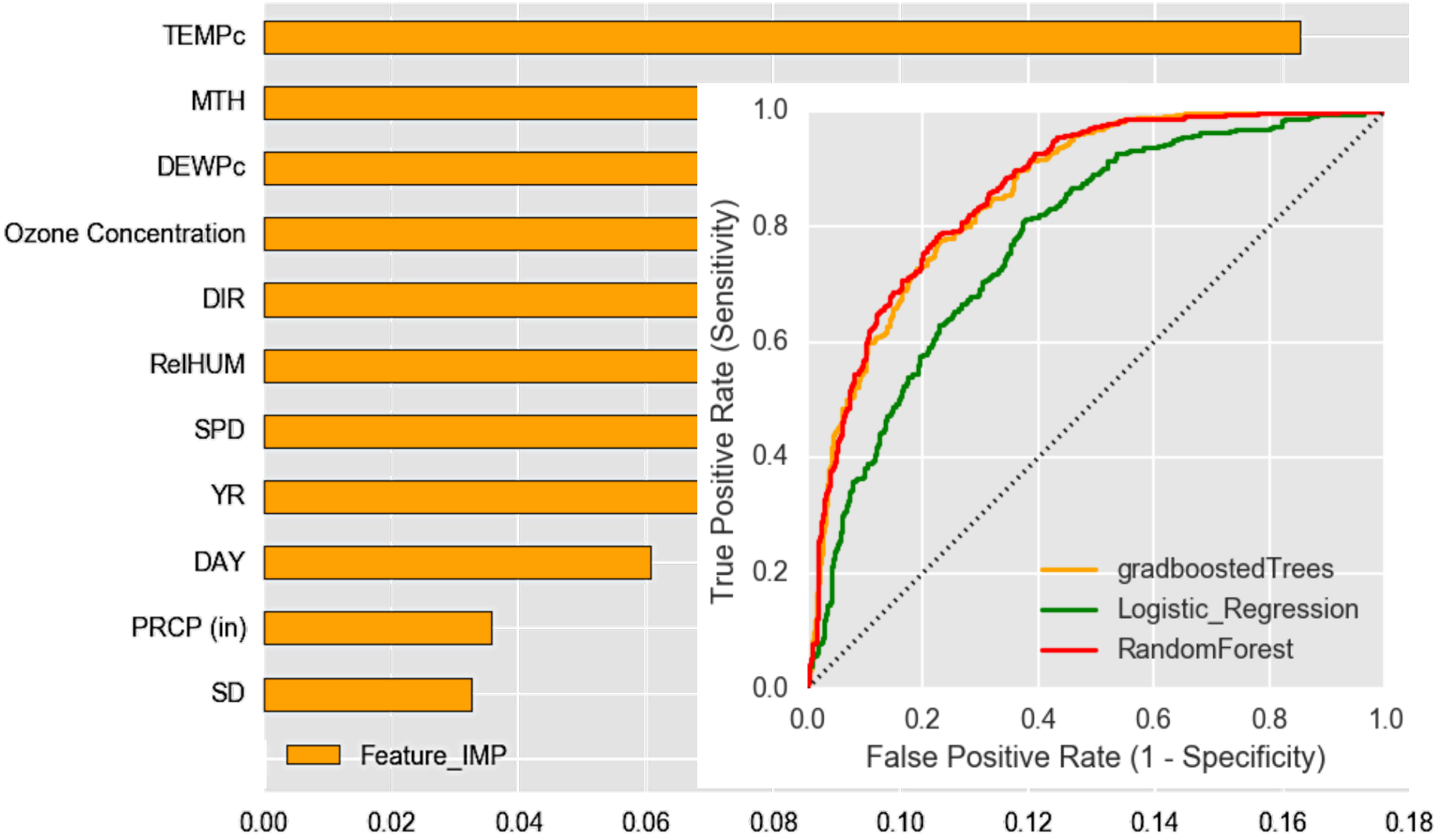
NYC Health

ED VISITS



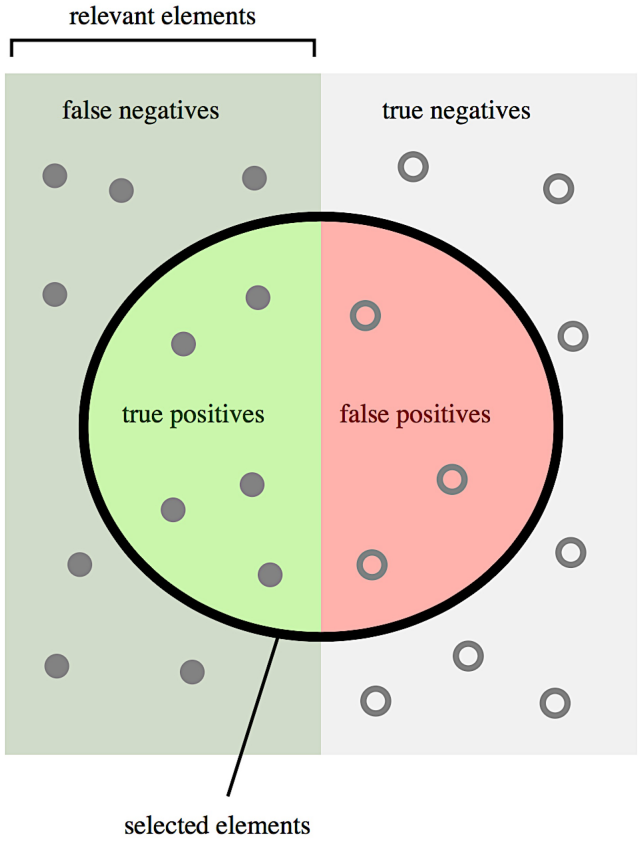
2006 ⟵ DATE ⟶ 2015

Features of importance | Model prediction



Precision & Recall

GBTrees		Precision	Recall
Train_Validate	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



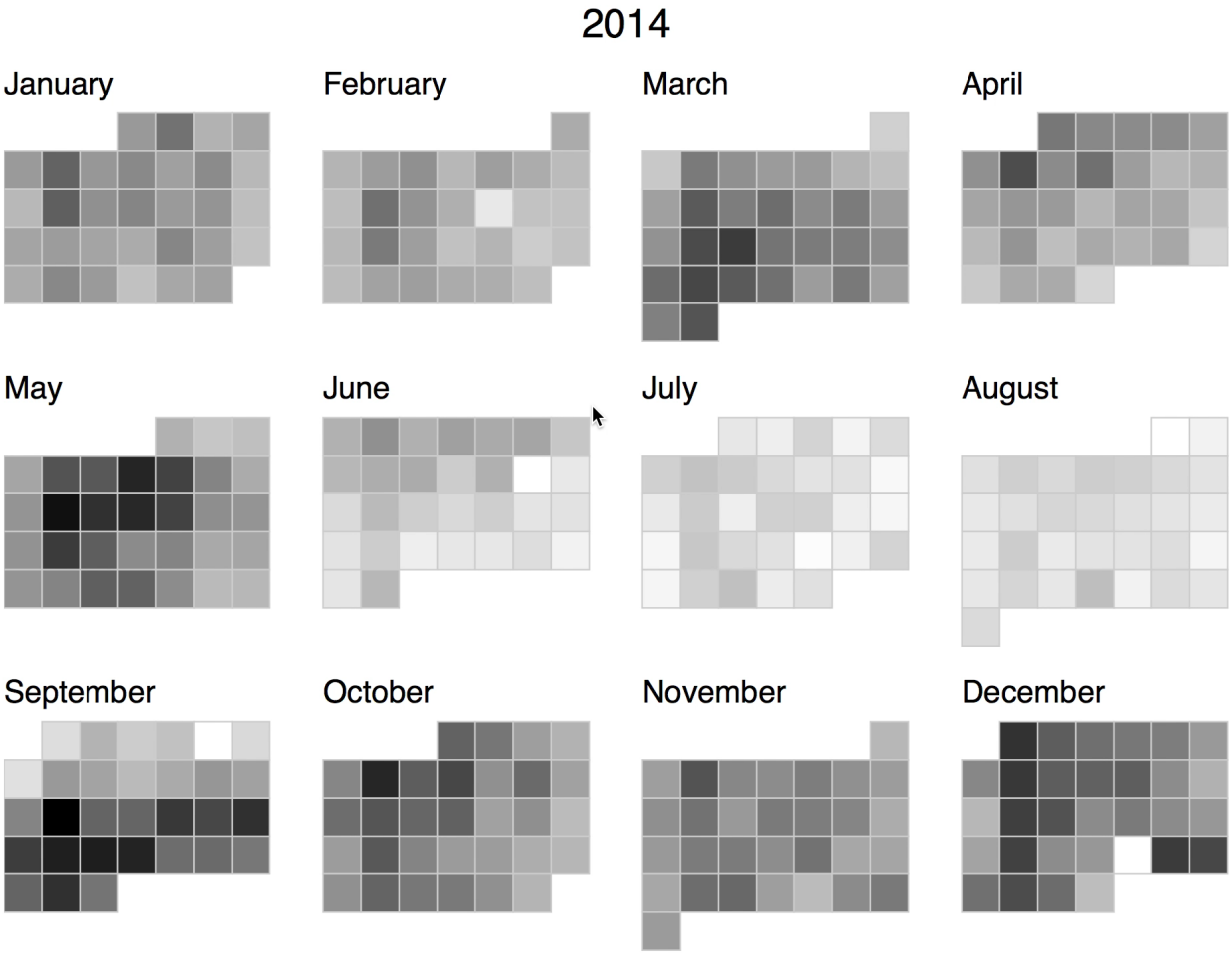
How many selected items are relevant?

Precision =

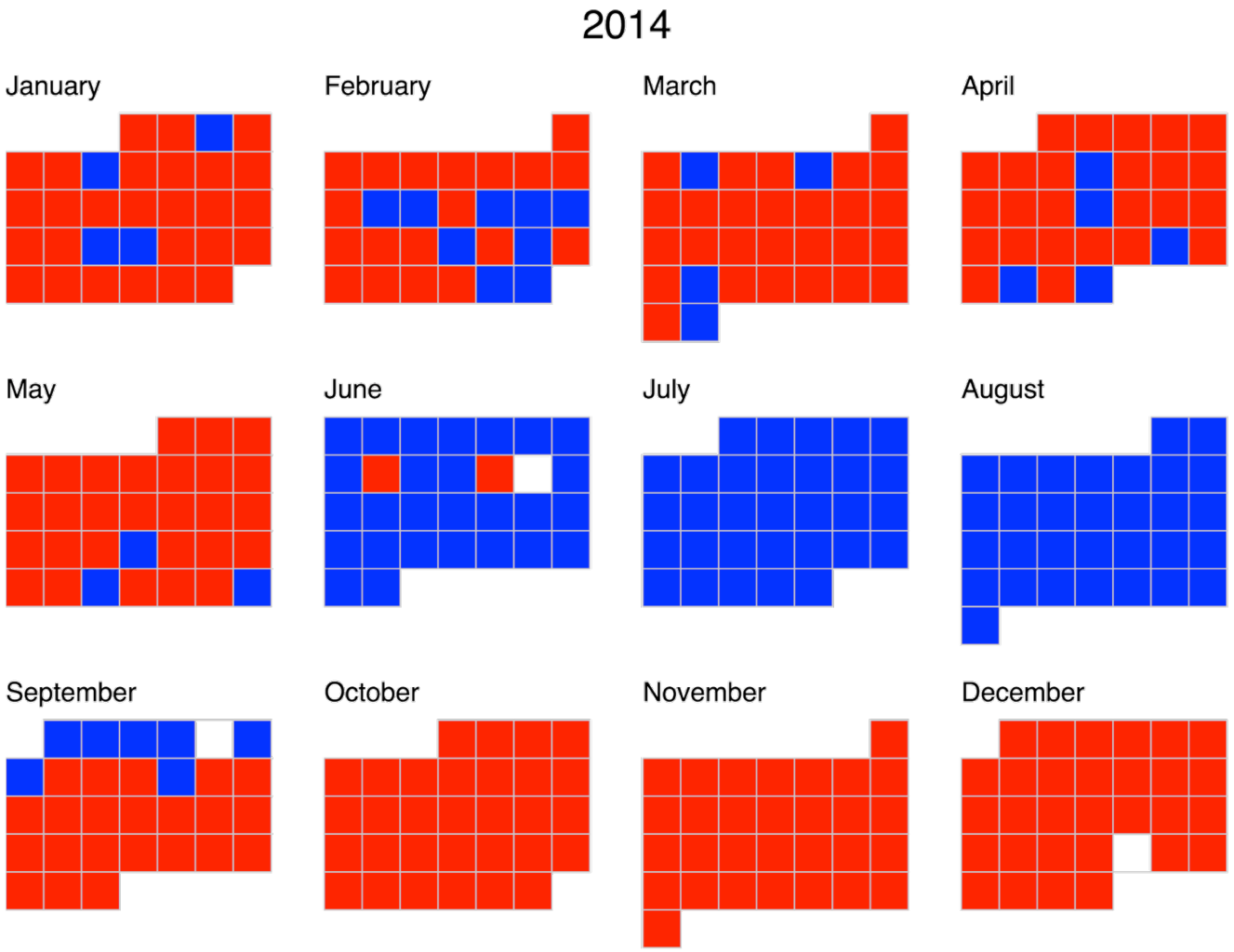
How many relevant items are selected?

Recall =

A d3.js calendar chart app. for prospective resource management



Online model updating when data is available to improve prediction



Further work + extension

- Integrating weather + air quality forecasts in the modeling
  - Ozone and particulate matter may interact in complex ways to act as irritants
- ED visits for different age-groups – varying needs
- Consider providing suitable precautionary alerts for those with asthma or respiratory diseases
- Extending this to other counties/cities/countries/ fields

THANK YOU

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