Exploring Perceived/Actual Impact on Property Value after a Hurricane

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Why are we here today?

During a disaster, it is important to model and estimate the potential or forecasted effect of the event, including the projected/forecasted damage. Existing indicators of forecasted damage include number of structures within the affected area, number of people in the area, number of households, demographics of the impacted population, etc. ***This project will add an additional perspective: It will compare how hurricanes do or do not impact real estate sale prices by zip code before and after the storm.***

Problem Statement:

How do we quickly glean insights on property values before and after a hurricane through a user friendly application?

Goals:

- Provide an **initial proof of concept** for a potential web application using Flask software for Python.
- This rudimentary web app will allow the user to input a zip code and see summary statistics for how **median real estate prices were affected after a hurricane.**

Limitations:

1. We used the **top ~6000 zip codes by population**, not the ~41000 exhaustive list of zips
2. This initial proof focuses on the recent hurricanes of **Sandy, Harvey, and Dorian**
3. Our focus for this project was financial impact on zip code aggregated **median sale prices**
4. This project considers **nominal/actual sale prices**, not indirect/real economic costs

Executive Summary:

1. While hurricanes have numerous nominal and real costs on individuals, groups, property, and governments, we have found that their impact on real estate sale prices **does not necessarily follow intuitive logic (size, proximity to storm or ocean).**

2. We identified **large fluctuations in sale price** in the affected areas, even when comparing adjacent zip codes, **suggesting limited geographic relevance.**

3. Hurricane Harvey produced the highest damage count of $125B, however, the real estate prices were **virtually unaffected when compared to the national average.**

Baseline Context (U.S. Impacted Data only)

National Median Real Estate Sale Price (% Change YoY | $ in Thousands)

2012: +8.7% | $244

2013: +8.9% | $266

2014: +7.3% | $286

2015: +2.9% | $294

2016: +3.7% | $305

2017: +5.7% | $322

2018: +0.9% | $325

2019: -1.7% | $319

Proof of concept MVP for three hurricanes within different regions of U.S.

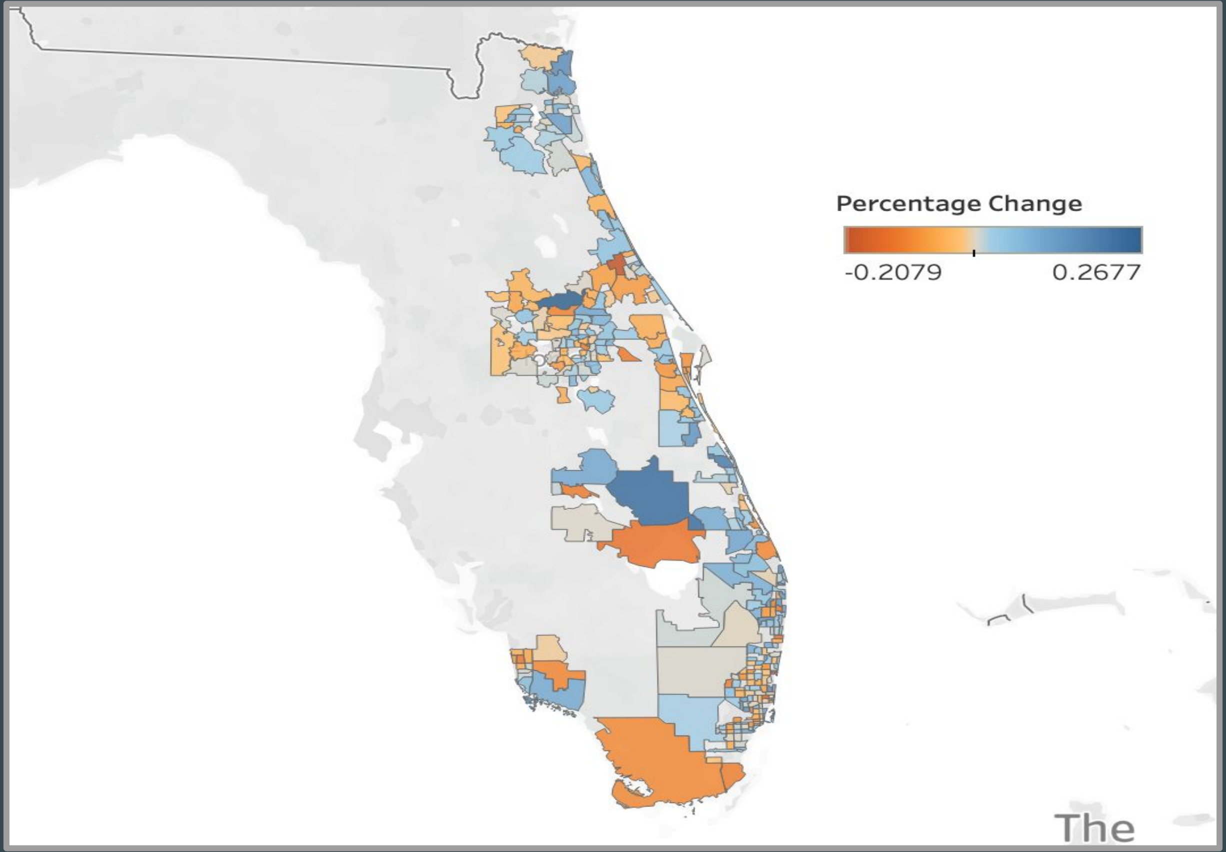
- **Sandy (Cat 1):** 2012 Northeast U.S. — **Damage Estimate: $70B, 200K Homes**
- **Harvey (Cat 4):** 2017 Gulf (TX/LA) — **Damage Estimate: $125B, 135K Homes**
- **Dorian (Cat 1):** 2019 South East — **Damage Estimate: $1.2B**

https://www.nhc.noaa.gov/news/UpdatedCostliest.pdf https://www.livescience.com/40774-hurricane-sandy-s-impact-infographic.html
https://fred.stlouisfed.org/series/MSPUS?utm_source=series_page&utm_medium=related_content&utm_term=related_resources&utm_campaign=categories#0 https://www.ncdc.noaa.gov/billions/

Acquiring the Data

- Background Research (Zillow)
- FEMA reports
- Counties/Cities → Zip codes
- Reusable Webscraper
- Worked individually on own datasets, then created the 'master'
- Feature engineered % change affected by storm

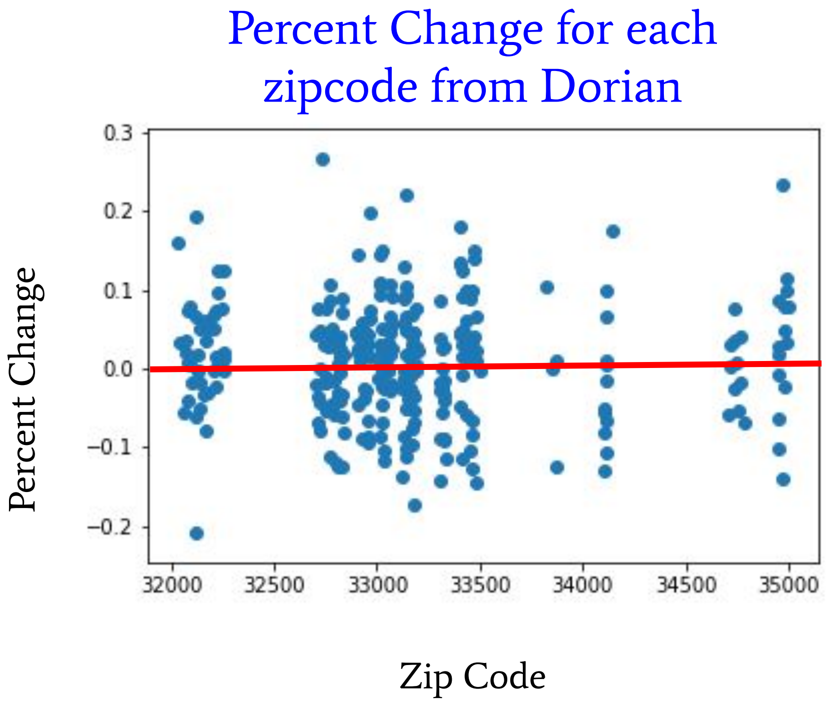
Hurricane Dorian- August 24, 2019 - September 10, 2019



Hurricane Dorian

Takeaways:

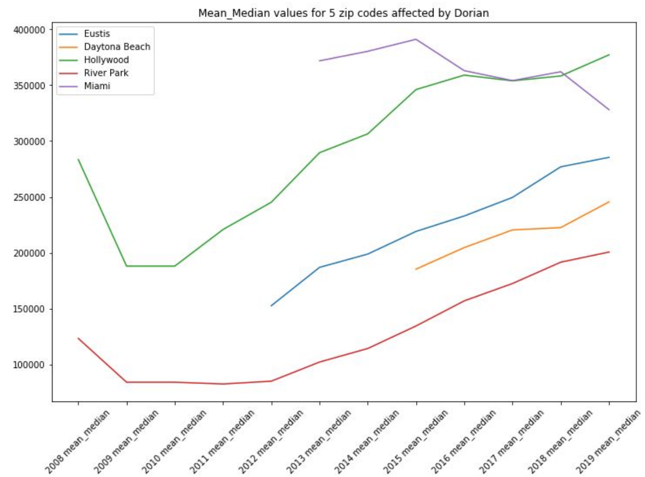
- Mean percent change was negligible ~ 0.0099 or barely 1%
- Most positive percent change ~ 27% in city of Eustis
- Most negative percent change ~ 21% in Daytona Beach

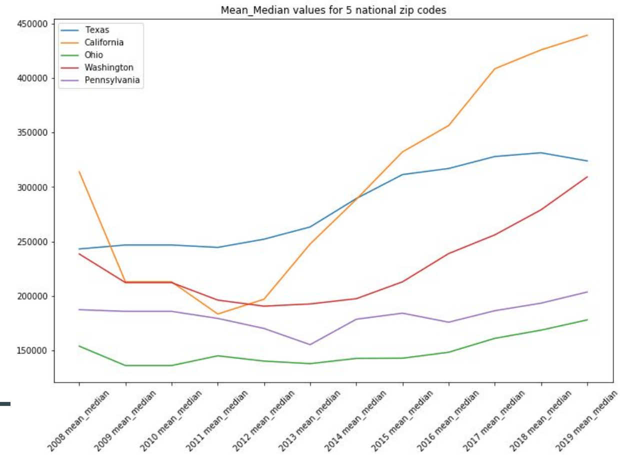


Hurricane Dorian

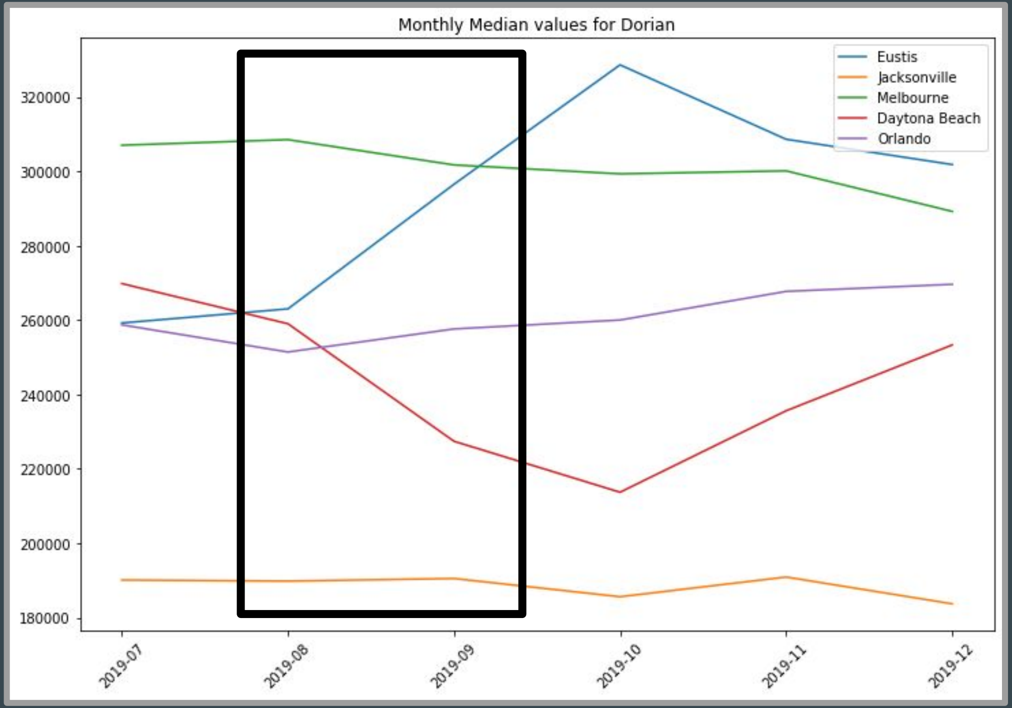
Comparing to National Trends:

- Significant number of NA values makes trend analysis harder
- Can't see the min/max % change from storm because it's within the year
- Each zip code has a certain range of median values

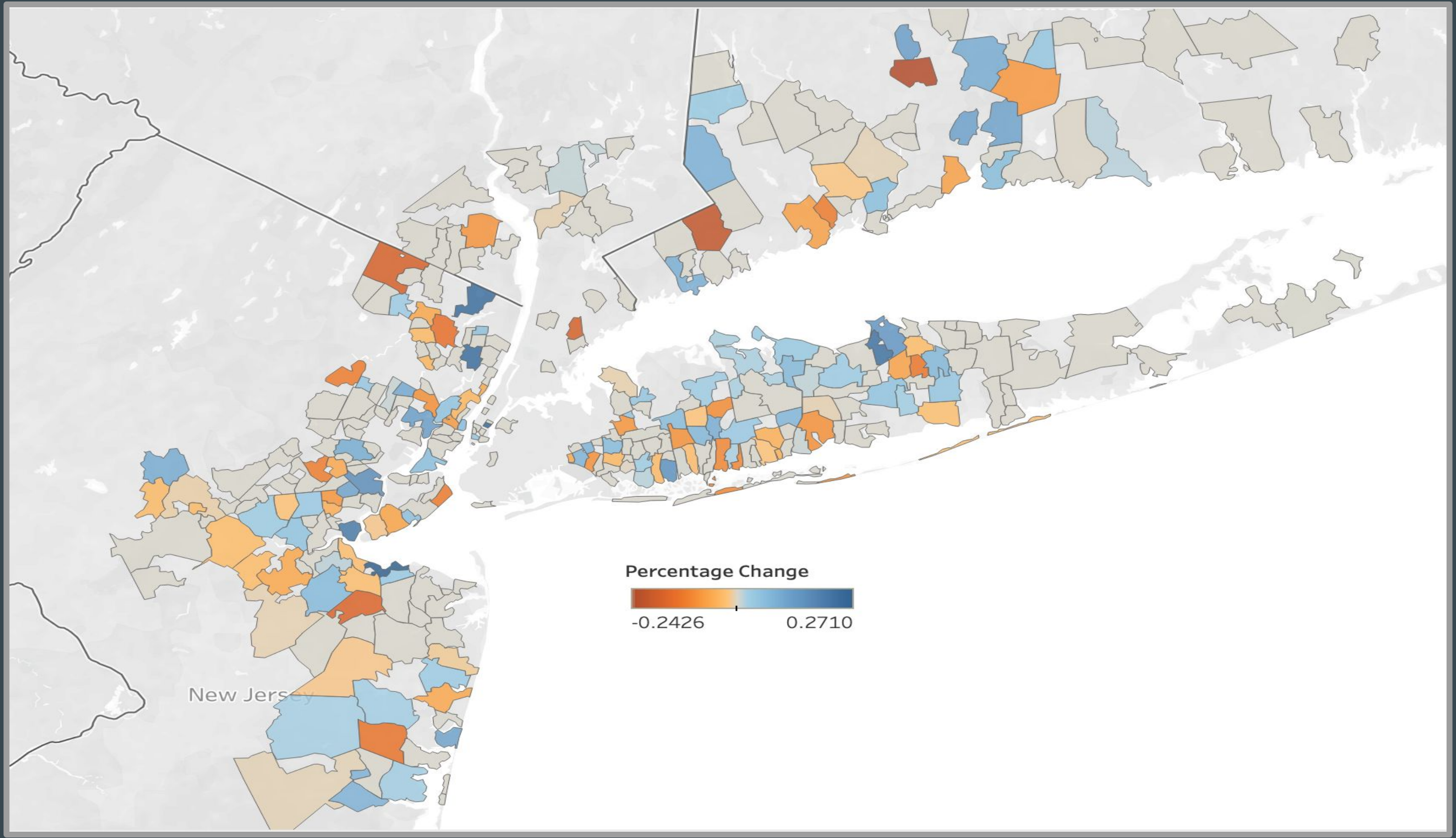




Hurricane Dorian--narrowing down to affected months



Hurricane Sandy- October 22, 2012 - November 2, 2012

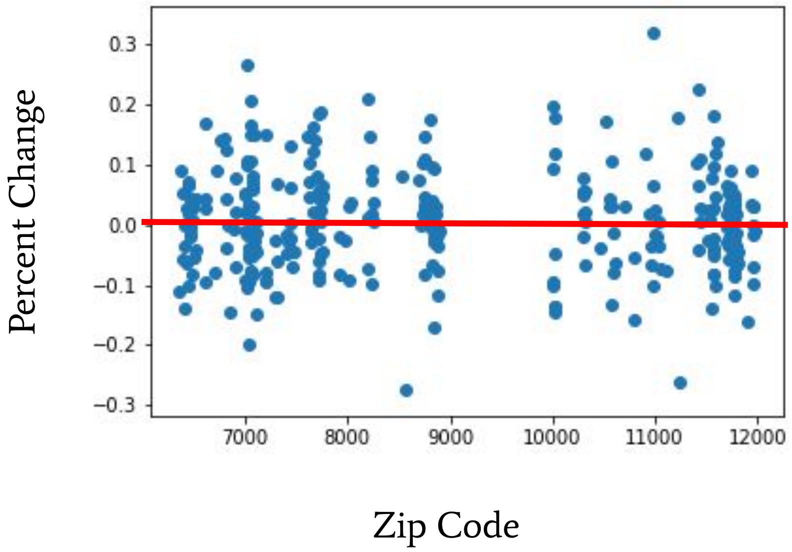


Hurricane Sandy

Takeaways:

- Mean percent change was negligible ~ 0.0076 or barely 1%
- Most positive percent change ~ 27% in city of Keyport, NJ
- Most negative percent change ~ 24% in Middlebury, CT

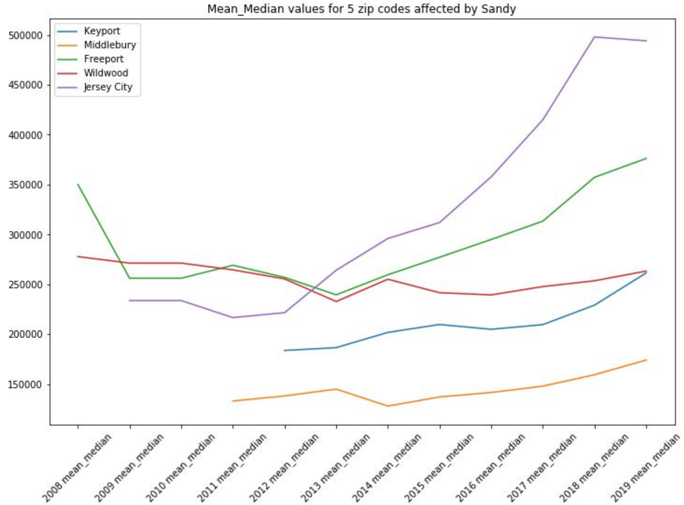
Percent Change for each zipcode from Sandy

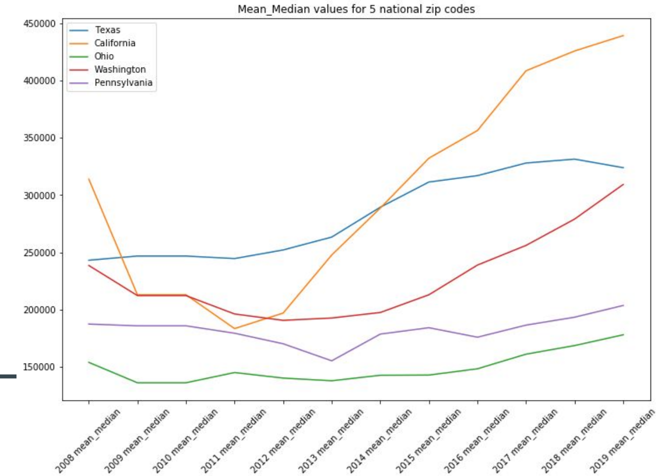


Hurricane Sandy

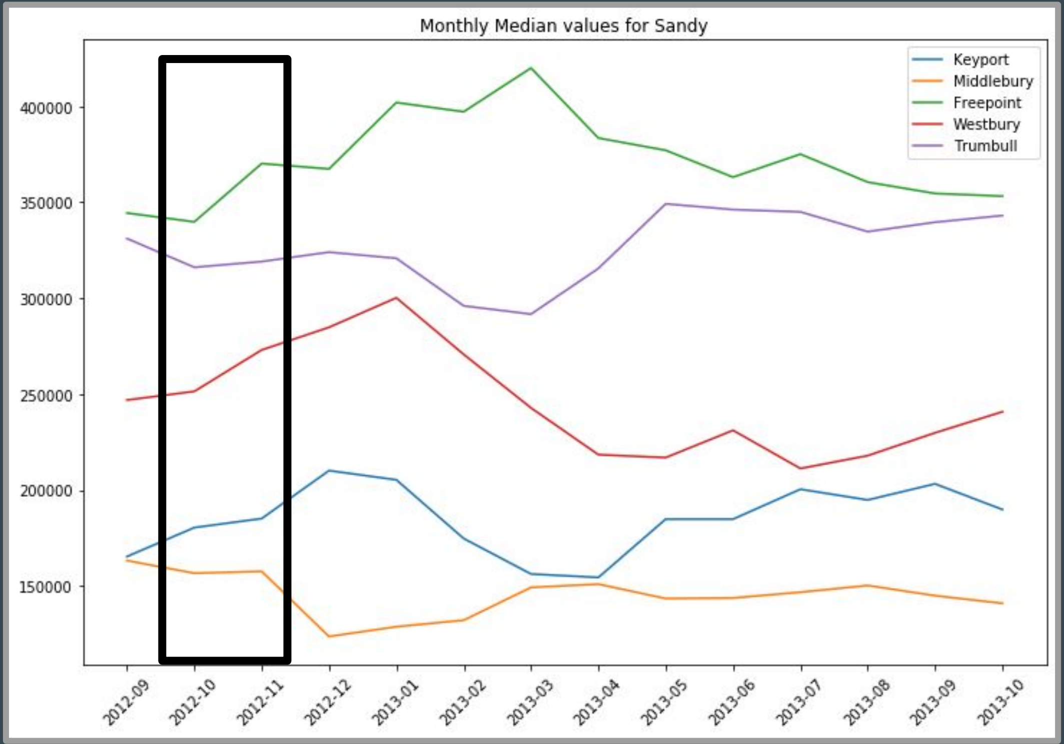
Comparing to National Trends:

- Generally follows the year trends of the nation

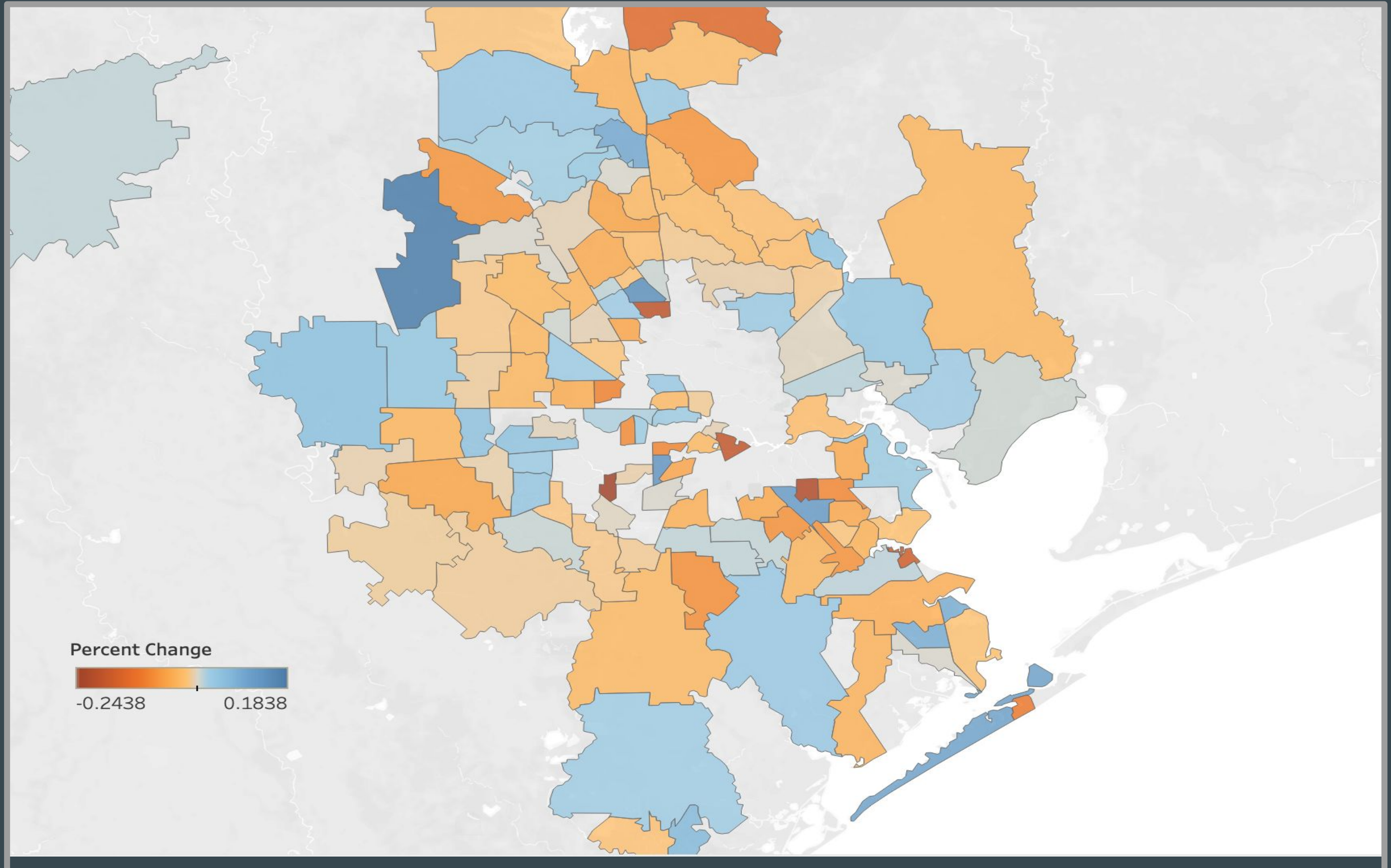




Hurricane Sandy--narrowing down to affected months



Hurricane Harvey- August 17, 2017 - September 3, 2017

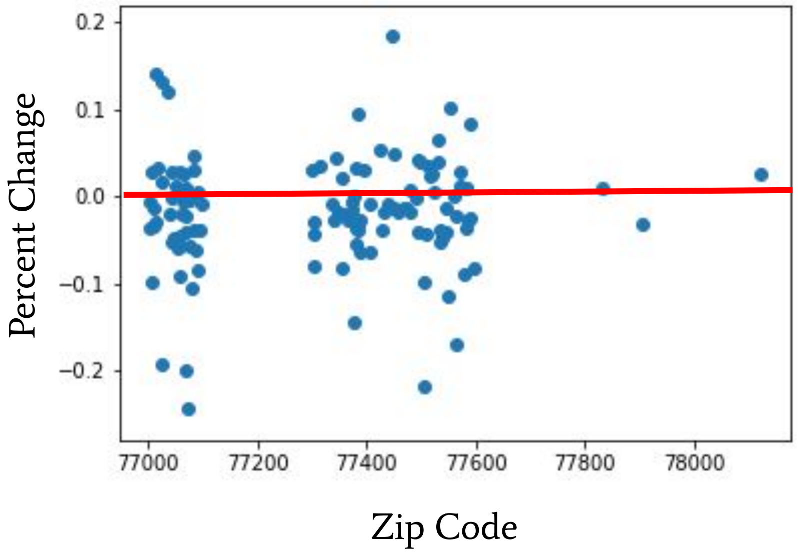


Hurricane Harvey

Takeaways:

- Mean percent change ~ -0.0174 or about minus 2%
- Most positive percent change ~ 18% in city of Hockley
- Most negative percent change ~ 24% in Houston

Percent Change for each zipcode from Harvey



Hurricane Harvey

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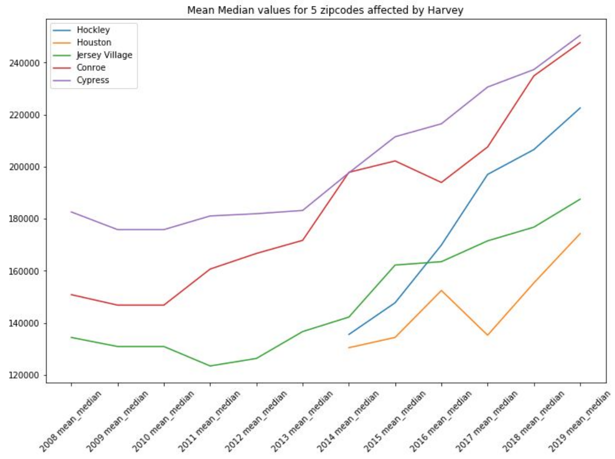
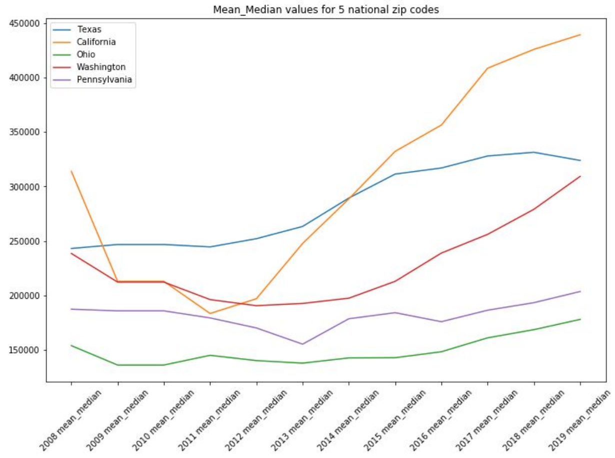
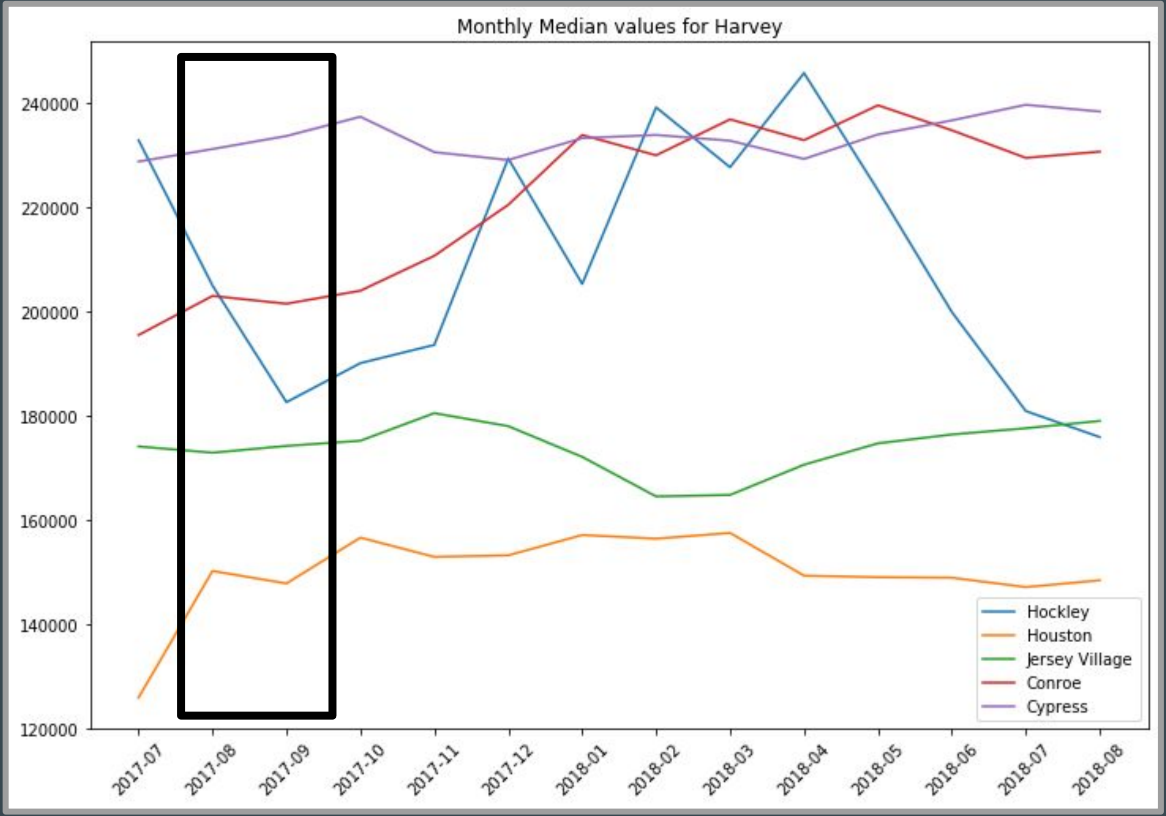


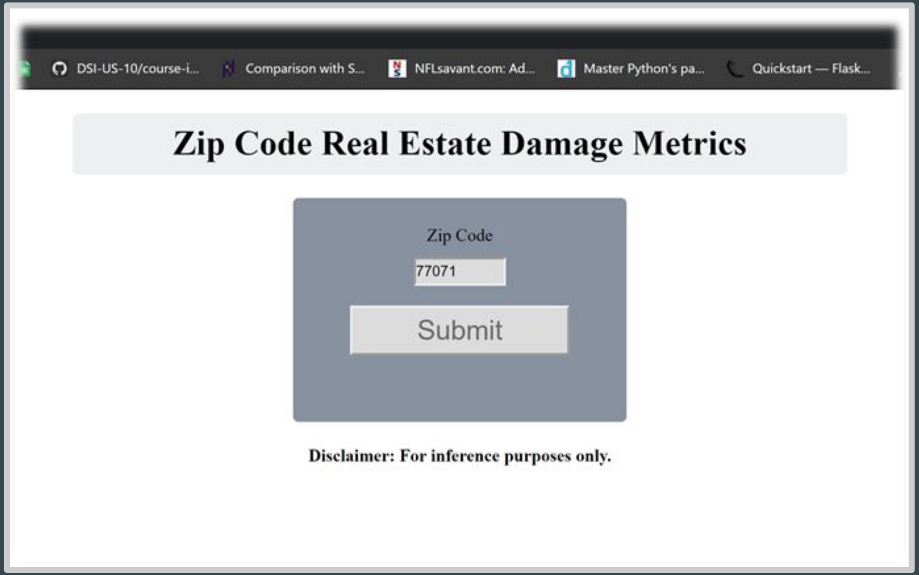


Hurricane Harvey--narrowing down to affected months

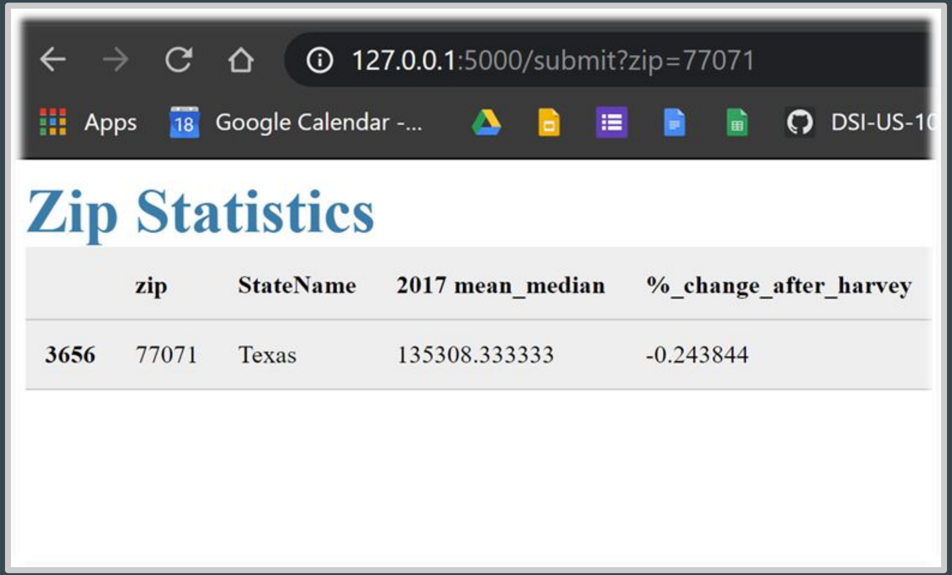


Flask-our interactive application

Home page



Results Page



[Live Flask Demo URL]

Closing Metrics

	Context Official U.S. hurricane damage	**Compare** National median sale price after storm	**Actual** Median sale price after storm in affected zip	**Normalize** Percentage Delta
Dorian 2019	$1.2B	+5.7%	+1%	-470 BPS
Sandy 2012	$70B	+8.7%	+0.8%	-790 BPS
Harvey 2017	$125B	-1.7%	-1.7%	No Change

Suggestions for New Light Technologies

<u>Possible Next Steps</u>

- Why are the most negatively impacted zip codes adjacent to the most positively impacted zip codes? (Elevation, levies, state/fed resources)
- How can we best feature engineer zoning laws and real estate regulations into a machine learning model? (Binary dummies, ordinal)
- What kind of model might we want to use? (regressor/classifier/hybrid)
- Scale this concept to other natural disasters (Earthquake, fire, tornado)