

THE IMPACT OF SAN FRANCISCO INTERNATIONAL AIRPORT NOISE ON BAY AREA COMMUNITIES

By Megan Leung

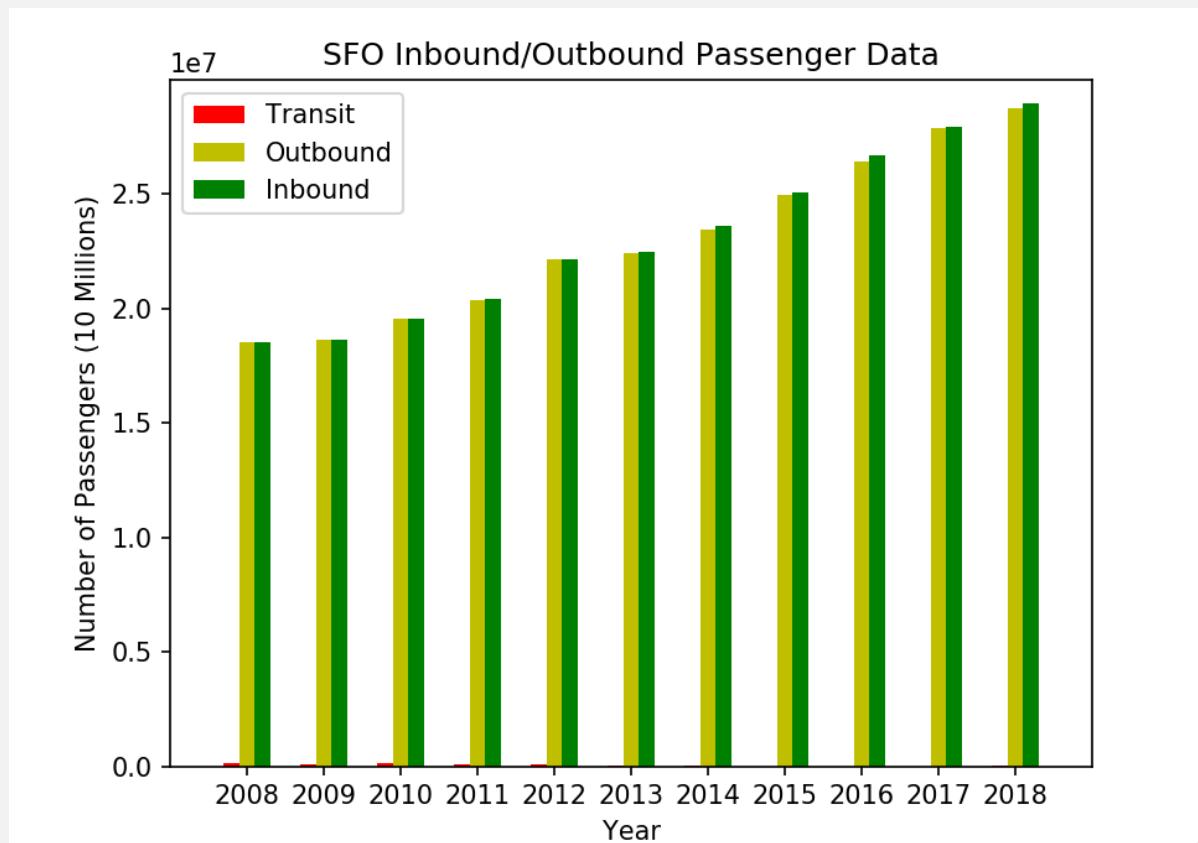
**WHICH COMMUNITIES
HAVE BEEN MOST
IMPACTED BY AIRPLANE
NOISES FROM SFO?**



SFO DATA

- Source: SFO
- Timeframe: 2008 to 2018
- Datasets:
 - Air Traffic Passenger Statistics
 - Aircraft Noise Complaints
 - SFO Runway Usage
 - Airline Noise Exceedance Rating

FROM 2008 TO 2018, THE NUMBER OF SFO PASSENGERS INCREASED YEAR OVER YEAR



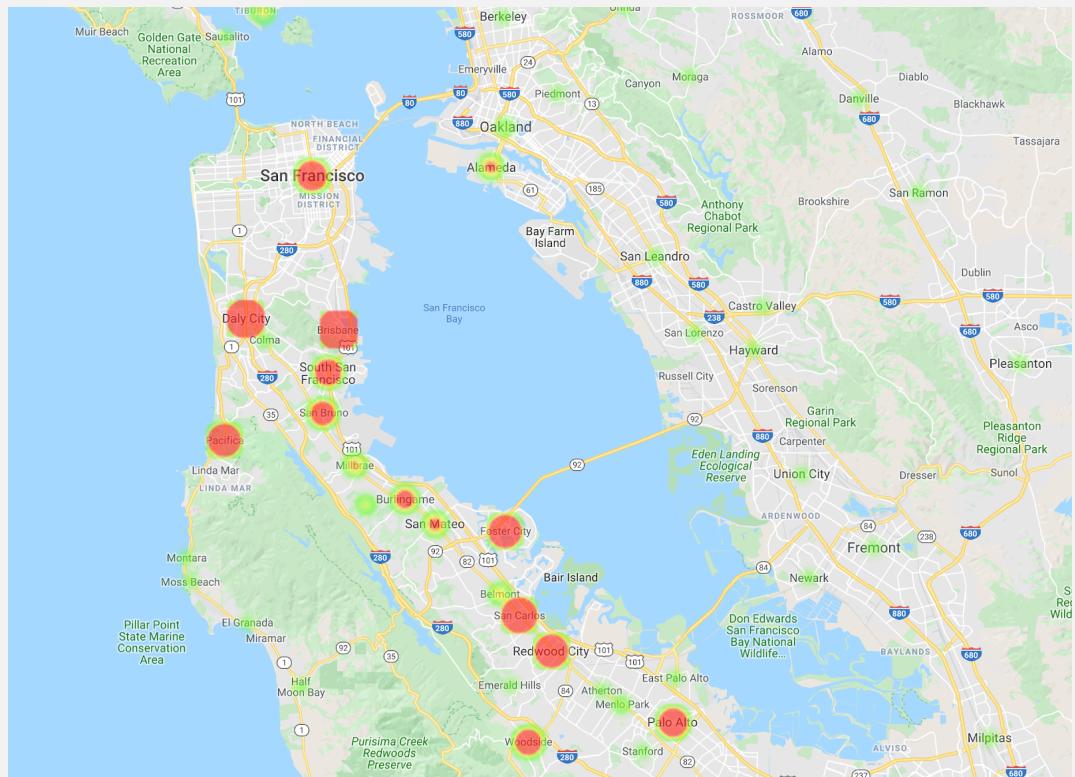
DATA CLEANING PROCESS

```
1 #Plot bar graphs with Deplaned and Enplaned passengers for a comparison
2
3 year = ["2008", "2009", "2010", "2011", "2012", "2013", "2014", "2015", "2016", "2017", "2018"]
4 deplaned = sfo_passenger_summary.loc["Deplaned"]
5 enplaned = sfo_passenger_summary.loc["Enplaned"]
6 transit = sfo_passenger_summary.loc["Thru / Transit"]
7
8 x_axis = np.arange(len(year))
9 tick_locations = []
10 for x in x_axis:
11     tick_locations.append(x)
12
13 plt.title("SFO Inbound/Outbound Passenger Data")
14 plt.xlabel("Year")
15 plt.ylabel("Number of Passengers")
16 plt.xticks(x_axis, ("2008", "2009", "2010", "2011", "2012", "2013", "2014", "2015", "2016", "2017", "2018"))
17
18 plt.xlim(-1, len(year))
19 plt.ylim(0, max(deplaned) + 1000000)
20
21
22 ax = plt.subplot(111)
23 ax.bar(x_axis-0.2, transit, facecolor = "r", width=0.2, align="center", label="Transit")
24 ax.bar(x_axis, enplaned, facecolor="y", width=0.2, align="center", label="Outbound")
25 ax.bar(x_axis+0.2, deplaned, facecolor="g", width=0.2, align="center", label="Inbound")
26 plt.legend(loc="upper left")
27 plt.show()
```

Data Source: Air Traffic Passenger Report

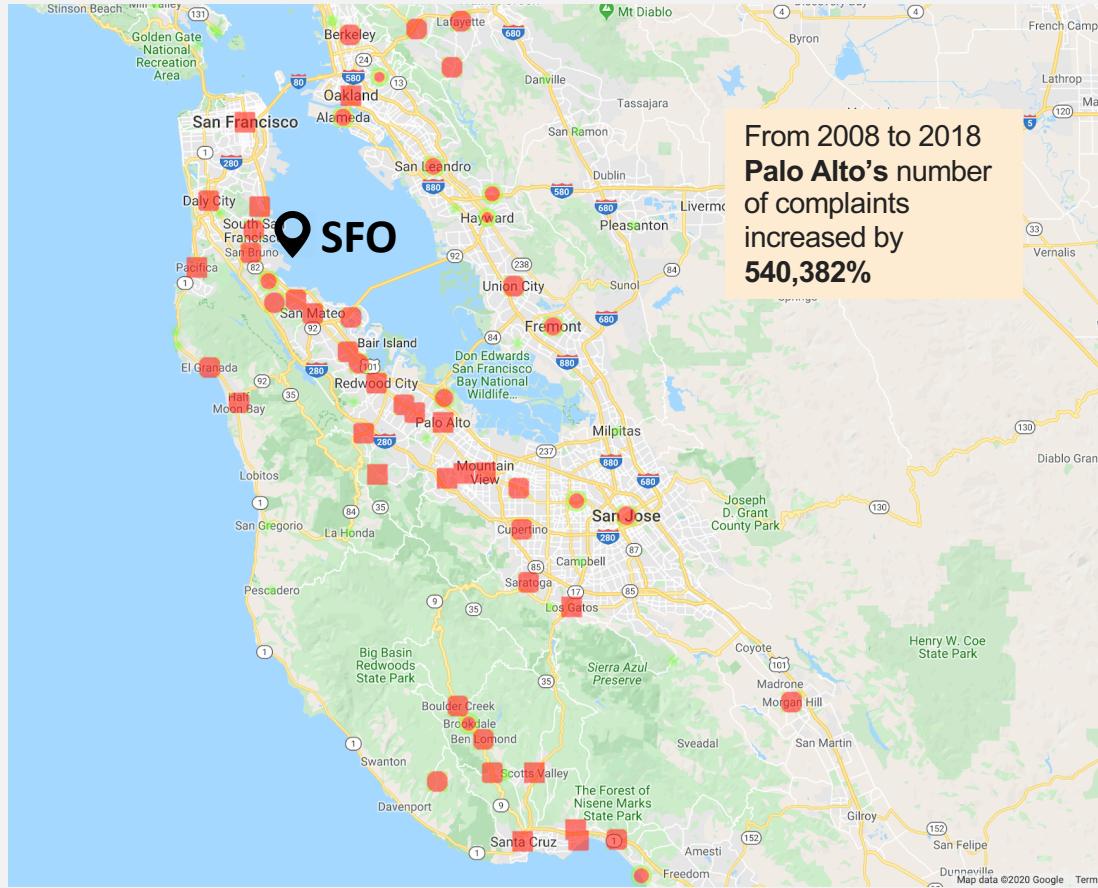
- > 25,000 raw data points
- Removed missing data points and unnecessary information
- Filtered and grouped data by categories
 - Year
 - Activity type code (inbound/outbound)
- Technologies utilized: Pandas, Matplotlib

CITIES WITH THE MOST SFO NOISE COMPLAINTS IN 2008



Rank	City	# of Complaints
1	Brisbane	3,849
2	Daly City	1,757
3	San Carlos	590
4	Redwood City	332
5	Foster City	319
6	Pacifica	306
7	San Francisco	146
8	Palo Alto	113
9	S. San Francisco	70
10	Woodside	67

CITIES W/ THE MOST SFO NOISE COMPLAINTS IN 2018



Rank	City	# of Complaints
1	Palo Alto	610,745
2	Los Altos	275,434
3	Los Gatos	256,522
4	Santa Cruz	248,581
5	Scotts Valley	143796
6	Los Altos Hills	108,978
7	Soquel	96,981
8	Oakland	94,871
9	Portola Valley	80,912
10	Pacifica	67,112

IN 2015, THE HIGHEST NUMBER OF COMPLAINTS SHIFTED FROM BRISBANE TO LOS GATOS/PALO ALTO



Year	Community	Number of Complaints
2008	Brisbane	3,849
2009	Brisbane	2,768
2010	Brisbane	5,150
2011	Brisbane	5,319
2012	Brisbane	3,630
2013	Brisbane	5,324
2014	Brisbane	9268
2015	Los Gatos	213,850
2016	Palo Alto	863,149
2017	Palo Alto	610,940
2018	Palo Alto	610,745

API INTERACTIONS FOR VISUAL ANALYSIS

```
[1]: 1 new_complaint_df['State'] = 'CA'
2 new_complaint_df['Lat'] = ''
3 new_complaint_df['Lng'] = ''
4 new_complaint_df = new_complaint_df[['Community', 'State', 'Lat', 'Lng', '2008', '2009', '2010', '2011',
5 '2012', '2013', '2014', '2015', '2016', '2017', '2018']]  
  
[2]: 1 # create a params dict that will be updated with new city each iteration
2 params = {"key": gkey}
3
4 # Loop through the cities_pd and run a lat/long search for each city
5 for index, row in new_complaint_df.iterrows():
6
7     # update address key value
8     base_url = "https://maps.googleapis.com/maps/api/geocode/json"
9     # make request
10    city = row["Community"]
11    state = row["State"]
12
13    params["address"] = (f"{city}, {state}")
14
15    cities_lat_lng = requests.get(base_url, params = params)
16    # print(cities_lat_lng.url)
17
18    cities_lat_lng = cities_lat_lng.json()
19
20    new_complaint_df.loc[index, "Lat"] = cities_lat_lng["results"][0]["geometry"]["location"]["lat"]
21    new_complaint_df.loc[index, "Lng"] = cities_lat_lng["results"][0]["geometry"]["location"]["lng"]
22
23
24    new_complaint_df
```

Data Source: Airport Noise Complaints

- >5000 data points
- Removed missing data points
- Utilized Google's geolocation API to gather latitude and longitude coordinates to map location of complaints
- Technologies utilized: JSON, Pandas, Matplotlib, NumPy

**WHAT HAPPENED IN 2015 TO
CAUSE AN INCREASE IN
NOISE COMPLAINTS IN PALO
ALTO?**

FAA CHANGES FLIGHT PATHS IN 2015

San Francisco Business Times

[Bay Area residents push back against SFO airport noise](#)

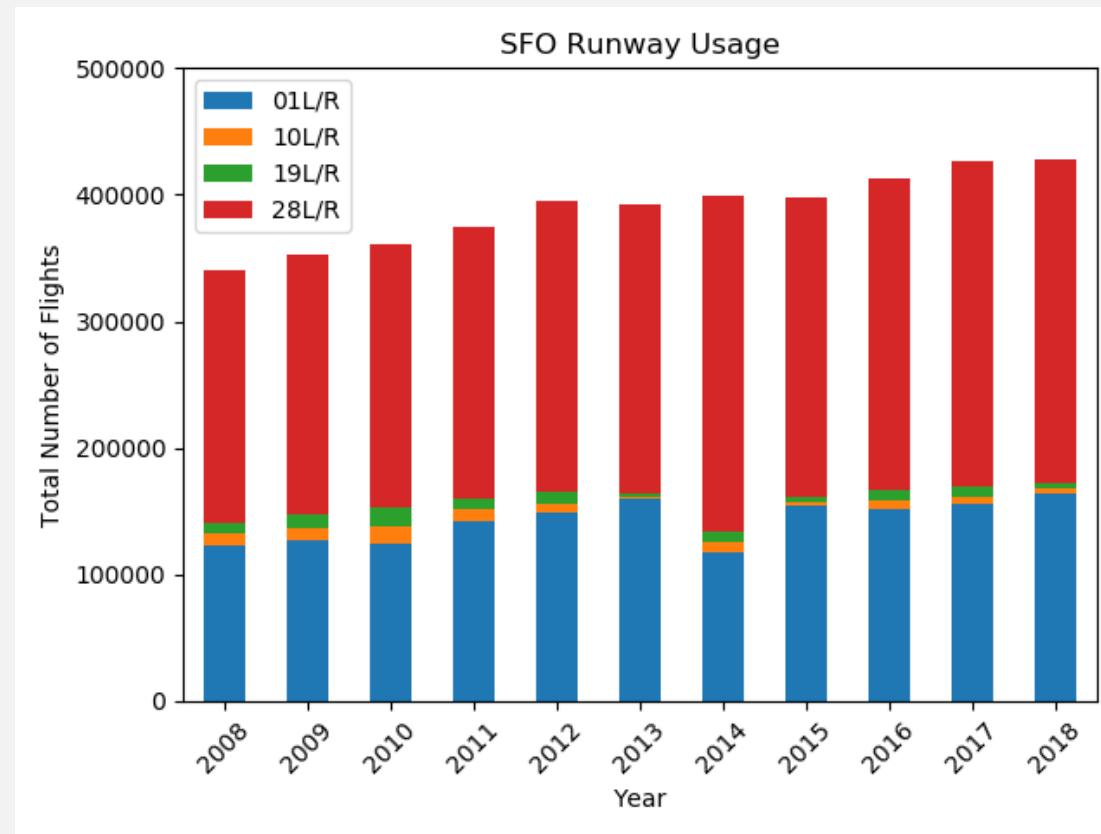
Airport noise has been a longstanding gripe from residents living near San Francisco International Airport, but complaints from San Francisco, San Mateo, Santa Clara and Santa Cruz counties have skyrocketed in recent years. (113 kB) ▾



SFO RUNWAY PATHS



THE RUNWAY WITH THE HIGHEST NUMBER
OF FLIGHT USAGE FROM 2008 TO 2018 WAS
28L/R



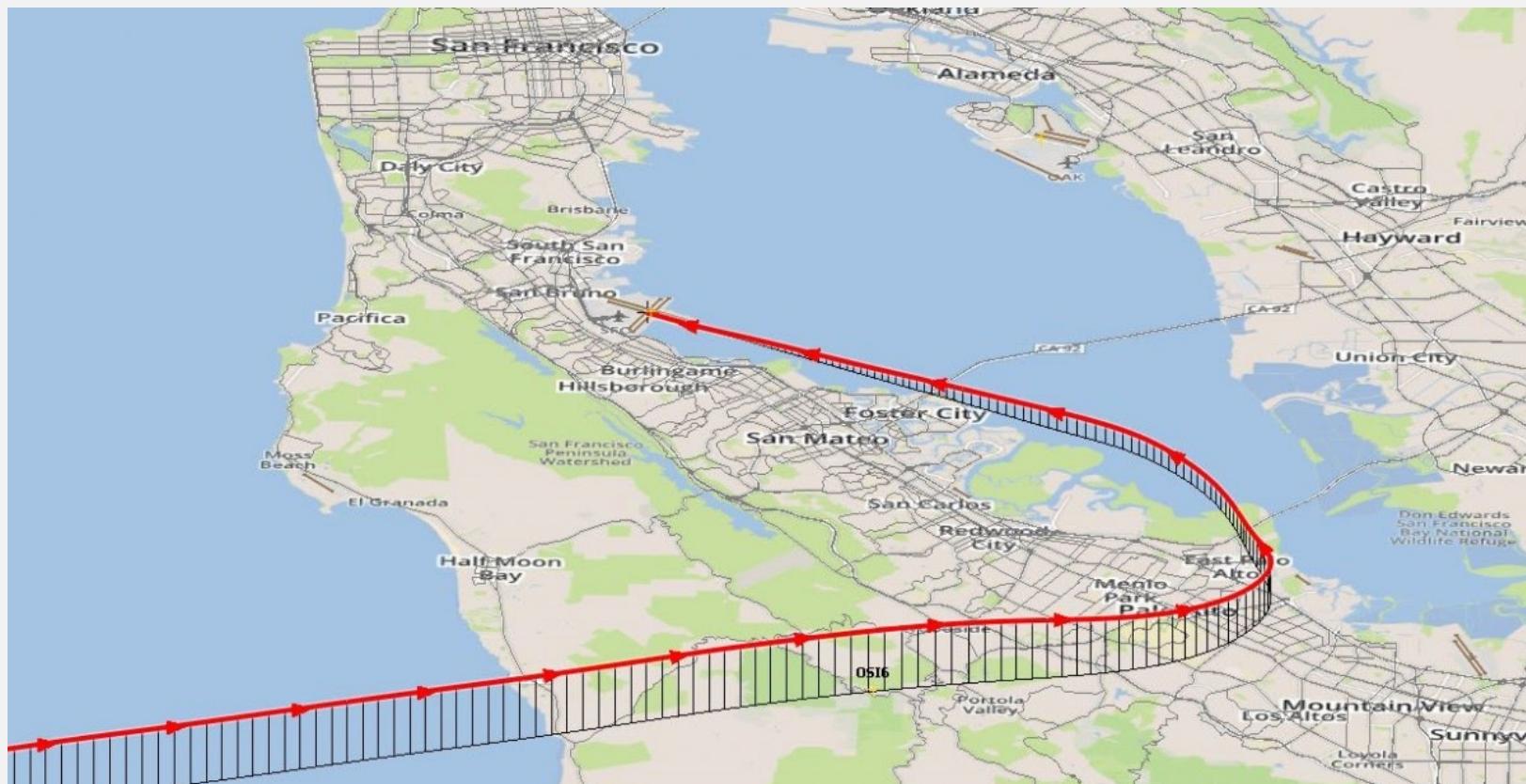
DATA PROCESS FOR SFO RUNWAY ANALYSIS

```
1 #Plot bar graphs with Deplaned and Enplaned passengers for a comparison
2
3 year = ["2008", "2009", "2010", "2011", "2012", "2013", "2014", "2015", "2016", "2017", "2018"]
4 zero_one = sfo_runway_final.loc["01L/R_Total"]
5 ten = sfo_runway_final.loc["10L/R_Total"]
6 nineteen = sfo_runway_final.loc["19L/R_Total"]
7 twenty_eight = sfo_runway_final.loc["28L/R_Total"]
8
9 x_axis = np.arange(len(year))
10 tick_locations = []
11 for x in x_axis:
12     tick_locations.append(x)
13
14 plt.title("SFO Runway Usage")
15 plt.xlabel("Year")
16 plt.ylabel("Total Usage Count")
17 plt.xticks(x_axis, ("2008", "2009", "2010", "2011", "2012", "2013", "2014", "2015", "2016", "2017", "2018"))
18
19
20 plt.bar(x_axis, zero_one, facecolor = "b", width=0.35, label="01L/R")
21 plt.bar(x_axis, ten, facecolor="r", width=0.35, bottom=zero_one, label="10L/R")
22 plt.bar(x_axis, nineteen, facecolor="y", width=0.35, bottom=np.array(ten)+np.array(zero_one), label="19L/R")
23 plt.bar(x_axis, twenty_eight, facecolor="g", width=0.35, bottom=np.array(nineteen)+np.array(ten)+np.array(zero_one),
24         label="28L/R")
25
26 plt.legend(loc="best")
27 plt.show()
28
```

Data Source: SFO Runway Usage

- Cleaned and categorized data
- Analyzed runway usage by year
- Technologies utilized: Pandas, NumPy, Matplotlib

28L/28R RUNWAY PATH FLIES THROUGH THE PALO ALTO AREA

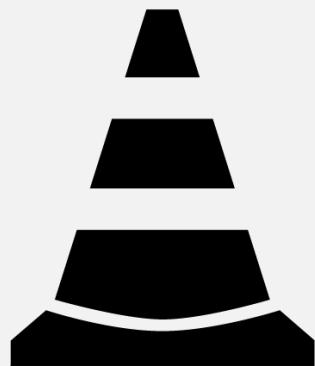


RECOMMENDATIONS

Airlines to Consider	Airlines to Avoid
Virgin Atlantic Airways	Qantas Airways
All Nippon Airways	Philippine Airlines
China Eastern Airlines	Asiana Airlines
KLM Royal Dutch Airlines	Fiji Airways
Air France	China Airlines
Japan Airlines	Eva Airways
Westjet	Korean Airlines
Turkish Airlines	Air India
Emirates	Singapore Airlines
Swiss International Airlines	Air New Zealand

- File more complaints to SFO (sfocop@flysfo.com)
- Alert city government officials to take action
- Avoid living in cities like Palo Alto, Los Altos, and Los Gatos

PROJECT ROADBLOCKS



- Identifying consistency in data sets:
 - Crime data
 - Business data
 - Eviction data
 - Housing data
 - Aircraft type data
- Selecting best visualizations to represent data
- Limited domain knowledge

Q&A