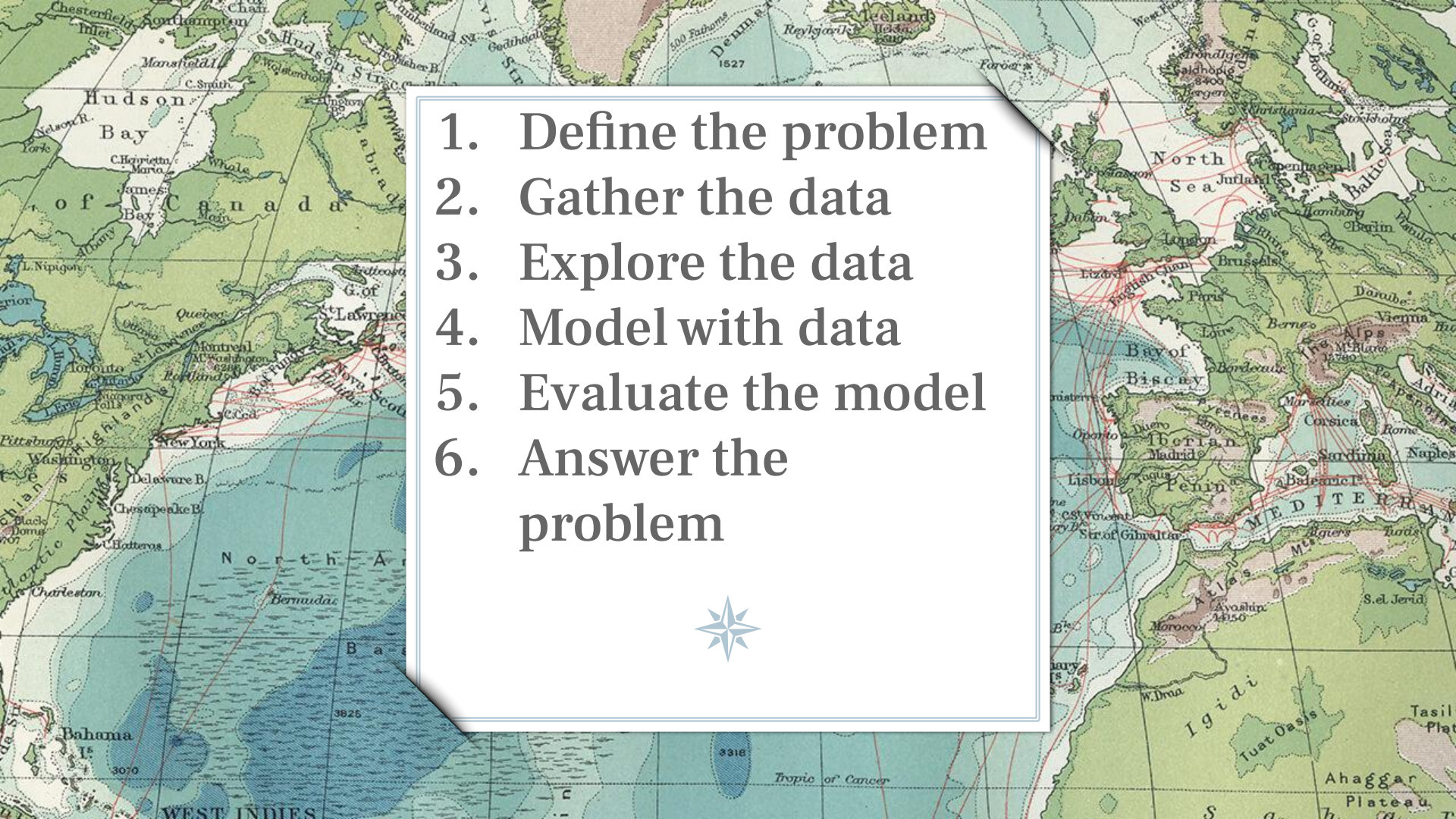


# Risk Assessment Model

by: Micah Luedtke,  
Mia Martin, &  
Kurt Wemhoener





- 
- A background map showing North America and Europe. Red lines trace various travel routes across the continents, connecting major cities and ports. The map includes geographical features like the Hudson Bay, St. Lawrence River, and the Atlantic Ocean, as well as labels for numerous cities and regions.
1. Define the problem
  2. Gather the data
  3. Explore the data
  4. Model with data
  5. Evaluate the model
  6. Answer the problem



# PROBLEM STATEMENT



- **Where should FEMA first deploy resources in a disaster?**
- **Specifically, which Massachusetts census tracts should they focus on?**



# APPROACH TO THE PROBLEM



- Build a risk assessment model  
$$\text{Risk} = \text{Vulnerability} - \text{Resources}$$
- Visualize risk on census tract map of MA

# GATHER THE DATA



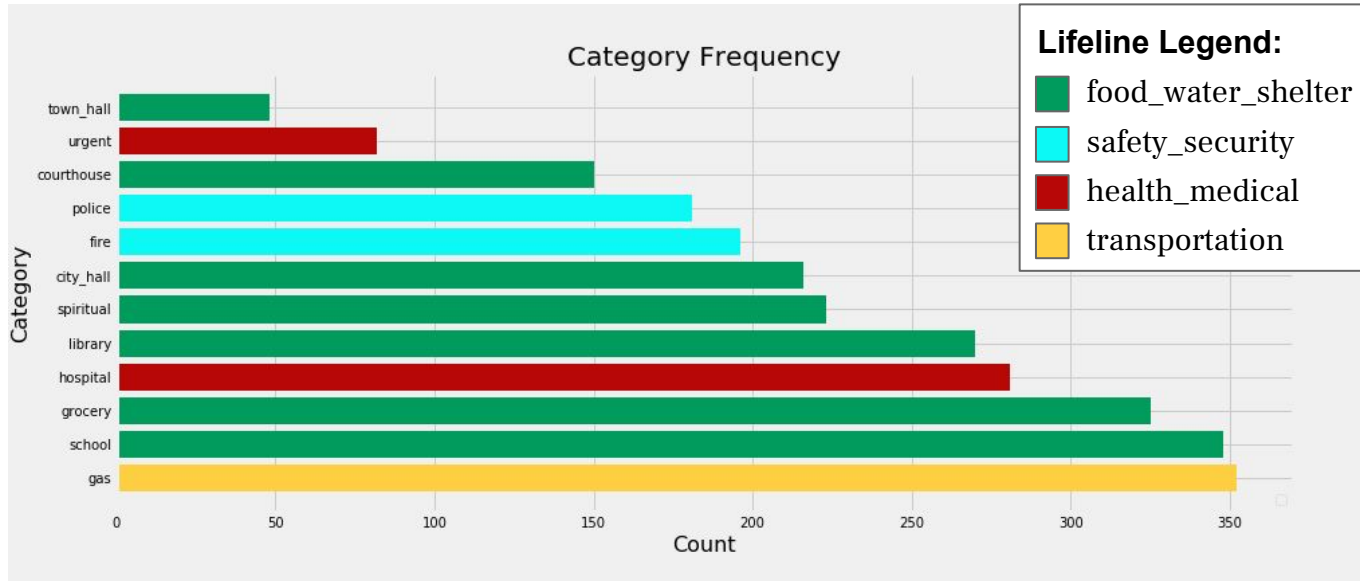
- **Vulnerability:** CDC social vulnerability data
- **Resources:** social media webscraping
  - Initially Yelp API
  - Changed to Foursquare API

# EXPLORE THE DATA

Overall Vulnerability	Socioeconomic Status	Below Poverty
		Unemployed
		Income
		No High School Diploma
	Household Composition & Disability	Aged 65 or Older
		Aged 17 or Younger
		Civilian with a Disability
		Single-Parent Households
	Minority Status & Language	Minority
		Speak English "Less than Well"
	Housing & Transportation	Multi-Unit Structures
		Mobile Homes
		Crowding
		No Vehicle
		Group Quarters



# EXPLORE THE DATA



# EXPLORE THE DATA



## Challenges:

- Foursquare limitations
- Combining lifeline and vulnerability dataframes in Geopandas



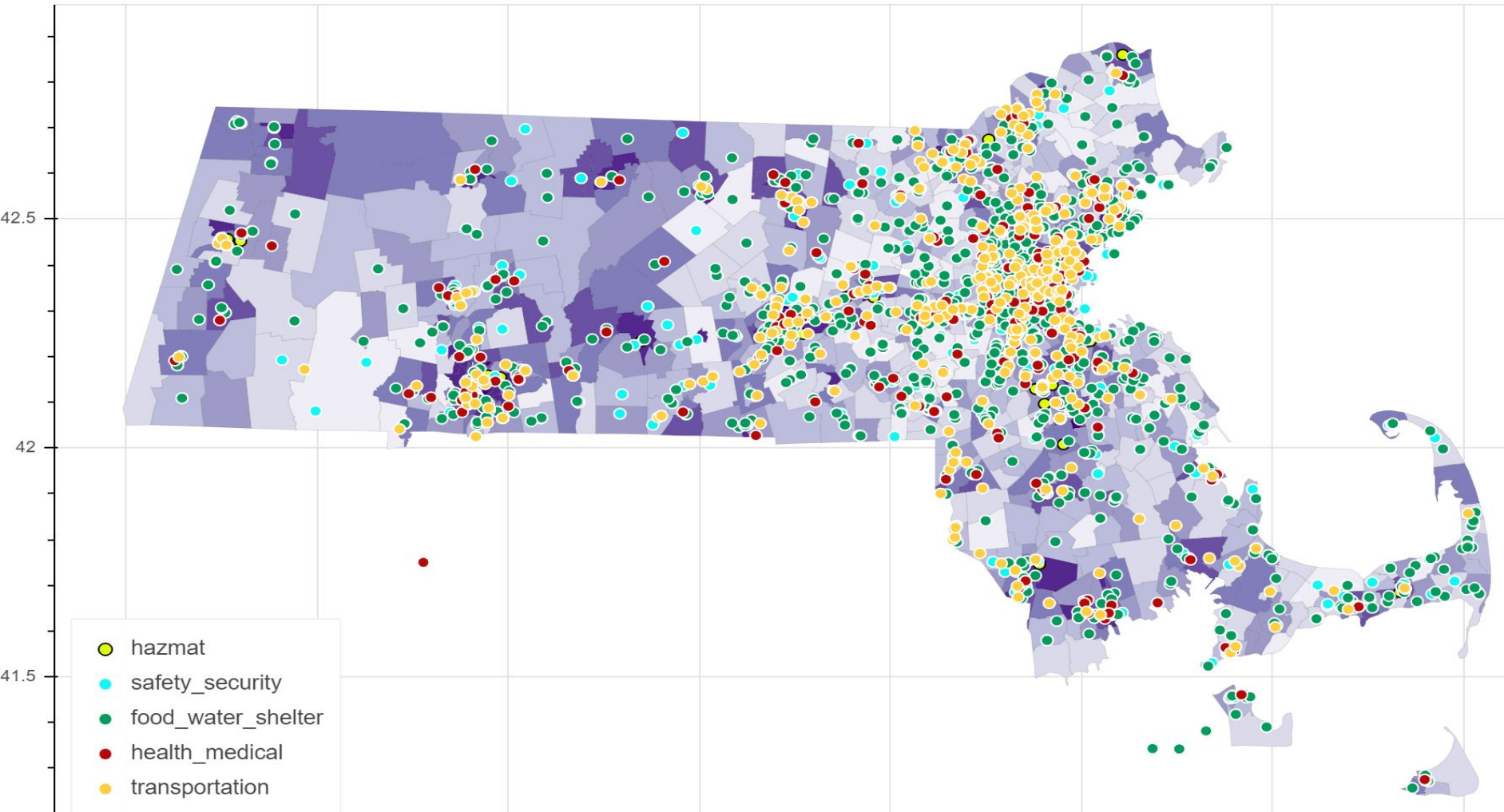
# EVALUATE THE MODEL



## ➤ Assessing the riskiest census tracts

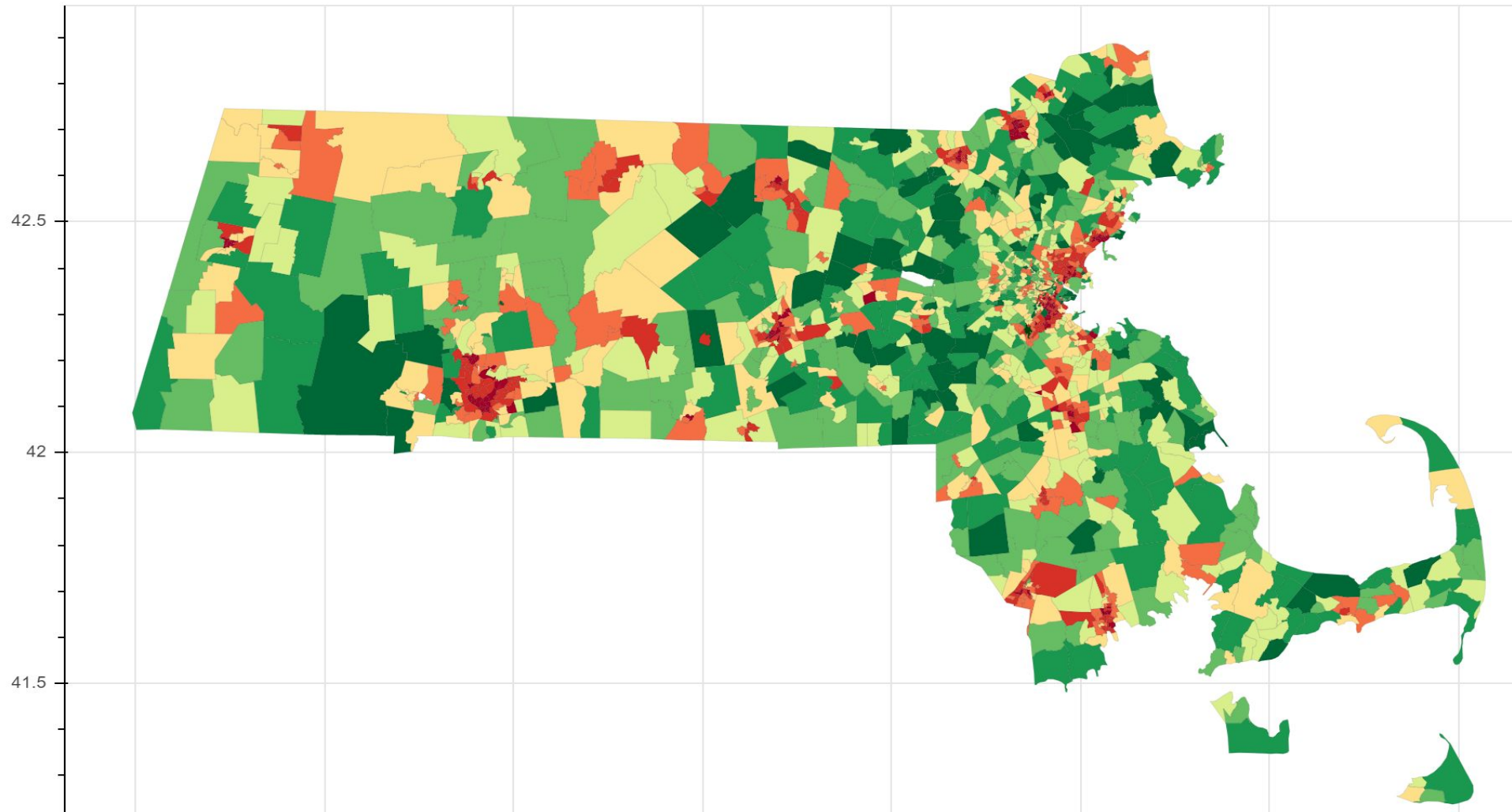
Risk Rank	County	Total Risk	=	Social Vuln.	-	Safety & Security	-	Food, Water & Shelter	-	Health & Medical	-	Trans.	+	Hazardous Waste
1	Hampden	1.072		0.839		0.016		0.000		0.000		0.000		0.250
2	Middlesex	1.060		0.810		0.000		0.000		0.000		0.000		0.250
3	Hampden	1.056		0.813		0.000		0.002		0.000		0.003		0.250
4	Norfolk	1.027		0.779		0.001		0.000		0.000		0.000		0.250
5	Berkshire	1.023		0.774		0.000		0.000		0.000		0.000		0.250

# Massachusetts Risk Assessment





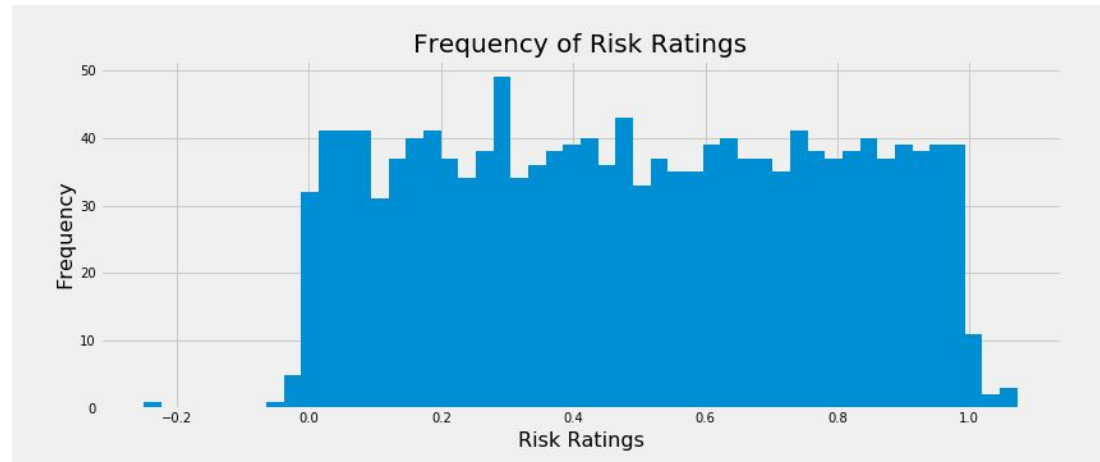
Massachusetts Risk



# ANSWER THE PROBLEM



## ➤ Distribution of risk ratings





# FUTURE RESEARCH



- Higher weighting to resource metrics
- Expanding lifeline data and measuring categories impact on risk
- Building distance-based rather than census tract-based model

# RESOURCES

- <https://svi.cdc.gov/A%20Social%20Vulnerability%20Index%20for%20Disaster%20Management.pdf>
- <https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2018&layergroup=Census+Tracts>
- <https://svi.cdc.gov/data-and-tools-download.html>
- <https://developer.foursquare.com/>
- <https://www.mass.gov/guides/hazardous-waste-facilities-recyclers>
- <https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines/data?geometry=-73.3%2C41.958%2C-69.626%2C42.669&page=7>