Diving Into the Impacts of Sea Level Rise

Anjana Mittal & Victoria Cicherski
Project Objectives

- Data Visualization and Analysis
- SLR Impact Predictor Algorithm
- Communication with end users
## Data Exploration

<table>
<thead>
<tr>
<th>Year</th>
<th>Sea Level Change</th>
<th>Coastal Flooding Events</th>
<th>Flood Events</th>
<th>Storm Surge Events</th>
<th>California Floods</th>
<th>White</th>
<th>African American</th>
<th>American Indian and Alaskan Native</th>
<th>Asian or Pacific Islander</th>
<th>Below Poverty Level (%)</th>
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American Indian and Asian or Pacific Islander Below Poverty Level (%)

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<thead>
<tr>
<th>Year</th>
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Data Visualizations

Annual Flooding Events (Bay Area)
Data Visualizations

Sea Level Change vs Flooding Events (California)
Data Visualizations

% Below the Poverty Line in Bay Area from 1990 to 2019

% Below Poverty Line
Some of the models we created….

Multivariate regression models

Multiple linear regression models

Simple linear regression models

Logistic regression models

Random forest models

Decision tree models
 Polynomial Regression Model

- R-squared: 0.84
- MSE: 4.21

Flood Events (Bay Area)

Sea Level Change + Coastal Flooding Events
The Machine-Learning Algorithm

The Dataset
For our analysis of the surrounding area of San Francisco, we used multiple datasets from various sources: the “Annual mean sea level trends” dataset from OEHHA (California Office of Environmental

Meet Team Penguins

Anjana Mittal  
B.S. in Statistics

Victoria Cicherski  
B.S. in Statistics, Minor in Computer Science

Our Vision
Our project sought to address the impact of sea level rise in San Francisco on the surrounding community and environment through machine-learning modeling and data visualizations.

Technology
Our work was accomplished with Python and the following libraries: numpy, sklearn, matplotlib, pandas, and seaborn.

Response variable. The model had a mean squared error of 4.21, indicating that the predicted values barely deviated from the actual values. The R-squared value of the model was 0.84. This means that 84% of the variability observed in the number of floods can be explained by the model.
Data Visualizations

The following graphs were created to illustrate the relationship between sea level rise, coastal floods, and tidal floods. We also wanted to understand the community that is impacted by the rise in sea levels in San Francisco, thus graphs depicting demographic data are included. The exploration of data enables patterns to be identified that can be utilized for preventative measures to protect people and the environment.
Bibliography


*Historical flood risk and costs.* FEMA.gov. (n.d.).

https://www.ncdc.noaa.gov/stormevents/

Census 2010 highlights - san francisco. (n.d.).

*San Francisco City and County.* Bay Area Census -- San Francisco County -- 1970-1990 census data. (n.d.).
http://www.bayareacensus.ca.gov/counties/SanFranciscoCounty70.htm

*Marin County.* Bay Area Census -- marin county. (n.d.).
http://www.bayareacensus.ca.gov/counties/MarinCounty.htm
Thank you!