Ocean Cleanup

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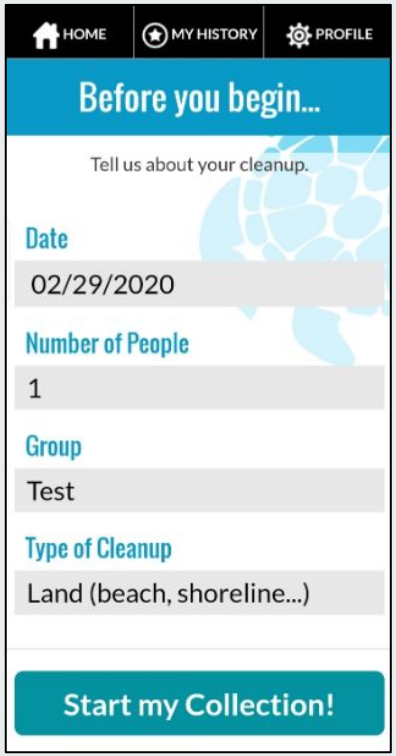
Cleanswell App : Beach Cleanup Data



Target Customers

- Non-Profit Ocean Cleanup Organisations
- School children
- People that live near the beach
- Businesses located near the beach
- The tourism industry business in various states

Summary

1 Exploratory Data Analysis

- State-wise analysis
- Type of trash collected
- The effect of individuals and groups on beach cleanup

3 Prediction

- Prediction of human resources for ocean cleanup in the US in the future.

2 Recommendations

- Organization
- CleanSwell apps
- Technology like floating garbage collectors and plastic detecting drones

1. State-Wise Analysis

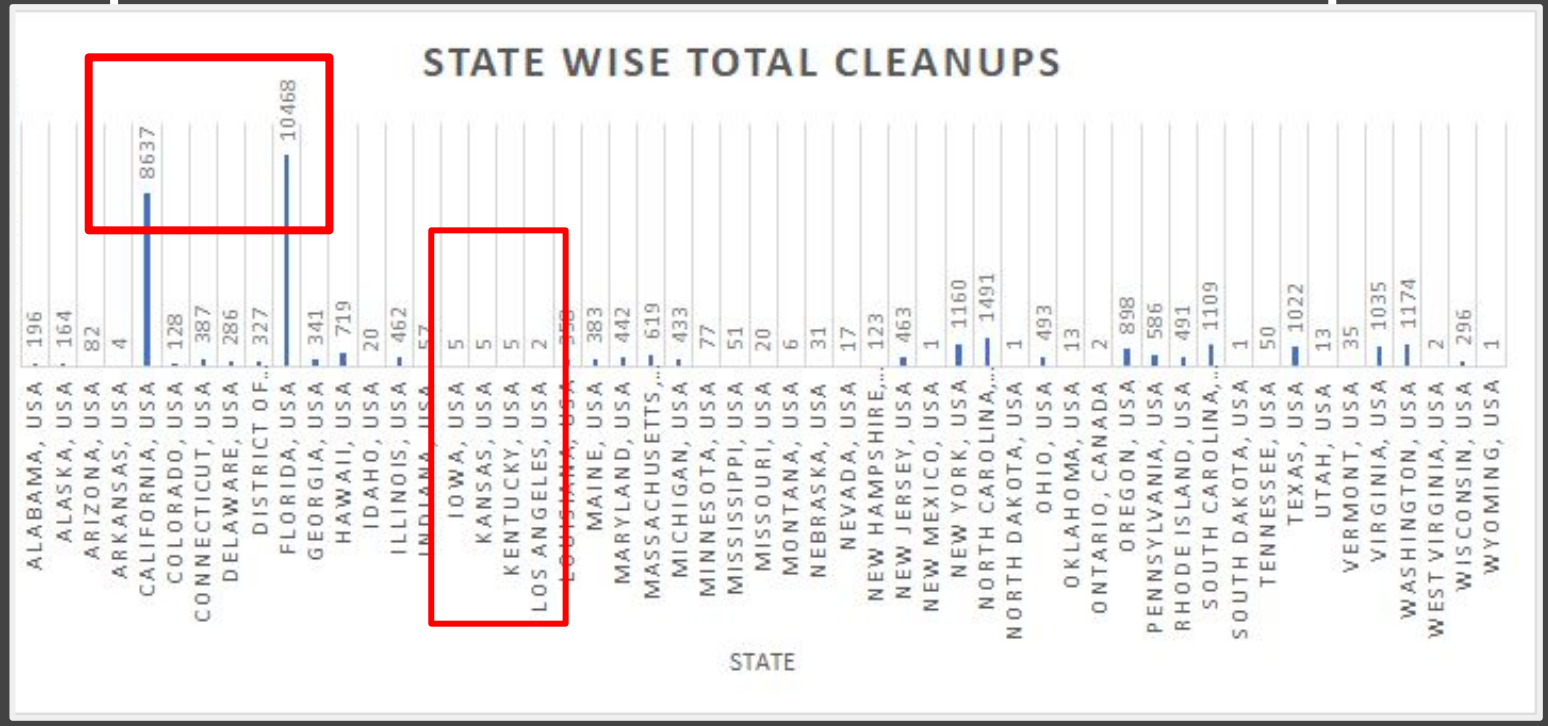
1. Which states perform a **highest** number of cleanups and which perform the **lowest**?
2. Which are the states that produce the maximum and minimum trash (in pounds)?
3. Which states might have problems of human resources allocation for ocean cleanup?

Which states are actively cleaning?

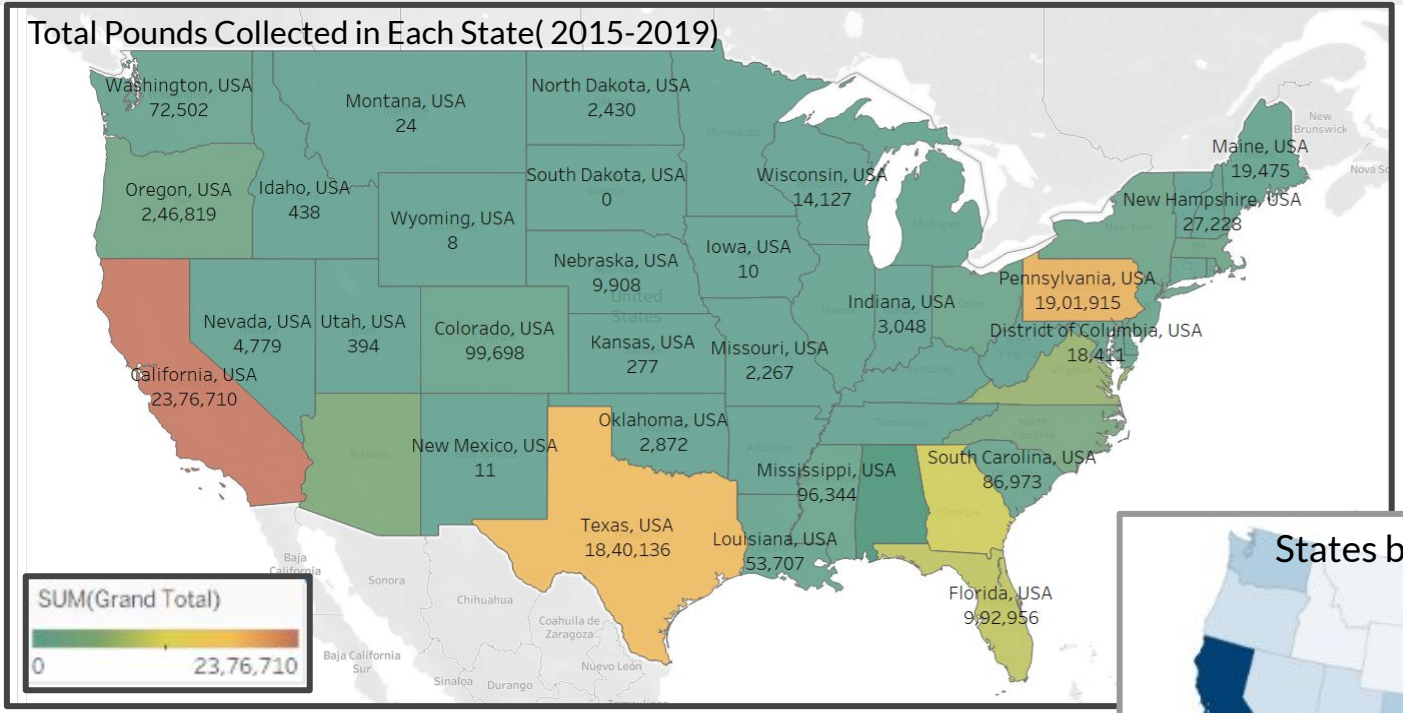
California and Florida:

- Have more than 8000 cleanup records
- 3000 more cleanup records than all the other states combined

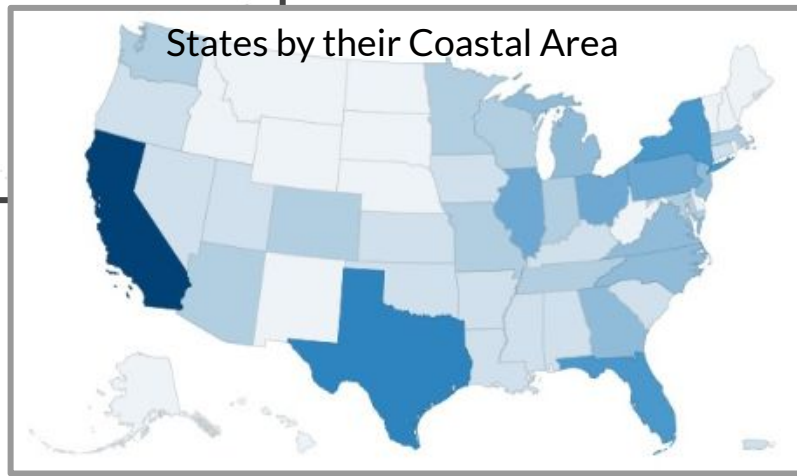
Pounds	Frequency
0-1000	44
1000-5000	6
>5000	2



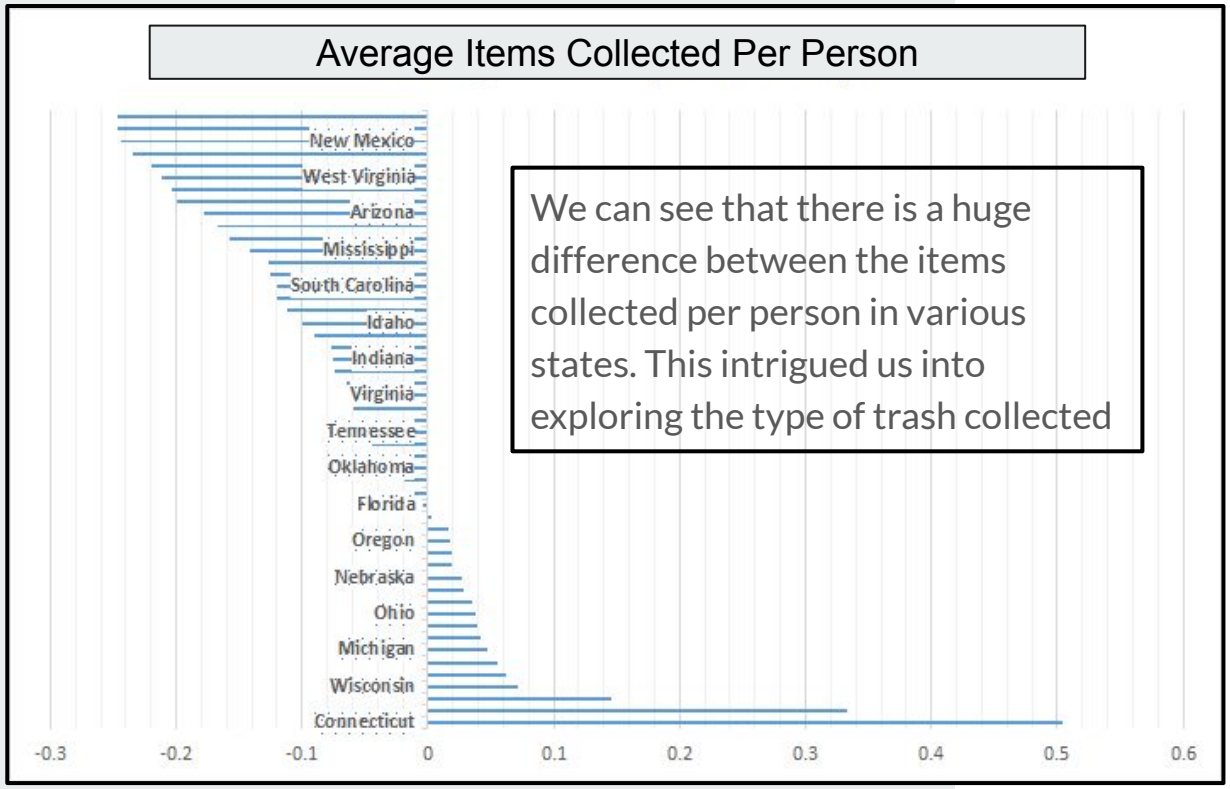
Which states collect what amount of trash(in pounds)?



- High population density areas such as: DC, New York, have very low number of pounds collected, but these states do have a good no.of lake and river bodies population density



With **253,343,400 pounds of trash** on the US beaches alone, all the states combined, have been able to collect only **4.77%** of all this trash, according to the dataset.



We can see that there is a huge difference between the items collected per person in various states. This intrigued us into exploring the type of trash collected

Are we collecting the same items per beach cleanup or are you slower?

$$\text{Items Collected Per Person} = \frac{\text{Total Items collected}}{\text{No. of people}}$$

Florida has collected a lot of beach trash through a lot of beach cleanup events actually see each person collecting very few trash items

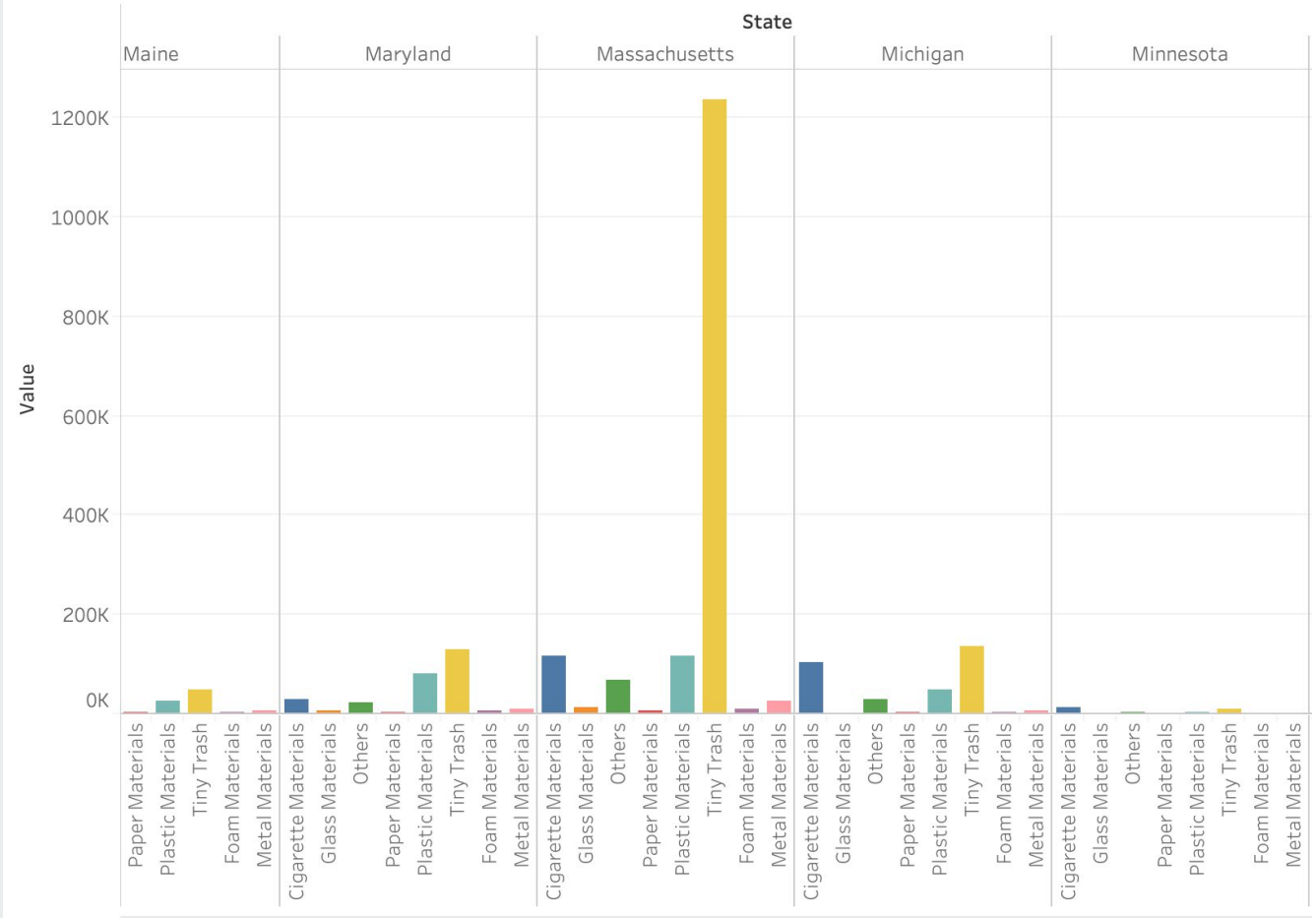
2. Trash-Type Analysis

1. Which types of trash are collected in each state?

2. How has trash collection changed over time by trash types?

3. Does collecting Tiny trash require more human resource compared to Larger trash?

Number of Trash Items In each State For Each Type

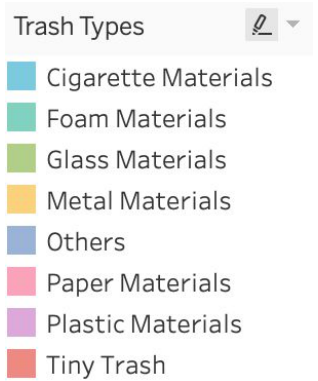


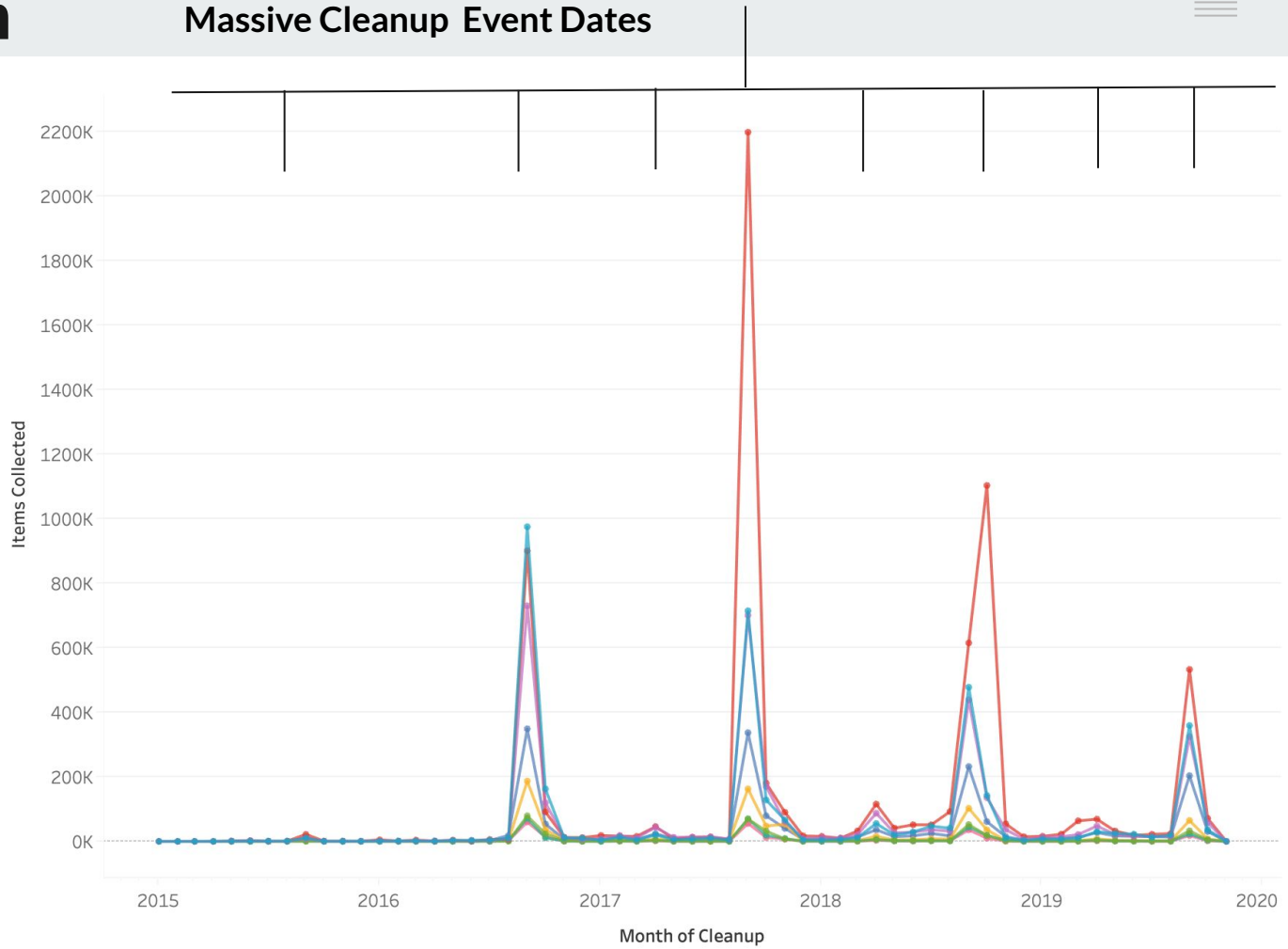
Common Types:

- Tiny trash
- Cigarette Materials
- Plastic Materials

Types of Trash over time

Massive Cleanup Event Dates:
ICC Day
Earth Day
National Cleanup Day
World Cleanup Day



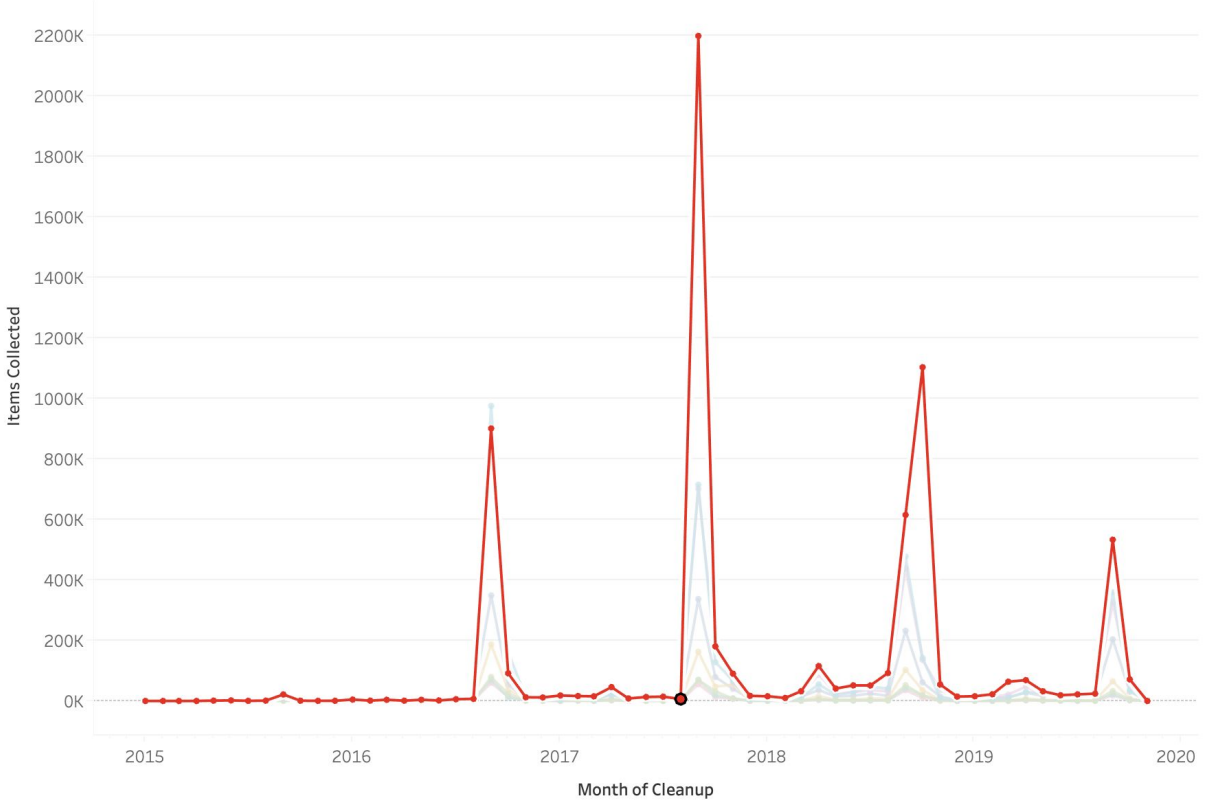


Tiny Trash Items collected over time

Tiny Trash

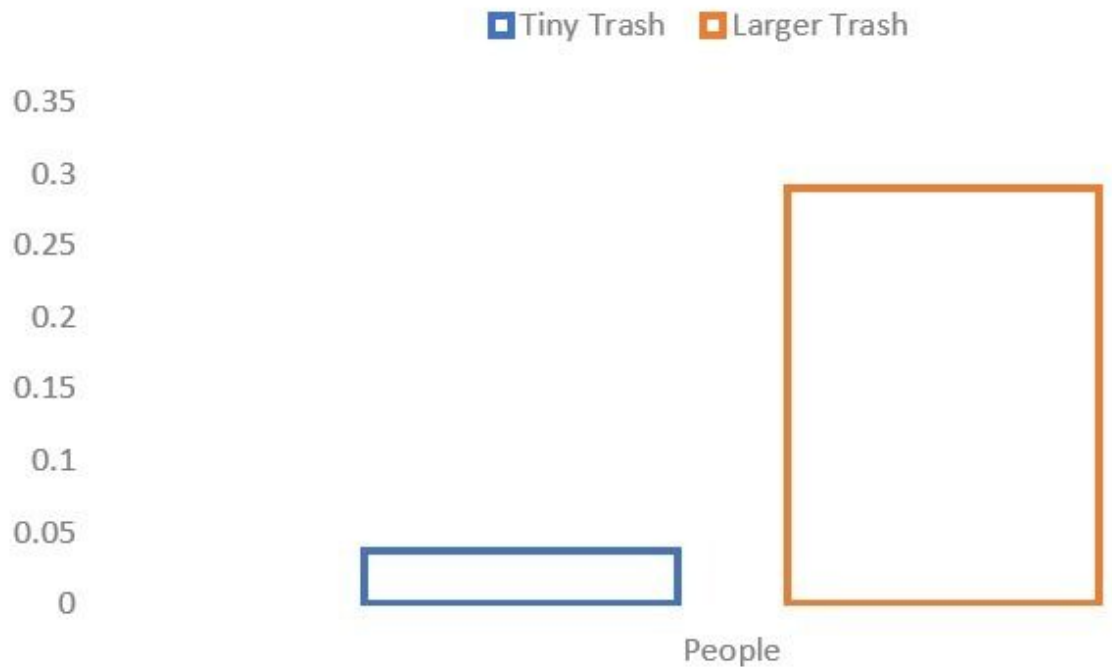
= Less Than 2.5 cm pieces:

- Foam Pieces
- Glass Pieces
- Plastic Pieces (the most out of the three)



Correlation

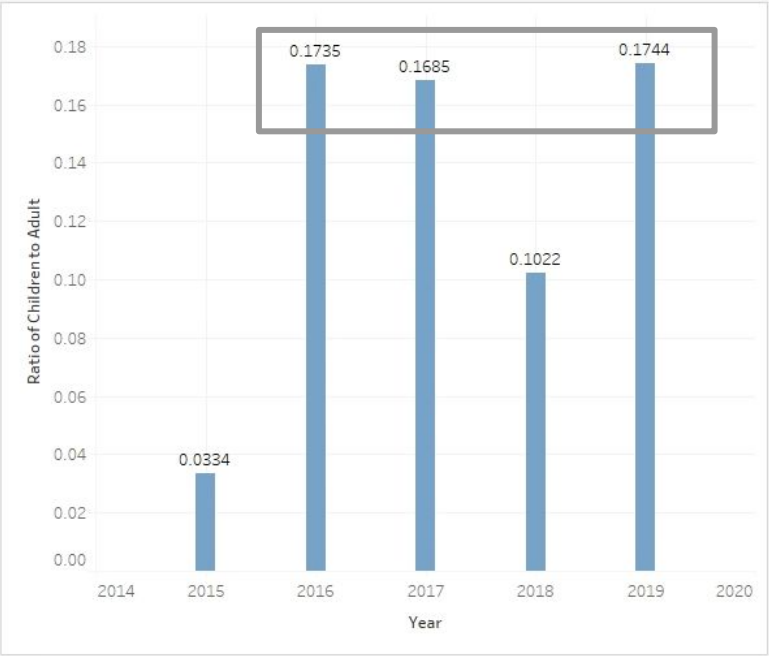
In general, less people collect Tiny Trash.



3. Organization Analysis

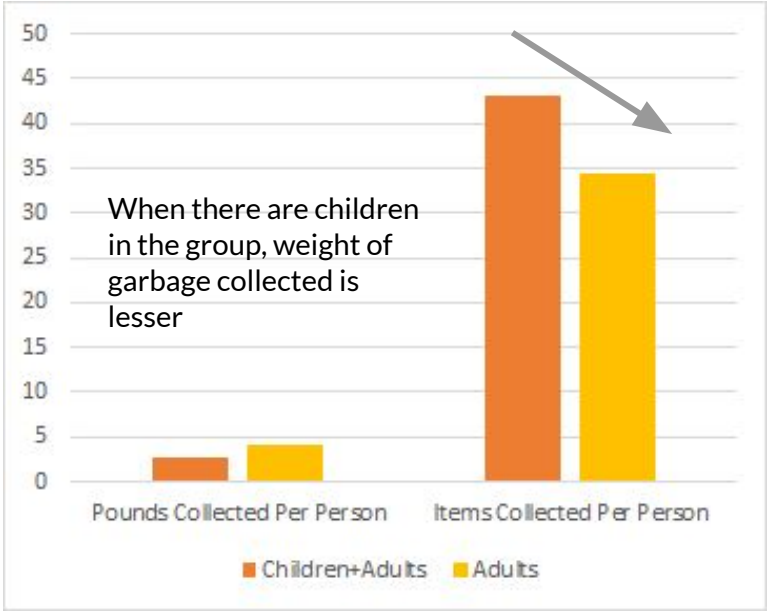
1. Are children the main power to cleanup?
2. Does children engagement increase the cleanup efficiency of group?
3. Do individuals, on average, work more efficiently than groups?
4. What's the relationship between group size and beach trash collection performance?

Children Effect: What's the children effect on cleanup?



Adults, but not children, are the majority contributors of ocean cleanup.

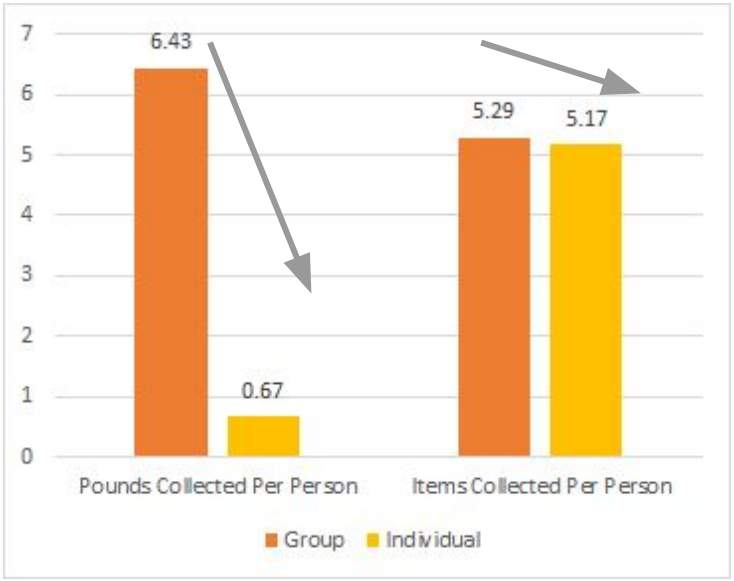
Do children have a positive influence on teams' behaviors?

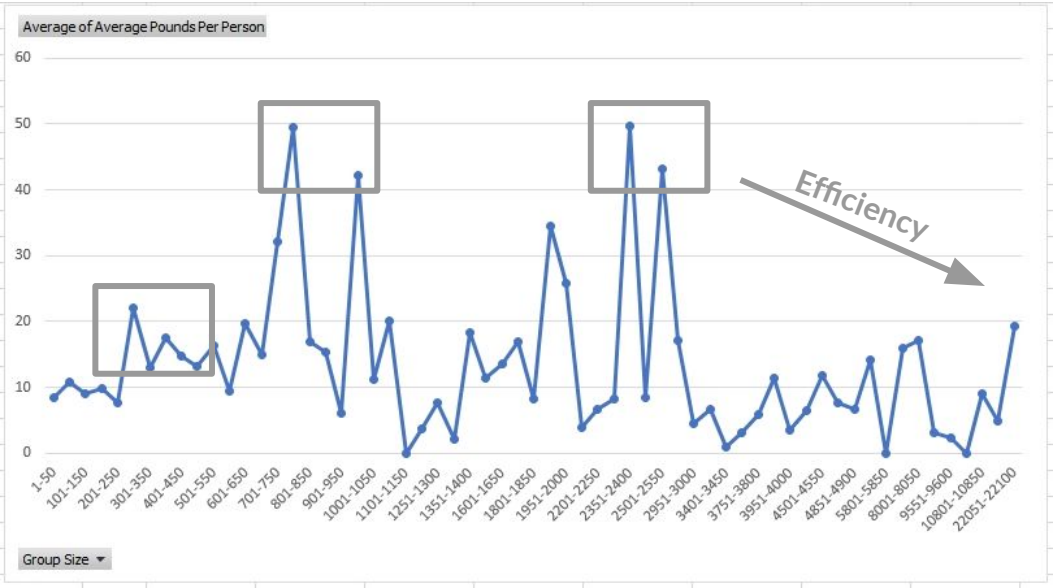


If there are children in a group,

Group members prefer to collect light-weight trashes rather than heavy items and they have motivation to spare more effort on beach cleanup.

Group Effect: Does group affect the efficiency of cleanup?





- Efficiency: Group > Individual
- Heavier garbage removal undertaker: Group

Does group size matter?

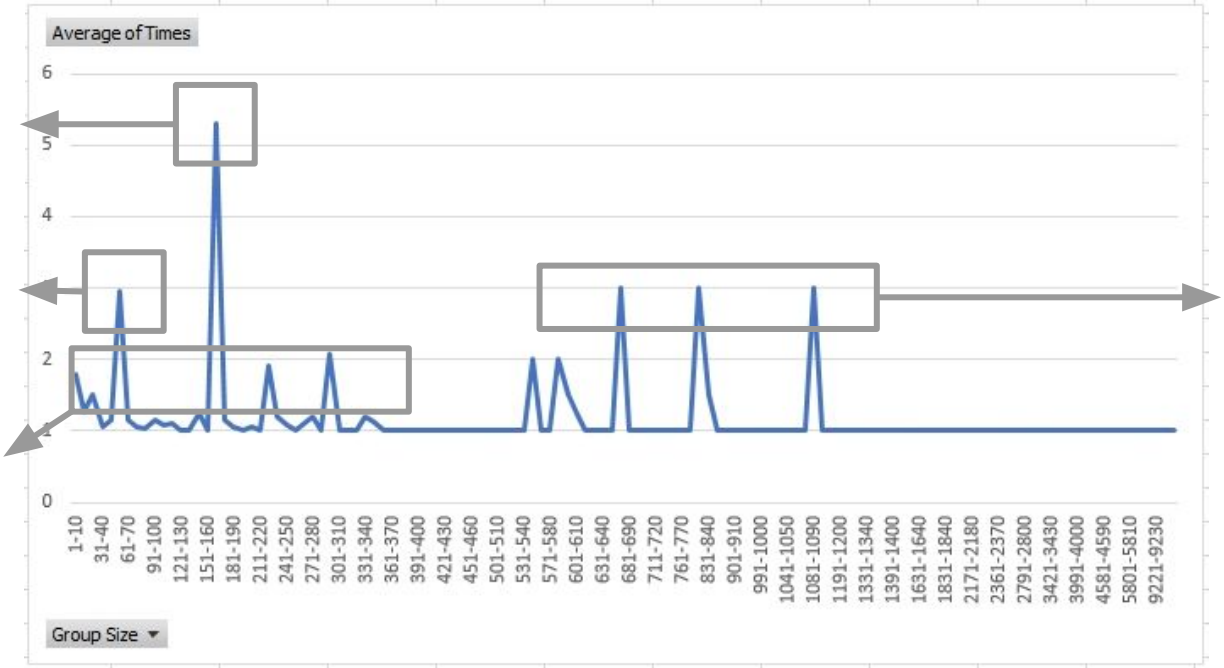
- The size of groups impacts cleanup efficiency
- Three peaks: 250, 800 and 2400
- Cleanup efficiency & extra benefit of one more members: size to be controlled under 800.

Group Effect: How often do different size groups do cleanup?

Most frequent cleanup organizations : Keep Pandolph County Beautul

cleanup organizations contributing most: SOLVE

Irregular Behaviour of smaller groups



Not representative data: each range contains insufficient number of groups

Prediction

Ocean cleanup organizers want to predict:

With **an estimated amount of trash** (number of items, number of pounds), on **weekend**, in **August**, within **five miles.**

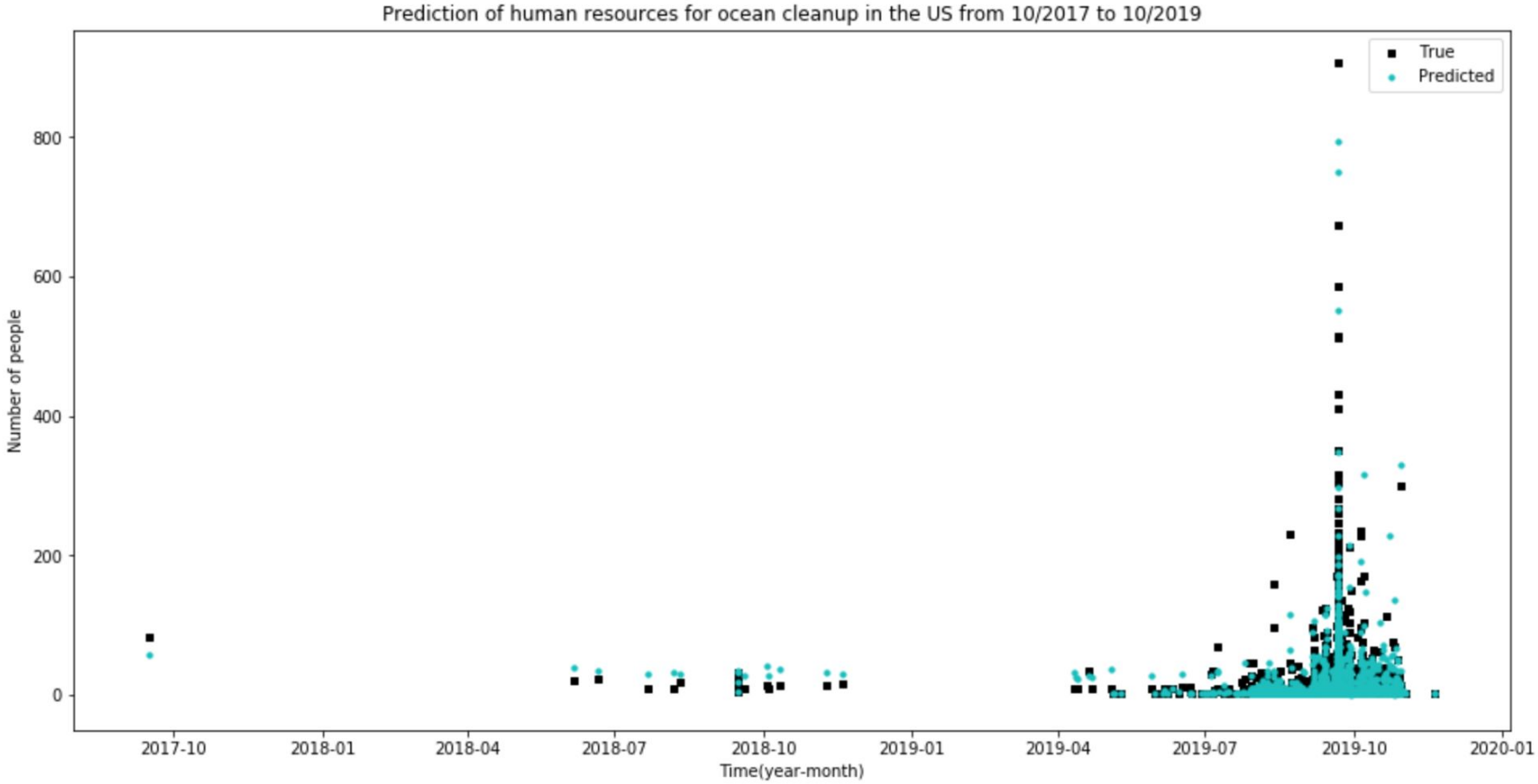
=> how many people needed to do the cleanup?

Prediction

- Data Preprocessing
- Exploratory data analysis
- Data Normalization
- Missing-value treatment
- Feature engineering
- Model development

(please see our jupyter notebook file)

Prediction


Prediction of human resources for ocean cleanup in the US from 10/2017 to 10/2019
True
Predicted
Number of people
0
200
400
600
800
2017-10
2018-01
2018-04
2018-07
2018-10
2019-01
2019-04
2019-07
2019-10
2020-01
Time(year-month)

Prediction

Data

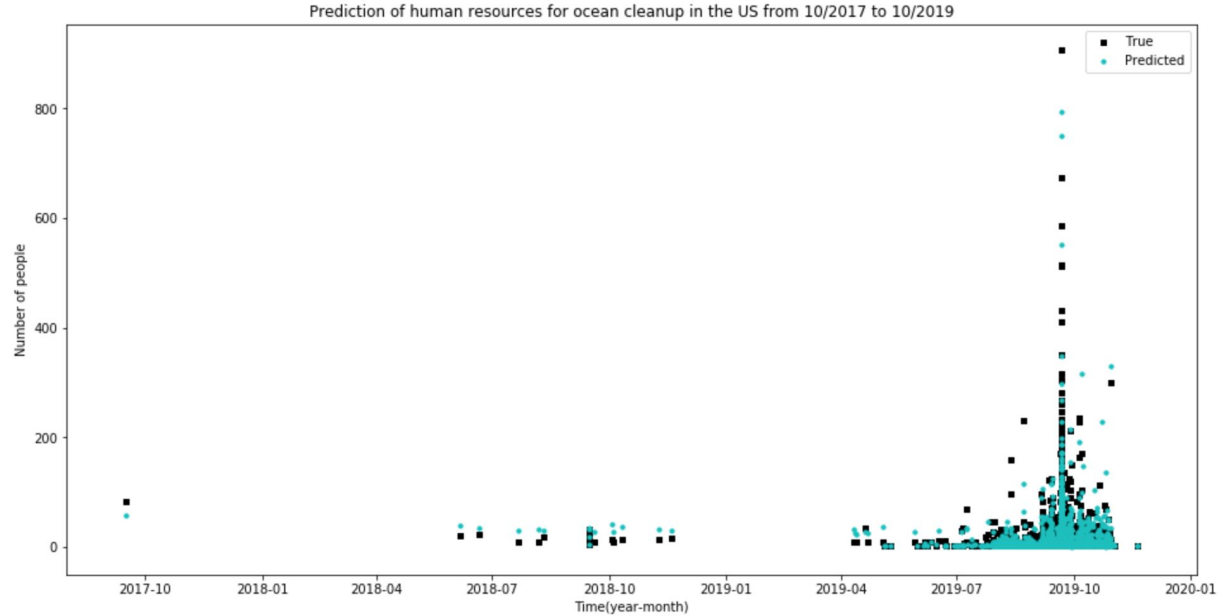
Training set: 75%
Test set: 25%
10-fold cross-validation

Metrics: RMSE

RMSE baseline: **163.47**
RMSE of our model:
+ **Xgboost**: **83.57**
+ **Lasso linear regression**: **86.77**

Features

+ Total Items Collected
+ Month
+ Weekend
+ Pounds
+ Miles

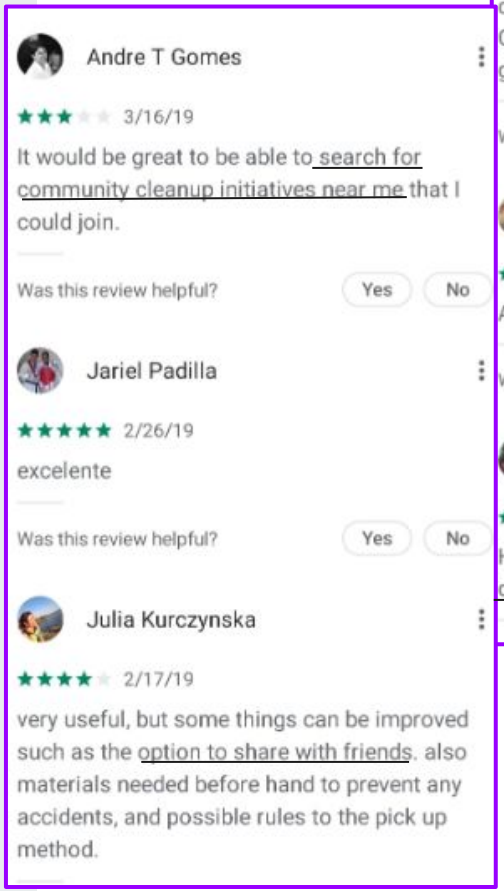


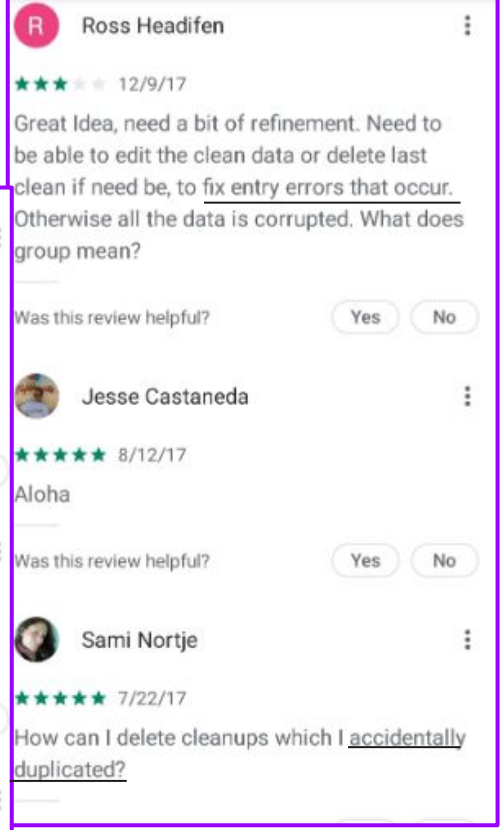
Recommendations

Data collection process

Improve Cleanswell Apps:

- There should be fields that need to be mandatorily filled and some fields should be entered numerically
- Trash Types: No need to sub-classify items collected to a very specific level; rather classify broader categories that people would easily understand, would minimum user effort and increase data quality
- Synchronize Trash categories with website form
- Create a landing webpage that connects users with nearby beach cleanups





Data Analysis

State-Wise Analysis

- We should have more beach cleanup activities in high population density areas
- We should have more beach cleanup activities in inner states with significant water bodies like lakes and rivers

Trash Analysis

- Distribute cleanup events more evenly throughout the year
- Leverage Machines for the huge amount of tiny trash
- Human Resource should be concentrated on picking up larger trash

Organization Analysis

- Improve the group's diversity by teaming adults and children
- Upon adding a new member to a large group, it does not improve the cleanup efficiency, so medium sized groups(<800) need to be formed
- People perform cleanup more frequently when with NGOs compared to private groups. So, people should be encouraged to join NGOs for beach cleanups

Prediction

Estimate the human resources allocation for a certain area based on the estimated amount of trash (number of items, number of pounds), date, and seasonality.

=> recommendation system that will be potentially helpful for environmentalists to estimate and optimize human resource recruitment in their campaigns.

Recommendations - Technical solutions that enhance the human resource

Ocean cleanup machine for **tiny trash** from Da Nang beach in Vietnam.

Floating trash collectors for tiny trash

These can be set up a little distance from beach shore lines so that trash is not washed away into the deep waters but rather collected and recycled

Beach Cleaning Drones

These AI driven drones have the capability of detecting plastic in the sand
This way people can pinpoint their clean-up efforts

Eg: This drone could fly on a handful of beaches and record data about how much plastic waste exists on each beach. This way cleanup groups/individuals can more efficiently select beaches to clean.

How would we broadcast this newly found information?

- Reddit/ Other Social Media
- Reach out to various targeted customers and present this newly found information to them
- Reach out to the tourism industry and businesses/govt agencies located near beaches
- With due respect to the upcoming elections, we could reach out to prospective candidates who are proposing environmental friendly policies

Questions?

Thank you.