K-MEANS PROJECT

CSCI 3302 - Machine Learning & Knowledge Discovery

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MOTIVATION OF PROJECT

- We wanted to see if tourism did have an impact on the number of COVID-19 cases in Hawaii.
  - Find any possible information in regards to COVID-19 in Hawaii, with a primary focus on trans-pacific travelers.

- Hoped to find possible trends through the use of **K-Means Clustering**.

RELATED REFERENCE WORK

- “Assessing global preparedness for the next pandemic: development and application of an Epidemic Preparedness Index”
  - K-Means Clustering was used on **2009 H1N1 influenza pandemic**.
  - Clusters were used to determine a Epidemic Preparedness Index (EPI).
  - Used to improve overall preparedness for possible future pandemics.

- “Immunophenotyping of COVID-19 and influenza highlights the role of type I interferons in development of severe COVID-19”
  - K-Means Clustering was used on blood samples from COVID-19 patients. (Mild & Severe)
  - Clusters were based on gene expression changes against a healthy donor group.

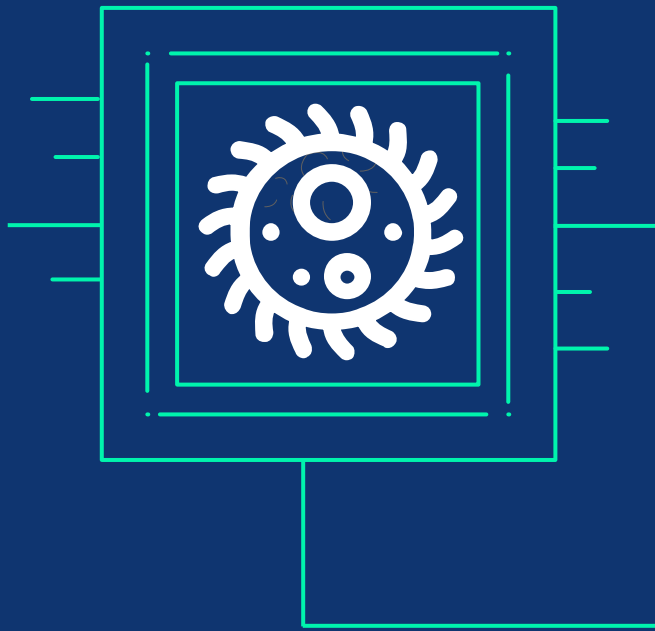
RELATED REFERENCE WORK

- “Enhancement of hepatitis virus outcome predictions with application of K-means clustering”
  - K-Means Clustering was used to determine if a patient with symptoms similar to Hepatitis B and Hepatitis C, actually has it.
  - The program had a roughly 84.85% success rate.
  - Authors note that K-Means Clustering could be used to make other medical predictions.

DATASET OVERVIEW

FEATURES	RANGE	AVERAGE
Daily COVID-19 Cases with Travel History	0 - 50 Cases	4.64 Cases
Percentage of all COVID-19 Cases with Travel History	0% - 100%	10.85%
Daily Trans-Pacific Passenger Arrivals	386 - 24,654 Arrivals	6,479.43 Arrivals

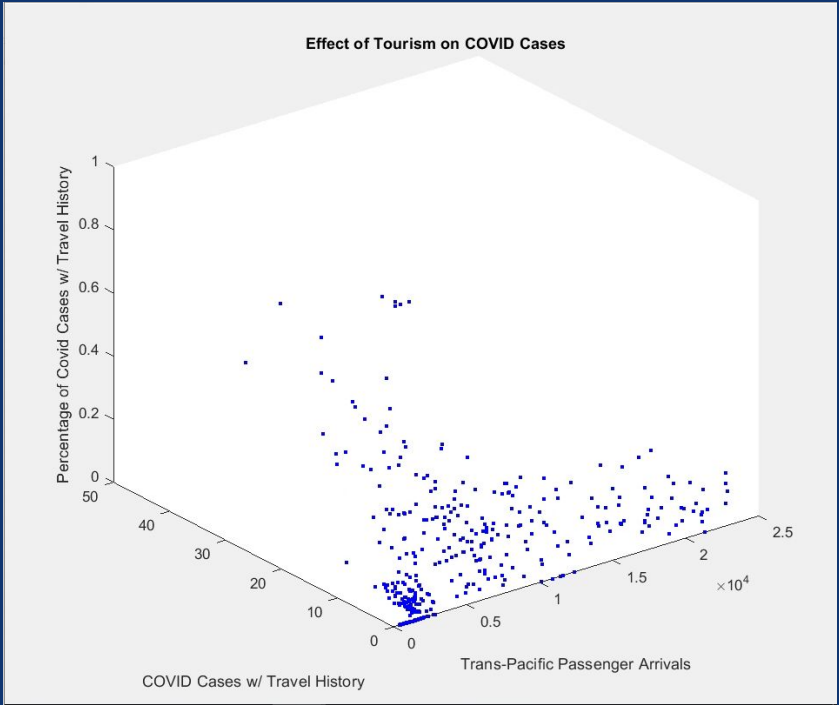
***Features - Categorized by County and Statewide*



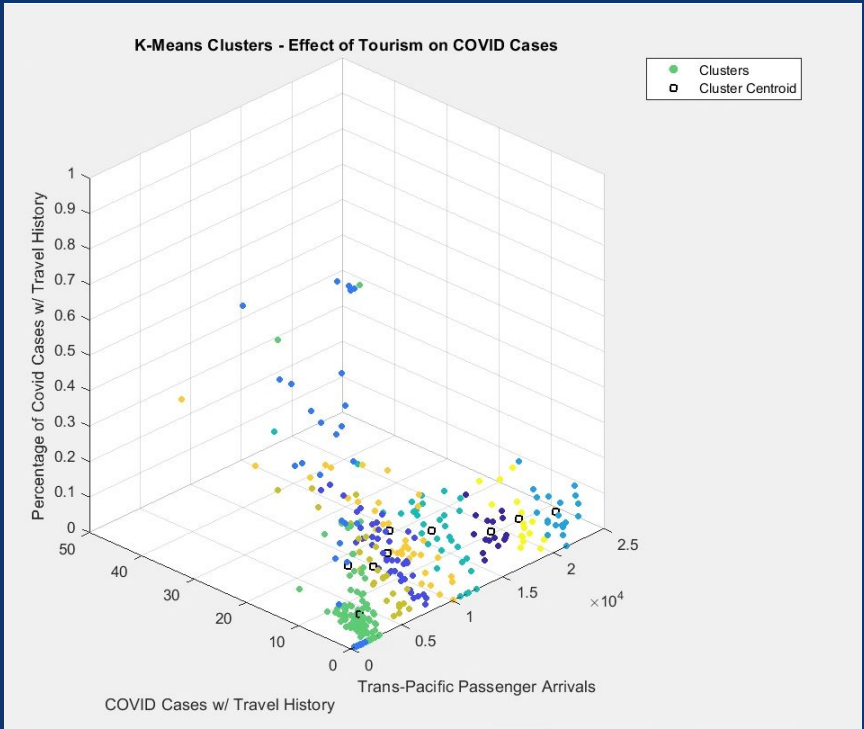
K-MEANS CLUSTERING OVERVIEW

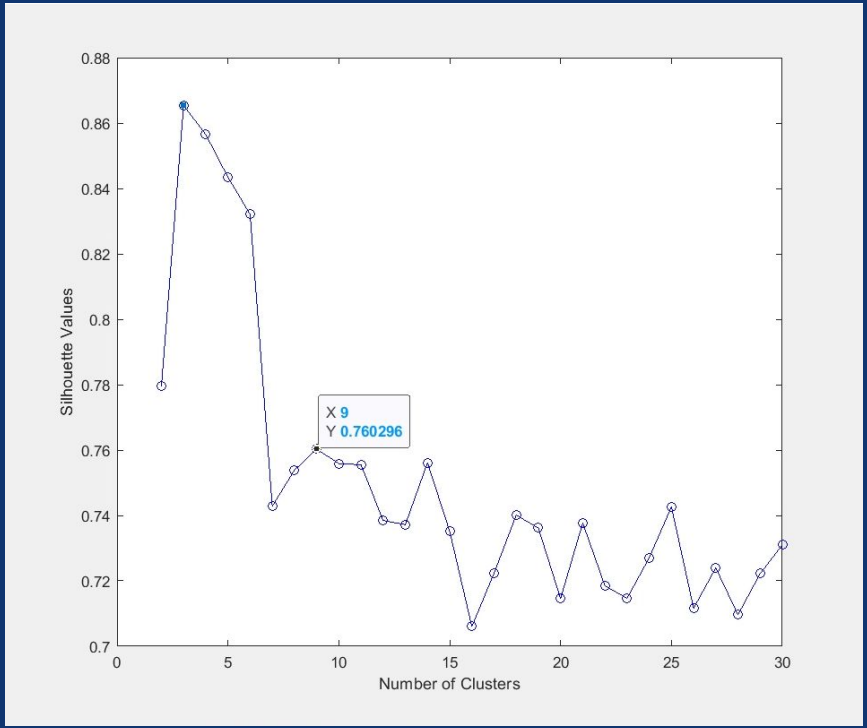
- Type of unsupervised learning, which is used on unlabeled data.
- The goal is to find groups of data with a number of groups k, based on feature similarity.
- When a new data point is added, it can be grouped with a cluster based on its features.
- Can be used to find trends in data and classify new data accordingly.

RESULTS


Effect of Tourism on COVID Cases
Percentage of Covid Cases w/ Travel History
1
0.8
0.6
0.4
0.2
0
50
40
30
20
10
0
COVID Cases w/ Travel History
0
0.5
1
1.5
2
2.5
×10^4
Trans-Pacific Passenger Arrivals

RESULTS


K-Means Clusters - Effect of Tourism on COVID Cases
Clusters
Cluster Centroid
Percentage of Covid Cases w/ Travel History
COVID Cases w/ Travel History
Trans-Pacific Passenger Arrivals
×10^4

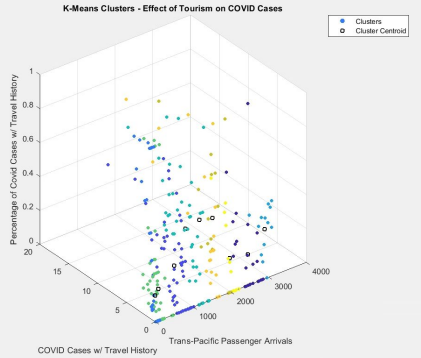

Silhouette Values
Number of Clusters
X 9
Y 0.760296

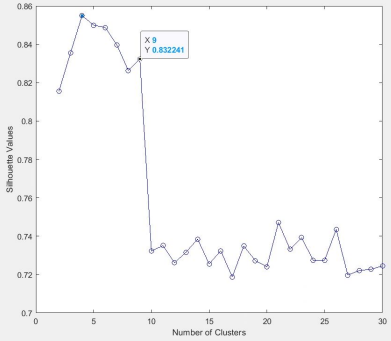
RESULTS

CLUSTER CENTROIDS	ARRIVALS	# OF TRAVEL COVID CASES	% OF TRAVEL COVID CASES
1	781	2	20.98%
2	2,050	2	5.47%
3	5,786	7	10.79%
4	7,623	8	11.73%
5	9,449	11	13.49%
6	12,065	8	11.84%
7	15,822	4	9.10%
8	18,812	4	8.36%
9	21,959	3	6.71%

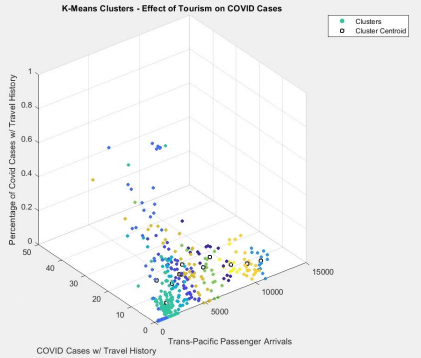
RESULTS PER COUNTY

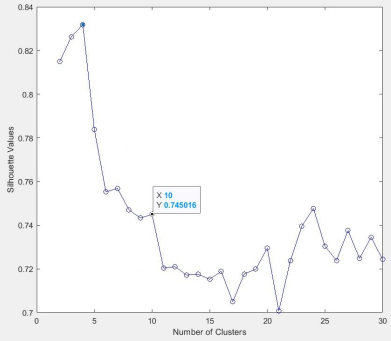
HAWAII



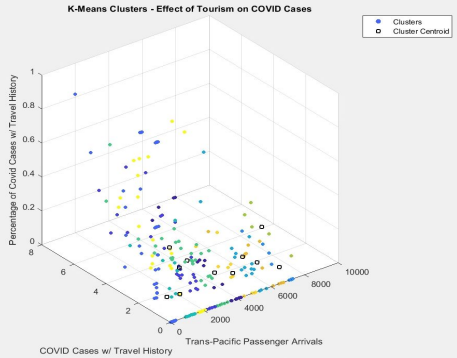


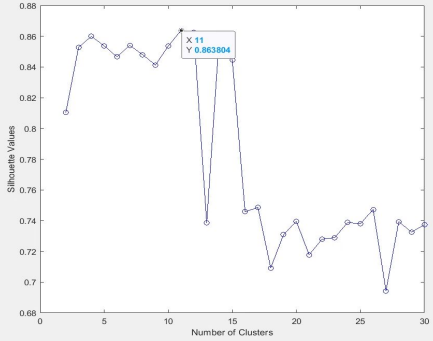
OAHU



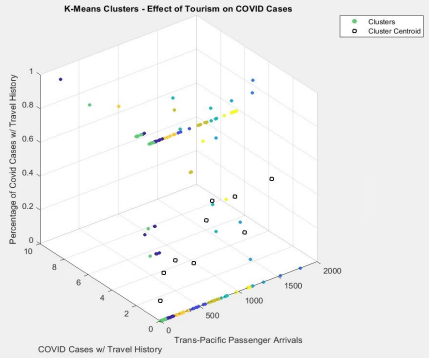


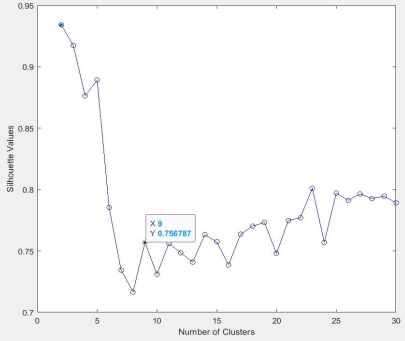
MAUI



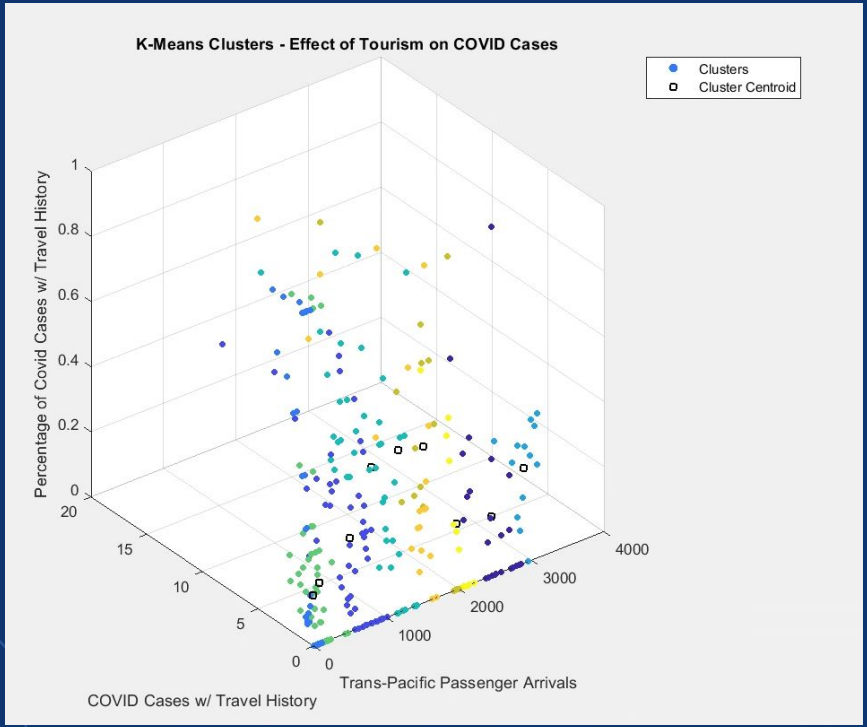


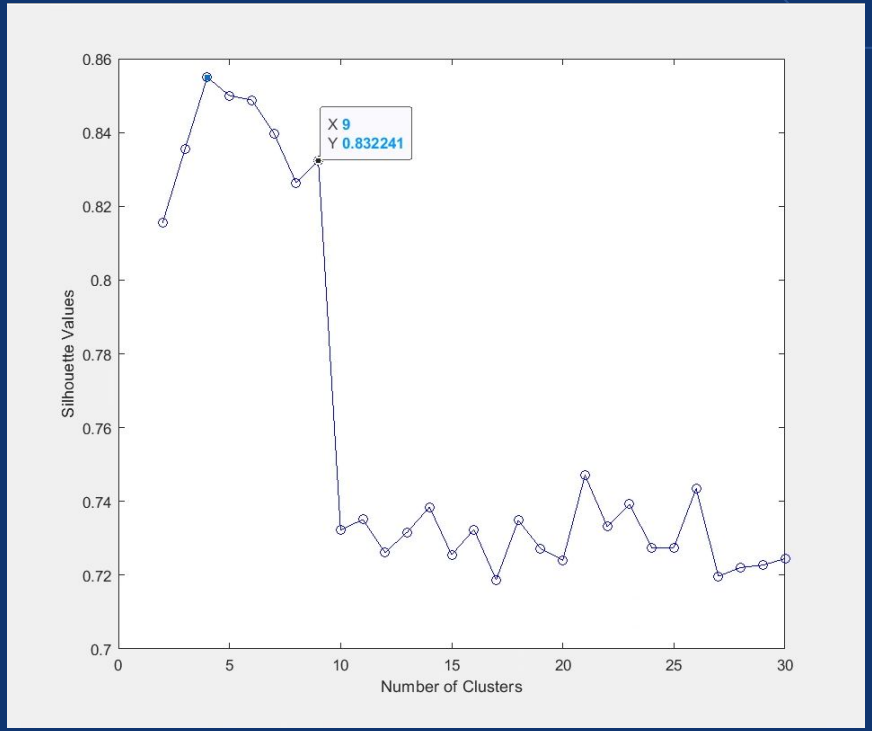
KAUAI



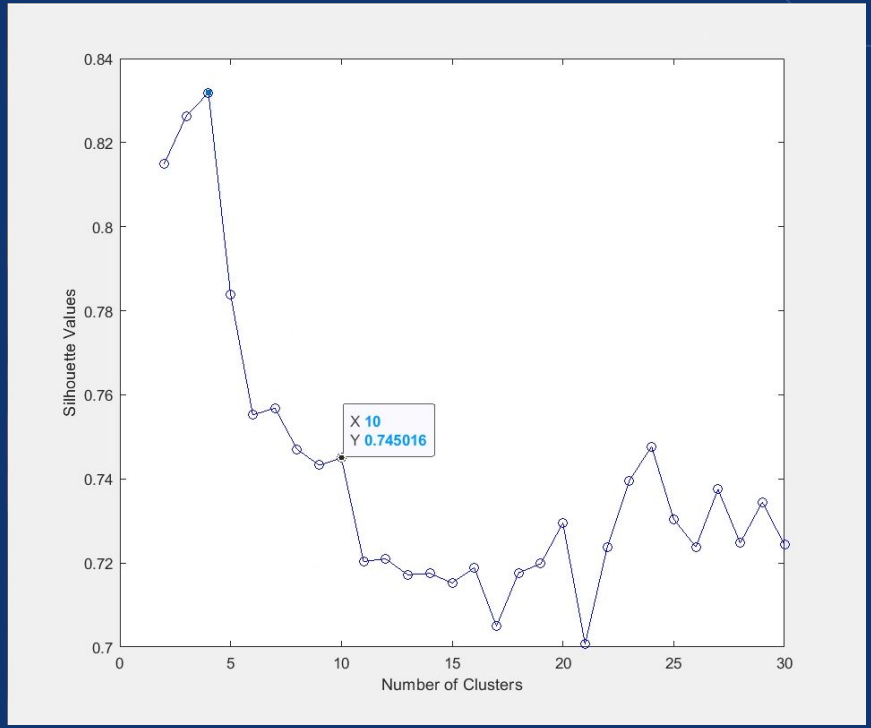


HAWAII RESULTS

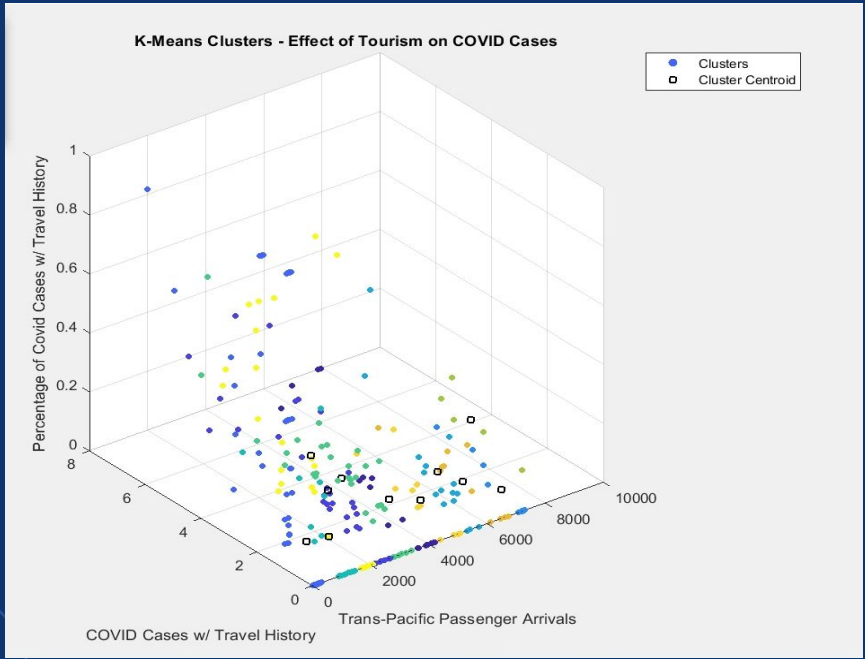


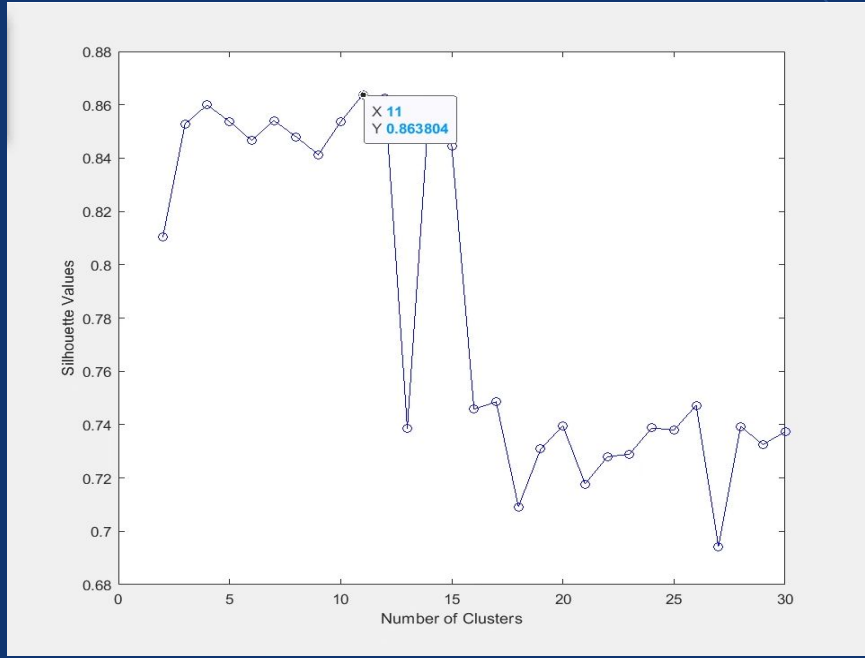


OAHU RESULTS

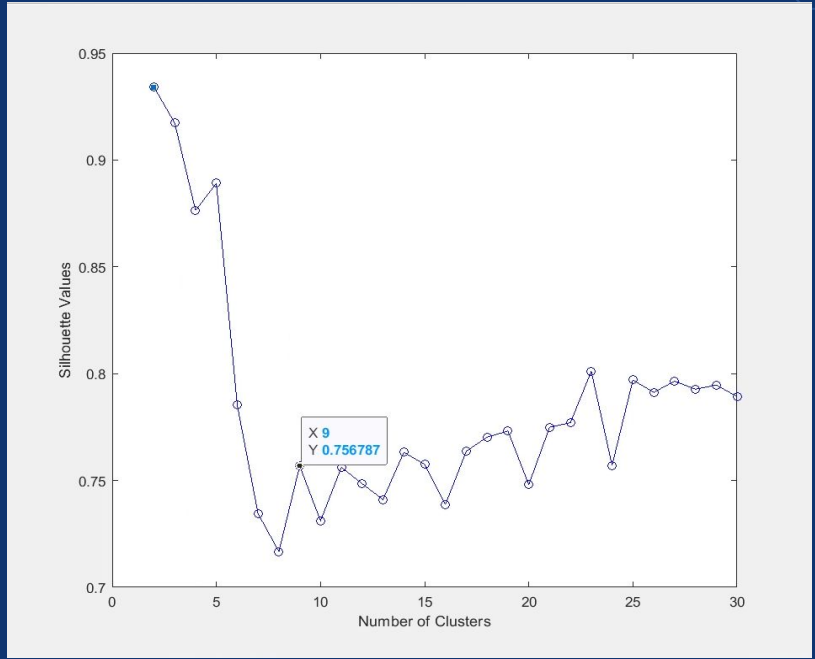


MAUI RESULTS





KAUAI RESULTS



RESULTS DISCUSSION

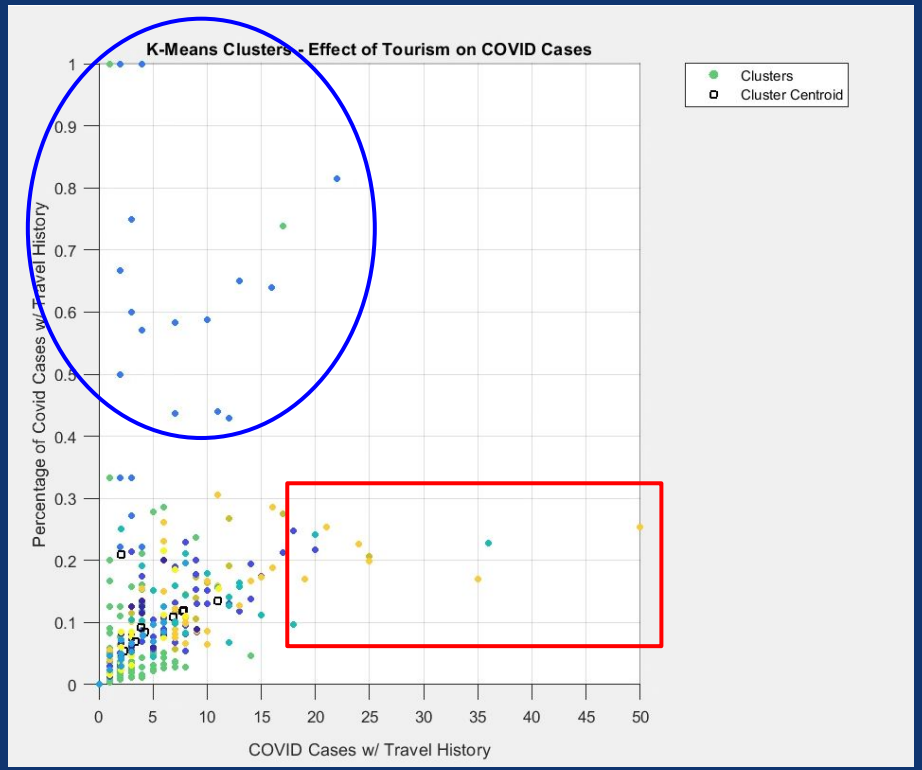
- Outliers in Red Rectangle
  - 1/5 -1/7 → Christmas
  - 1/8 - 1/12 → New Year's
- Days when most COVID-19 cases were associated with travel correspond to Major Holidays

RESULTS DISCUSSION

- Outliers in Blue Circle
  - 3/2020 - 5/2020

→ At start of COVID-19, most cases were associated with travel but few number of COVID-19 cases

- Outliers in Red Rectangle
  - 11/24 → Veterans Day
  - 12/3, 12/8 → Thanksgiving
  - 1/4 - 1/7 → Christmas
  - 1/8 - 1/14 → New Year's



CONCLUSION

- Implementation of the K-Means Clustering algorithm provided an accurate representation of the effect of tourism on COVID-19 Cases.
- Major Findings:
  - Tourism is not a major contributor to COVID-19 Cases for the overall State of Hawaii
  - On the contrary, tourism does have an impact on the island of Kauai independently

THANK YOU!

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RESOURCES

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