



Impact of COVID-19 on the U.S. Housing Market

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Introduction

The United States has experienced the steady growth in the housing market. This steady growth was interrupted by COVID-19 pandemic. This study compares the United States' housing market before and after COVID -19.

This information is important to the local government and real estate developers when planning to develop the next community.



Research Questions

- Has there been a change in house prices since COVID-19?
- Has there been a change in in-demand house location since COVID-19?
- Has there been a change in buyer's house buying criteria since COVID-19?



Data Sources

Data Set	Source	Description	Link
Land Area	US Census Bureau	The file will use county land area information to compute the population densities.	https://www2.census.gov/library/publications/2011/compendia/usa-counties/excel/LND01.xls
Population	Economic Research Service US Department of Agriculture	This file provides population estimates for all counties in the US. Note: 2016 to 2019 estimates and 2020 actual population will be used.	https://www.ers.usda.gov/webdocs/DataFiles/48747/PopulationEstimates.xls https://www.ers.usda.gov/webdocs/DataFiles/48747/PopulationEstimates.csv?v=390.6
Real Estate	Realtor.com	This real estate data file contains a historical market trends and monthly statistics on active for-sale listings (including median list price, average list price, luxury list price, median days on market, average days on market, total active listings, new listings, price increases, price reductions)	https://econdata.s3-us-west-2.amazonaws.com/Reports/Core/RDC_Inventory_Core_Metrics_County_History.csv
Rural Area	US Census Bureau	The file will use county rural information to categorize the urban and mostly and all rural areas.	http://www2.census.gov/geo/docs/reference/ua/County_Rural_Lookup.xlsx



Data Variables

DATA VARIABLE	DESCRIPTION
Active Listing Count	The count of active listings within the specified geography during the specified month. The active listing count tracks the number of for sale properties on the market, excluding pending listings where a pending status is available. This is a snapshot measure of how many active listings can be expected on any given day of the specified month.
Avg Listing Price	The average listing price within the specified geography during the specified month.
Avg Listing Price M/M	The percentage change in the average listing price from the previous month.
Avg Listing Price Y/Y	The percentage change in the average listing price from the same month in the previous year.
County	The county in the state
Date	The date of the property transaction
Density	The ratio of the population per square mile of the county
FIPS	The five digit code representing the state and the county
Median List Price Per Sqft	The median listing price per square foot within the specified geography during the specified month.
Median Listing Price	The median listing price within the specified geography during the specified month.
Median Listing Sqft	The median listing square feet within the specified geography during the specified month.
Rural Percent	The total percentage of the population that classifies almost or all rural areas and urban area
Rural Cat	The category 1 represents all or mostly rural areas; category 2 represents urban area.
State	The abbreviation of the state
Total Listing Count	The total of both active listings and pending listings within the specified geography during the specified month. This is a snapshot measure of how many total listings can be expected on any given day of the specified month.

Variables and Measurements

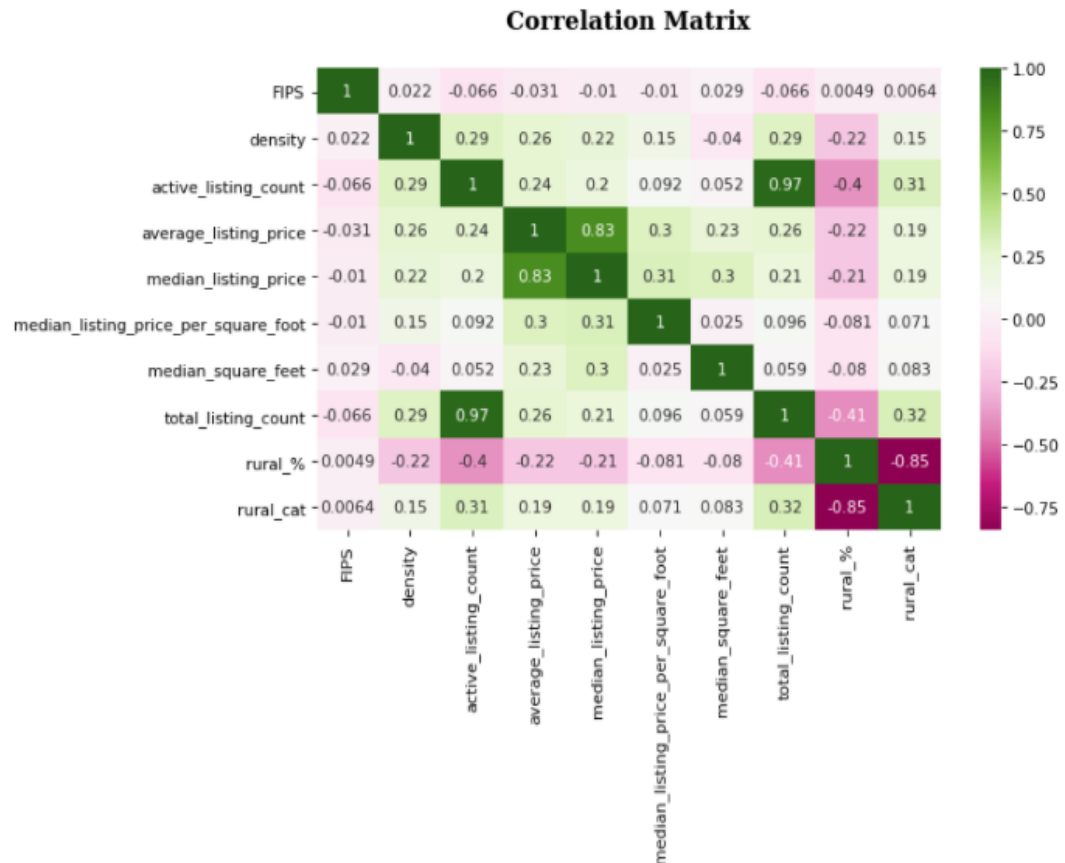


- Average listing price and average listing prices changes per year for the state, individual state, and county will be analyzed during 2019 and 2021.
- The basis of comparison is pre-COVID (2019) and post-COVID (2021)
- The unit for analysis used is FIPS which represents the Federal Information Processing Standard code. FIPS is a five digit code that uniquely identifies counties in the United States.



Initial Exploratory Results

Correlational Matrix



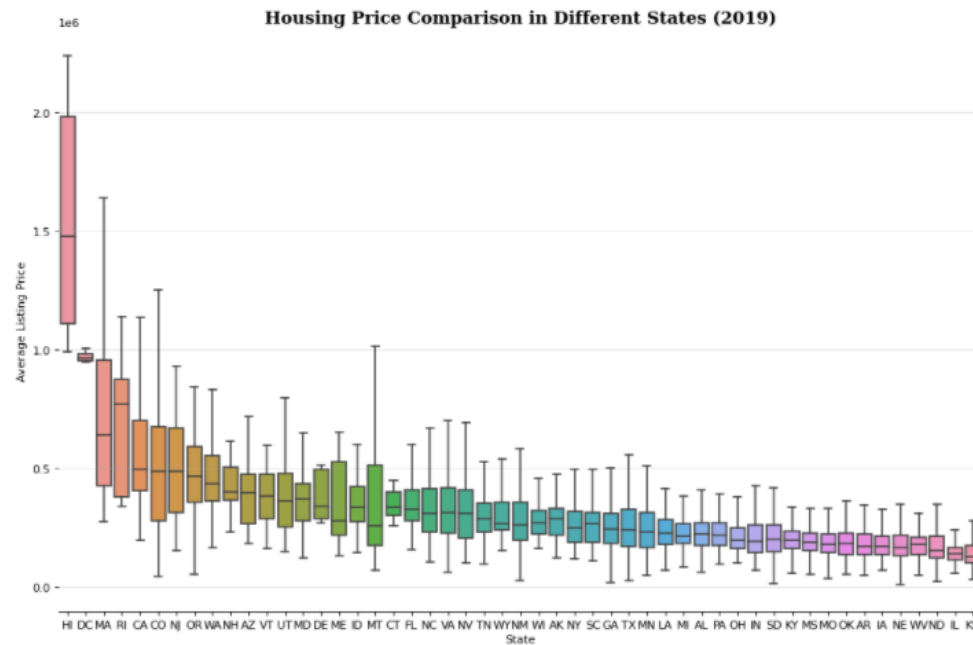
- In this matrix, the highest correlation is between active listing count and total listing count which is 97%. The second highest is between average listing price and median listing price which is 83%.



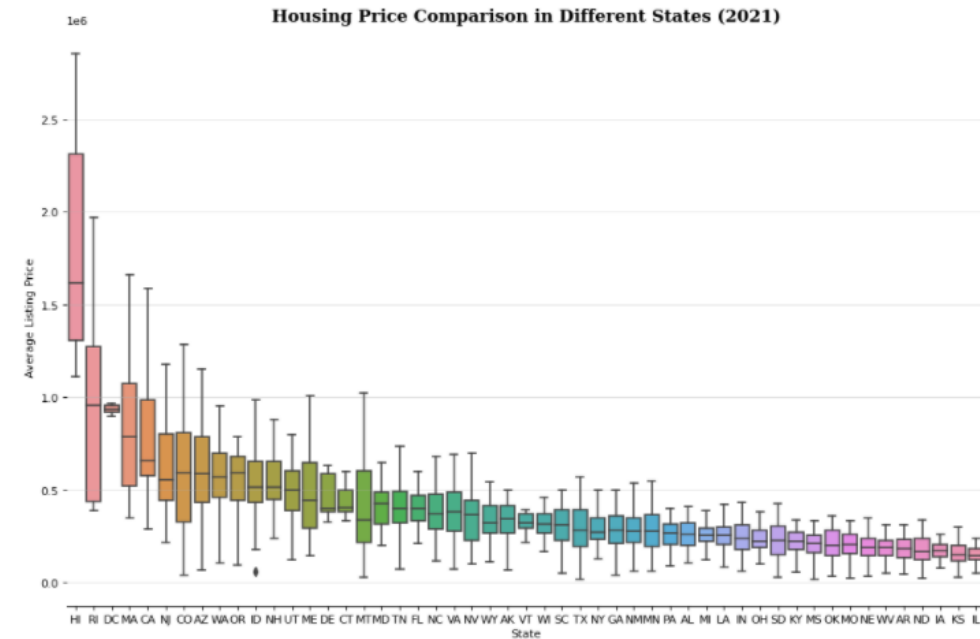
Initial Exploratory Results

Average Listing Price

2019



2021

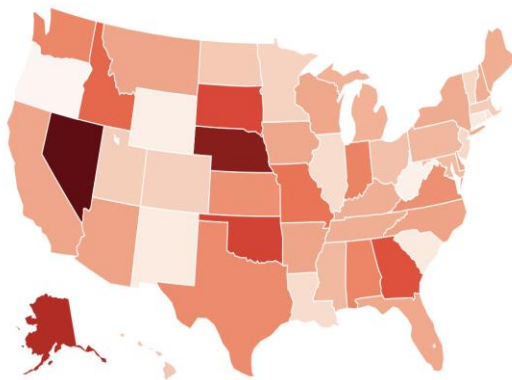


Initial Exploratory Results

Average Listing Price Change (%)

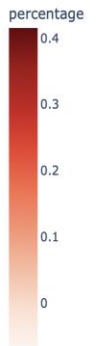
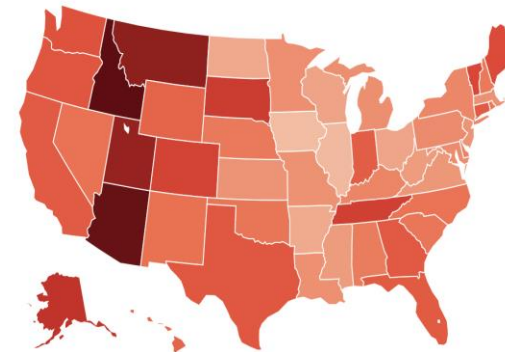
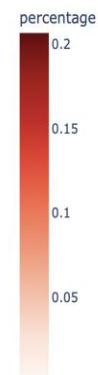
2019

2019 US Average Listing Price Change per State (%)



2021

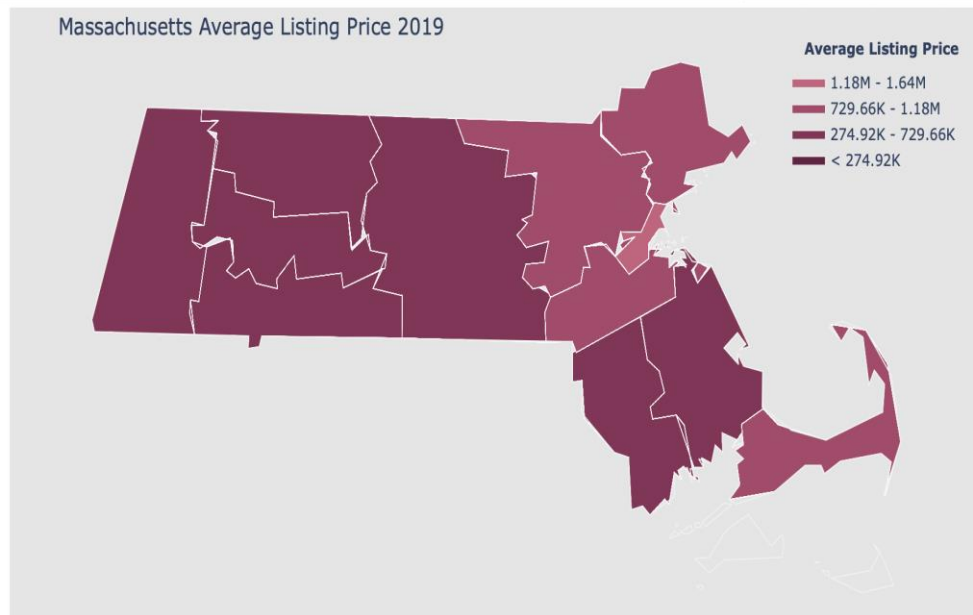
2021 US Average Listing Price Change per State (%)



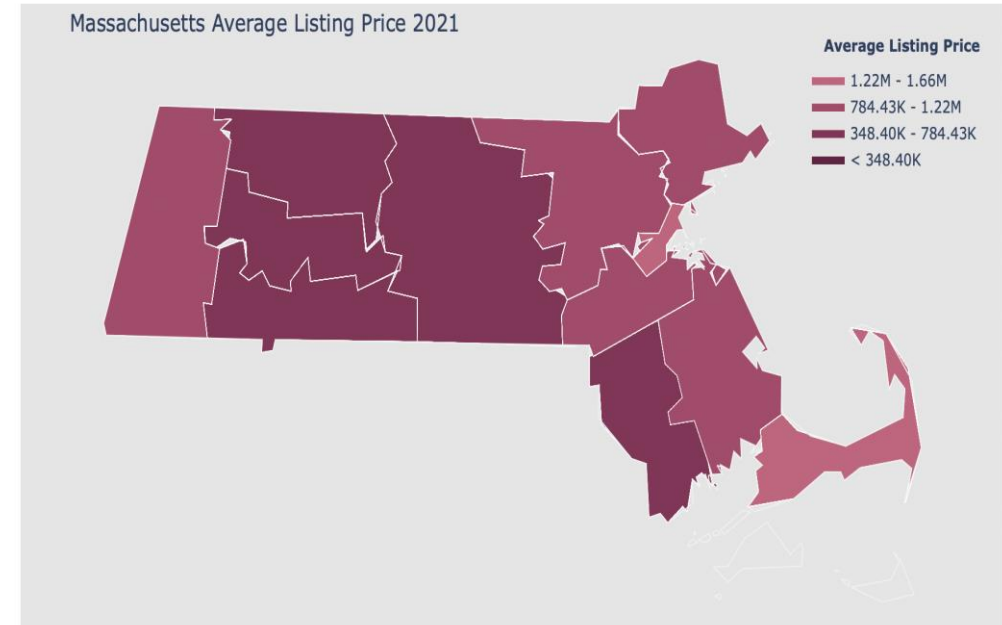
Initial Exploratory Results

Average Listing Price

2019



2021



Machine Learning Model

The machine learning model to be used for this project is K-means with centroid. K-means works by selecting how many clusters, k , exist in the data. Each cluster will be represented by a centroid (average) of similar points with continuous features.

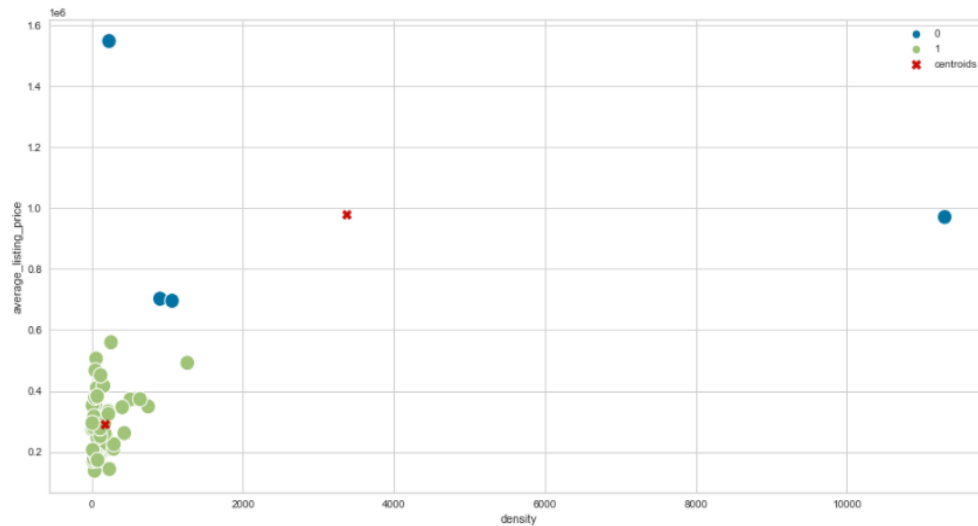
It will be applied to the average listing price, average listing price change, rural percentage, and density on the county, state, and individual state level.



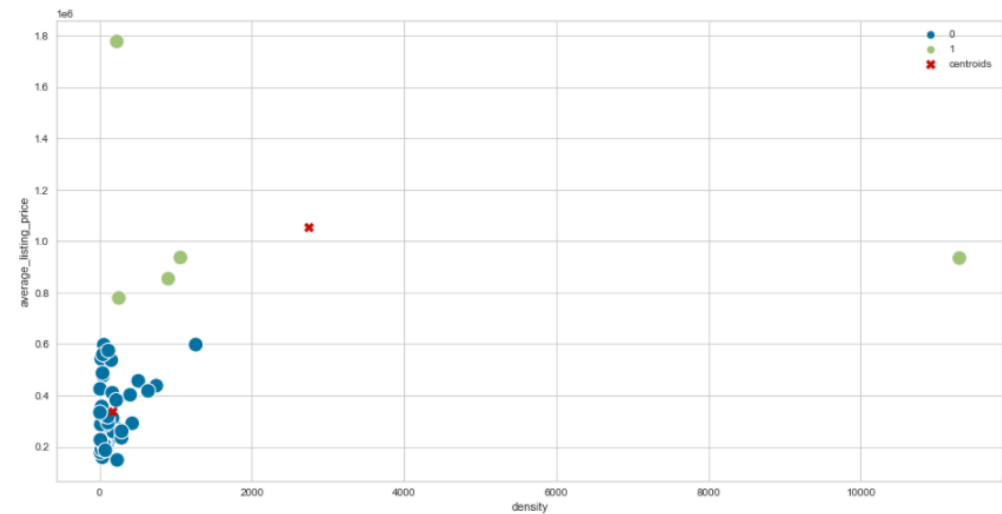
K-means

Average Listing Price (State Level)

For 2019



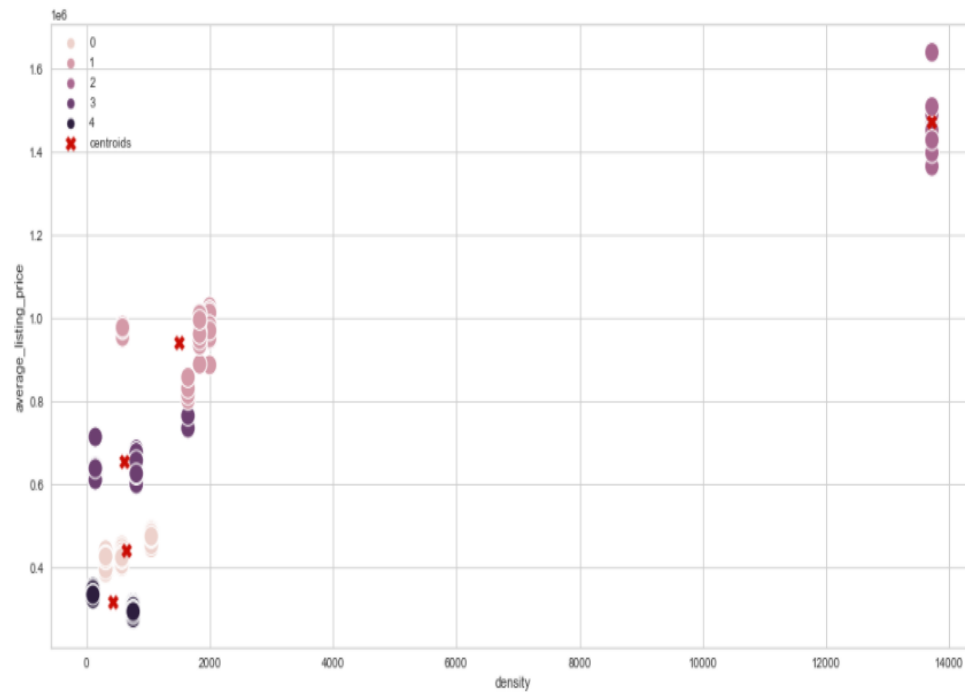
For 2021



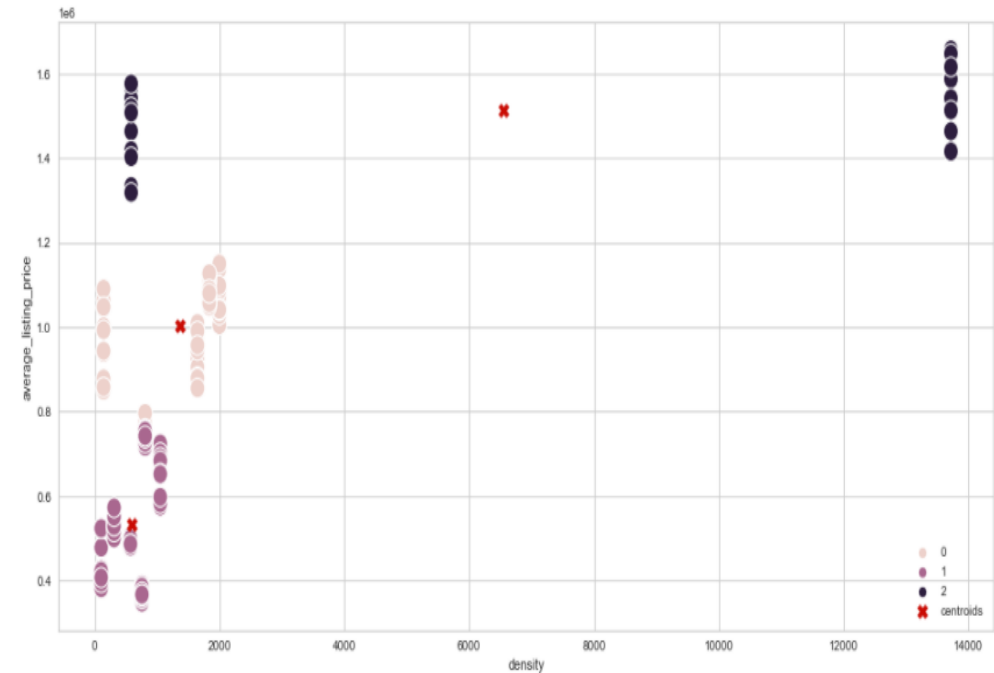
K-means

Average Listing Price (Individual State Level)- Massachusetts

2019



2021



Expected Outcome

A shifting of the demand for houses from the urban area to the rural area can be seen.

- at the state level
 - Hawaii maintained a highest average listing price in 2019 and 2021. However, the second highest average listing price for 2019 was DC which was displaced by Rhode Island in 2021. Rhode Island used to be the 4th placer in 2019. It surpassed Massachusetts with a higher average listing price. In comparison with the density. District of Columbia has the highest density 11294 density/sq mile compared to Hawaii of 229 density/sq. mile, Rhode Island of 106 density/sq. mile, Massachusetts of 901 density/sq. mile and California of 253 density/sq. mile.



Expected Outcome

- at the county level
 - Suffolk county, Massachusetts has the highest listing price in 2019 and 2021. Although there are movement in the placement of 2nd, 3rd, and 4th placement in the highest listing. There is a big change in the 5th placement of 2021. The fifth placement used to be Essex county which is categorize as urban with rural percentage of 4.24%. Essex county was displaced by Berkshire county which is also another urban but has a bigger rural percentage of 31%.



Expected Outcome

- at the FIPS level
 - In 2019, the highest average listing price goes to Kauai, Hawaii, followed by Maui, Hawaii, Suffolk, Massachusetts, Routt, Colorado, and Honolulu, Hawaii.
 - In 2021, the first two highest are still the same, but Newport, Rhodes Island became the 3rd placer, followed by Suffolk, Massachusetts and lastly San Diego, California.
 - Routt, Colorado, an urban area, has a rural percentage of 45% in 2019 was displaced in the top 10 list. Another county belonging to the top 10 list was Gunnison, CO (58%) which is an rural area was displaced out of the top 10 list. In 2021, the top 10 list added 3 more California counties: Santa Cruz (12%), San Luis Obispo (16%), and Mendocino (45%).



References

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