

# Applied Data Science Capstone

## Exploring Museums in the Rural and Suburban Area of Ohio, United States

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### ABSTRACT

In this report I used data analysis and visualization with Python and Foursquare API to explore museums in the state of Ohio. The goal is to find out museums in the rural and suburban area that are ideal for weekend/summer getaways for general public and their family while learning cultures and history of Ohio, United States.

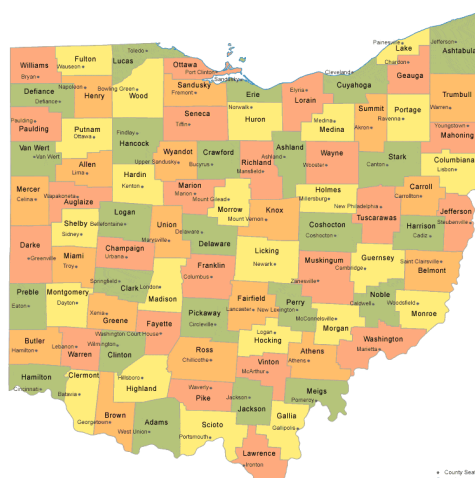
### INTRODUCTION

In this report, museums are defined as institutions, including nonprofit organizations, government entities, and private businesses, collect and care for objects of cultural, artistic, scientific, or historical interest and make their collections or related exhibits available for public viewing. Museums that exist only in cyberspace or on the Internet (i.e., virtual museums) are not included.

When I was in college 30 years ago, when video games, internet and web surfing are in their infancies, physically visiting museums was a big deal. That being said, museums in metropolitan area, such as Chicago, New York and Washington D.C., still draw a lot visitors, especially during the weekend. In contrast, museums in Ohio, except National Museum of the United States Air Force located in Dayton ([https://en.wikipedia.org/wiki/National\\_Museum\\_of\\_the\\_United\\_States\\_Air\\_Force](https://en.wikipedia.org/wiki/National_Museum_of_the_United_States_Air_Force)), few museums are known even for most people who even live in Ohio. In searching for a project for Applied Data Science Capstone, I feel it is useful to explore museums in Ohio and what they may offer.

The target audience for this report will be general public who are looking for summer / weekend getaways and interested in learning the history and cultures of Ohio and United States. Visiting museums in rural and suburban area in Ohio could be a nice way to accomplish both.

Through searching on-line, together with data processing and analysis in this report, I learned that there are 468 museums displayed in 76 out of 88 counties (**Fig. 1**) through the state of Ohio and museum guides are available for 250+ museums, <http://www.museumstuff.com/states/OH.php>. In this report, I used data analyses and visualization, including Foursquare API analyses, to explore a small representative dataset.



**Figure 1.** 88 counties and their township in Ohio (<https://geology.com/county-map/ohio.shtml>)

## DATA

In order to visualize the museums in different counties, two sets of data were chosen for this project.

- The list of museums in Ohio ([https://en.wikipedia.org/wiki/List\\_of\\_museums\\_in\\_Ohio](https://en.wikipedia.org/wiki/List_of_museums_in_Ohio))
- County coordinates ([https://github.com/jotang1/Capstone\\_Project/blob/master/County\\_Coords.csv](https://github.com/jotang1/Capstone_Project/blob/master/County_Coords.csv)). The coordinate of the township of each county was chosen to represent the coordinate of each county.

### (1) List of Museums in Ohio:

I first scraped the Wikipedia page and transformed the data in the table into a pandas dataframe. I used one of the most popular packages, BeautifulSoup (<http://beautiful-soup-4.readthedocs.io/en/latest/> and <https://www.youtube.com/watch?v=ng2o98k983k>), to scrape the Wiki-page. From the data processing, I learned that there are 469 museums in Ohio. Below show the data summary.

```
# Museums in Ohio
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 469 entries, 0 to 468
Data columns (total 6 columns):
Name                469 non-null object
Town/city           469 non-null object
County              469 non-null object
Region              469 non-null object
Type                469 non-null object
Summary             469 non-null object
dtypes: object(6)
```

**Table 1** below is prepared from Table in Wikipedia ([https://en.wikipedia.org/wiki/List\\_of\\_museums\\_in\\_Ohio](https://en.wikipedia.org/wiki/List_of_museums_in_Ohio)). Not to bore the readers who need to read this report, I only listed 5 out of 469 museums on the list below using the head() function.

**Table 1. Museums in Ohio** (5 out of 469 museums are shown)

Museum	Town/city	County	Region	Type	Summary
103rd Ohio Volunteer Infantry Museum	Sheffield Lake	Lorain	Northeast	Civil War	Open by appointment
1810 House	Portsmouth	Scioto	Southwest	Historic house	Operated by the Scioto County Historical Society
A.B. Graham Memorial Center	Conover	Miami	Southwest	Biographical	Honors
Adena Mansion	Chillicothe	Ross	Southwest	Historic house	Early 19th-century mansion on 300 acres.....
AHA! A Hands-On Adventure	Lancaster	Fairfield	Central	Children's	

To simplify the data analyses, I removed “Summary” column for each museum, although it is a nice information to know for each museum, especially for those who are in the rural area and less known. Furthermore, I further modified the Table as follows:

- Found out museums in different towns or cities using the `groupby()` function.
- Arranged the Table by sorting the “County” column alphabetically.

The results in **Table 2** show 253 cities and towns in Ohio own museums (see the code deposited in GitHub). Again, below I only listed museums in 5 out of 253 cities and towns.

**Table 2. Museums in different cities and towns in Ohio**  
(museums in 5 out of 253 cities / towns are shown)

County	Town / city	Region	Museums
Adams	Peebles	Southwest	Serpent Mound
Adams	Winchester	Southwest	National Barber Museum and Hall of Fame
Allen	Delphos	Northwest	Delphos Canal Commission Museum, Delphos Museu...
Allen	Lima	Northwest	Allen County Museum, ArtSpace Lima
Ashland	Ashland	Northeast	Ashland County Historical Society Museum

In order to use Google map to visualize the approximate locations of the museums on the map, I further simplify the Table by removing Town/city and region. **Table 3** below shows museums in 5 out of 76 counties in Ohio.

**Table 3. Museums in different counties in Ohio**  
(museums in 5 out of 76 counties are shown)

County	Museums
Adams	Serpent Mound, National Barber Museum and Hall...
Allen	Delphos Canal Commission Museum, Delphos Museu...
Ashland	Ashland County Historical Society Museum, Cleo...
Ashtabula	Ashtabula Maritime Museum, Blakeslee Log Cabin...
Athens	Dairy Barn Arts Center, Kennedy Museum of Art,...

## (2) Geographical Coordinates of Each County:

To make location of museums visible on the map, I needed to include geographical coordinates. The best way is to locate coordinates for all 469 museums, whereas it is very time consuming to find such information for all museums in Ohio, without mentioning coordinates for some museums are not readily available. Alternatively, I looked into coordinates for the township of each county, recorded the data in a csv file, deposited in GitHub ([https://github.com/jotang1/Capstone\\_Project/blob/master/County\\_Coords.csv](https://github.com/jotang1/Capstone_Project/blob/master/County_Coords.csv)) and extracted csv with each county's geographical coordinates to dataframe. **Table 4** shows coordinates of 5 out 88 counties in Ohio.

**Table 4.** coordinates of counties in Ohio (coordinates for 5 out of 76 counties are shown)

County	Latitude	Longitude
Adams	39.0317	-83.4221
Allen	40.5318	-84.2350
Ashland	41.0358	-82.2500
Ashtabula	41.5840	-81.0000
Athens	39.3322	-82.1606

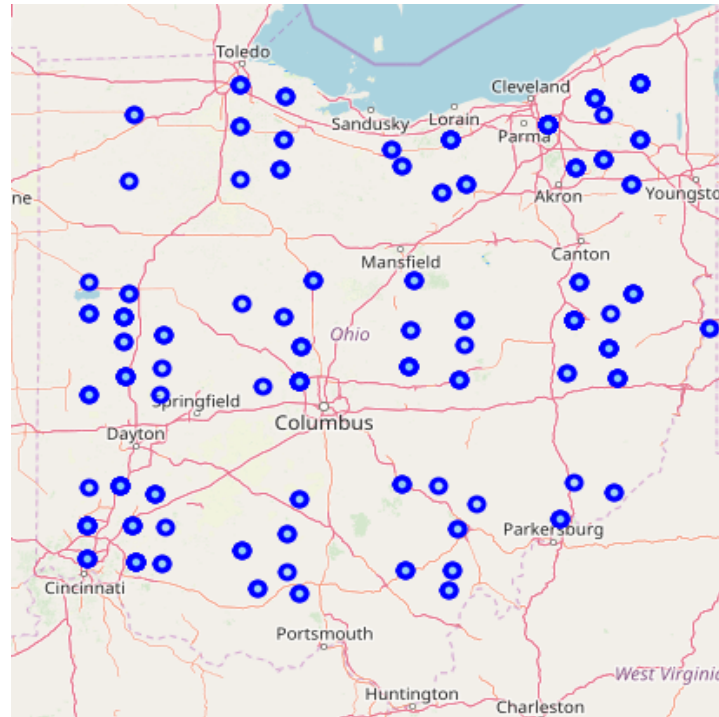
## Methodologies

Now I have museums in different cities/towns and geographical coordinate of each county, I merged the data together in **Table 5** using the `merge()` function.

**Table 5.** Museums in different counties with coordinates (data for 5 out of 253 cities / towns are shown)

County	Town / city	Region	Museums	Latitude	Longitude
Adams	Peebles	Southwest	Serpent Mound	39.0317	-83.4221
Adams	Winchester	Southwest	National Barber Museum and Hall of Fame	39.0317	-83.4221
Allen	Delphos	Northwest	Delphos Canal Commission Museum, Delphos Museu...	40.5318	-84.2350
Allen	Lima	Northwest	Allen County Museum, ArtSpace Lima	40.5318	-84.2350
Ashland	Ashland	Northeast	Ashland County Historical Society Museum	41.0358	-82.2500

From there, I first located the coordinate of the state of Ohio using the *Nominatim* function imported from the *geolocator* module and then used folium to make location of museum visible. **Figure 2** shows the locations of museums in different counties in Ohio.



**Figure 2.** locations of museums in different counties.

Next, to find out the museums in rural and suburban area in the state of Ohio using Foursquare API, instead of looking into museums in 76 counties and 253 cities/towns, I would like to choose a small but representative set of data. As I did not have knowledges for most museums in rural and suburban area in Ohio, I chose to analyze the museums in the counties that have museums with “Ohio” as part of their name. **Table 6** shows the museums in 16 cities/towns, all of which are in rural and suburban area in different regions of Ohio. It is of interest to find out that **Ohio Governor's Mansion** is listed as a museum. More importantly, 16 cities/towns are spread out Ohio (Central, Northeast, Southeast and Southwest) and thus the dataset display a good representation of museums in the state of Ohio.

**Table 6.** List of 16 towns/cities in Ohio has museums with “Ohio” as part of their name.

County	Town / city	Region	Museums	Latitude	Longitude
Athens	Athens	Southeast	Dairy Barn Arts Center, Kennedy Museum of Art, Southeast Ohio History Center	39.3322	-82.1606
Brown	Ripley	Southwest	John P. Parker House, John Rankin House, Ohio Tobacco Museum, Ripley Museum	39.1515	-84.0200
Darke	Bradford	Southwest	Bradford Ohio Railroad Museum	40.0208	-84.4843
Fairfield	Lancaster	Central	AHA! A Hands-On Adventure, Decorative Arts Center of Ohio, Georgian Museum, Ohio Glass Museum, Sherman House Museum	39.5627	-82.5039
Franklin	Bexley	Central	Ohio Governor's Mansion, Schumacher Gallery	40.0835	-83.1538
Franklin	Canal Winchester	Central	Mid-Ohio Historical Museum	40.0835	-83.1538
Franklin	Hilliard	Central	Early Television Museum, Hilliard Ohio Historical Society Museum	40.0835	-83.1538
Franklin	Worthington	Central	Doll Museum at the Old Rectory, Ohio Railway Museum, Orange Johnson House	40.0835	-83.1538
Greene	Xenia	Southwest	Greene County Ohio Historical Society Museum, Xenia Station	39.5102	-84.0648
Lake	Mentor	Northeast	Indian Museum of Lake County, Ohio, James A. Garfield National Historic Site, Mentor Safety Village	41.5113	-81.2920
Lorain	Sheffield Lake	Northeast	103rd Ohio Volunteer Infantry Museum	41.3055	-82.2045
Medina	Chippewa Lake	Northeast	Northern Ohio Railway Museum	41.0812	-82.1025
Monroe	Clarington	Southeast	Ohio Valley River Museum	39.5210	-81.1701
Pickaway	Ashville	Central	Ohio's Small Town Museum	39.4845	-83.1601
Richland	Mansfield	Northeast	Bible Walk, Kingwood Center, Mansfield Art Center, Mansfield Fire Museum, Mansfield Memorial Museum, Oak Hill Cottage Museum, Ohio State Reformatory	40.5945	-82.4306
Scioto	Portsmouth	Southwest	1810 House, Southern Ohio Museum	39.0056	-83.1605
Seneca	Tiffin	Northeast	American Civil War Museum of Ohio	41.1520	-83.2730
Washington	Marietta	Southeast	Campus Martius Museum, The Castle, Henry Fearing House Museum, Ohio River Museum, Peoples Mortuary Museum, Toy and Doll Museum of Marietta	39.384	-81.5112

Since my goal in this report is to look for museums in the rural and suburban areas that are suitable for weekend / summer getaway for general public and their family, it is important to find out venues those museums have offered. Museums in the middle of nowhere will not be ideal for family visiting, especially if they have teenagers in their family.

I analyzed venues in different museums in **Table 6** using Foursquare API, and **Table 7** shows first 5 of the results. Not surprisingly, as those museums located in rural area, venues in the neighborhoods of the museums are expected to be limited, where “Rest Area” is considered as a venue.

**Table 7.** Venues in museums listed in **Table 6** displayed using Foursquare API.

Museum	Museum Latitude	Museum Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
AHA! A Hands-On Adventure, Decorative Arts Cen...	39.5627	-82.5039	Starbucks Coffee	39.562269	-82.505975	Coffee Shop
AHA! A Hands-On Adventure, Decorative Arts Cen...	39.5627	-82.5039	Rest Area 10-27 (Eastbound)	39.563629	-82.509339	Rest Area
AHA! A Hands-On Adventure, Decorative Arts Cen...	39.5627	-82.5039	Rest Area 10-28 (Westbound)	39.564337	-82.508093	Rest Area
AHA! A Hands-On Adventure, Decorative Arts Cen...	39.5627	-82.5039	Old Mans Caves	39.563700	-82.508100	Trail
AHA! A Hands-On Adventure, Decorative Arts Cen...	39.5627	-82.5039	Rest Area	39.563676	-82.509205	Rest Area

**Table 8** shows the venues in the neighborhoods of 13 museums in different regions of Ohio analyzed using Foursquare API.

**Table 8.** Venues in 13 museums in different regions of Ohio.

Museum	Museum Latitude	Museum Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
AHA! A Hands-On Adventure, Decorative Arts Center of Ohio, Georgian Museum, Ohio Glass Museum, Sherman House Museum	5	5	5	5	5	5
Doll Museum at the Old Rectory, Ohio Railway Museum, Orange Johnson House	6	6	6	6	6	6
Early Television Museum, Hilliard Ohio Historical Society Museum	6	6	6	6	6	6
Mid-Ohio Historical Museum	6	6	6	6	6	6
Ohio Governor's Mansion, Schumacher Gallery	6	6	6	6	6	6

**Table 9** is to illustrate the venues in **Table 8**. The venues in the neighborhood of these 13 museums include coffee shops, Disc Golf, electronics stores, restaurants, gymnastics, IT services, parks, rest areas and trails (state or metro parks).

**Table 9.** List of different venues presented in **Table 8**.

Museum	Coffee Shop	Disc Golf	Electronics Store	Food	Gym	IT Services	Park	Rest Area	Trail
AHA! A Hands-On Adventure, Decorative Arts Cen...	1	0	0	0	0	0	0	3	1
Ohio Governor's Mansion, Schumacher Gallery	0	1	1	1	1	1	1	0	0
Mid-Ohio Historical Museum	0	1	1	1	1	1	1	0	0
Early Television Museum, Hilliard Ohio Histori...	0	1	1	1	1	1	1	0	0
Doll Museum at the Old Rectory, Ohio Railway M...	0	1	0	0	0	0	1	0	0

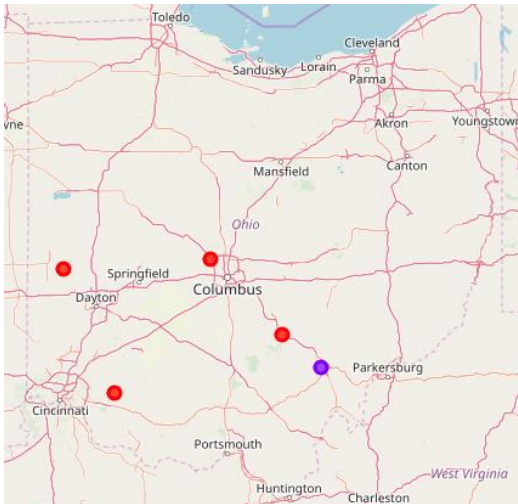
While venues in those museums may not be too exciting for some teenagers and college students, it is still informative to see what people have thought about the venues in the neighborhood of those museums. **Table 10** shows the ranking of common venues in those museums. The results are of interest as “rest area” is the most common venue in some museums but is the least common venue for the rest. It informed me where those museums are located - in the rural area or in the suburban area. Most importantly, **Table 10** gives people a general guide for museums they may want to visit as a family versus museums they want to visit without kids.

**Table 10.** The ranking of venues in 13 museums listed in **Table 8**.

Museum	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue
AHA! A Hands-On Adventure, Decorative Arts Cen...	Rest Area	Trail	Coffee Shop	Park	IT Services	Gym	Food	Electronics Store
Doll Museum at the Old Rectory, Ohio Railway M...	Park	IT Services	Gym	Food	Electronics Store	Disc Golf	Trail	Rest Area
Early Television Museum, Hilliard Ohio Histori...	Park	IT Services	Gym	Food	Electronics Store	Disc Golf	Trail	Rest Area
Mid-Ohio Historical Museum	Park	IT Services	Gym	Food	Electronics Store	Disc Golf	Trail	Rest Area
Ohio Governor's Mansion, Schumacher Gallery	Park	IT Services	Gym	Food	Electronics Store	Disc Golf	Trail	Rest Area

Last but not the least, the cluster of the museums in **Table 6** is illustrate in **Figure 3**. The clusters are distributed in central and southern Ohio. It is a bit surprisingly that no clusters is shown in northern Ohio, which is likely that museums in north with the name of “Ohio” are more spread out.

**Figure 3.** Clustering museums listed in **Table 6**.



## **DISCUSSION**

As an Ohioan who has raised my family here, in the beginning of this project I was mainly intended to find out the location of museums in the state of Ohio, as nowadays my family and I spent most outdoor activities in state/metro parks, theme/water parks and shopping. Admittedly the small set of the data, which is the counties containing museums with the name of “Ohio”, in this project is not optimized, since most Ohio’s museums do not have the name of “Ohio” included.

More through and detailed analyses should be performed, and more interesting and useful information could be extracted. Nevertheless, this report demonstrates that we could use Foursquare API to analyze data more than neighborhoods in the metropolitan area and there are a lot more to explore museums in Ohio.

## **CONCLUSION**

It is a bit challenging to put things together for this Capstone project, as I purposely picked a less popular topic with few data available on-line. Using the knowledge learned through the courses, in this report I intended to explore the museums in the State of Ohio as an Ohioan, although it is not a typical “neighborhood” people have defined. To me, physically visiting museums can never be replaced by virtual museums, and data analyses and visualization with Python and API help us to find out what they may expect in the neighborhood of museums before visiting them in person, and whether people should visit those museums with or without kids (especially teenagers).