Exploring Credit Union Saturation Across the United States

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Abstract

Through exploratory analysis using topological resources such as KeplerMapper (KMapper), we explore the geographical saturation of different office types of credit unions. The saturation of credit union offices in general seem to correspond with population density, whereas corporate offices specifically are disproportionately dense in the Great Lakes region.

The Problem

1. What is the density of credit unions in different regions of the continental United States?

2. Are different types of offices more common in different parts of the country?

Methods

1. We used Microsoft Excel to remove any duplicate sites, removed unnecessary information (e.g., country, phone numbers), and in some instances, round the map coordinate values to get more informative clusterings.

2. The data was then loaded into a Jupyter Notebook for further adjustment in Python.

3. The types of offices in the data set (i.e., corporate, branch, etc.) were assigned a numeric value for the development of scatter plots and Reeb spaces

4. Different parameters and variables were experimented with to find anything that was significant, interesting, or unexpected with the scatter plots and KMapper was used for creating the clusters and Reeb graphs.

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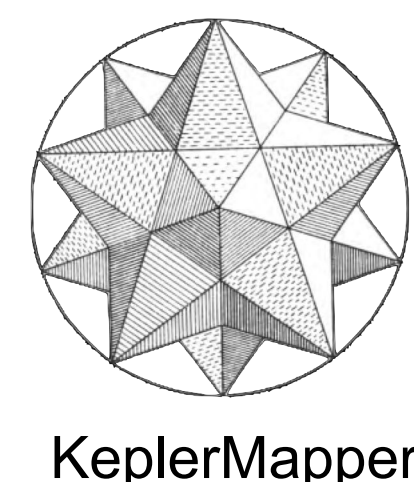
Analysis & Results

A scatterplot of longitude and latitudes of credit unions across the contiguous United States is on the right.

We can see that it resembles a population map of the United States. This is exactly what we would expect! With the large number of points in this graph, we want to refocus our analysis on where credit unions are disproportionately clustered, by using KeplerMapper to obtain a Reeb graph.
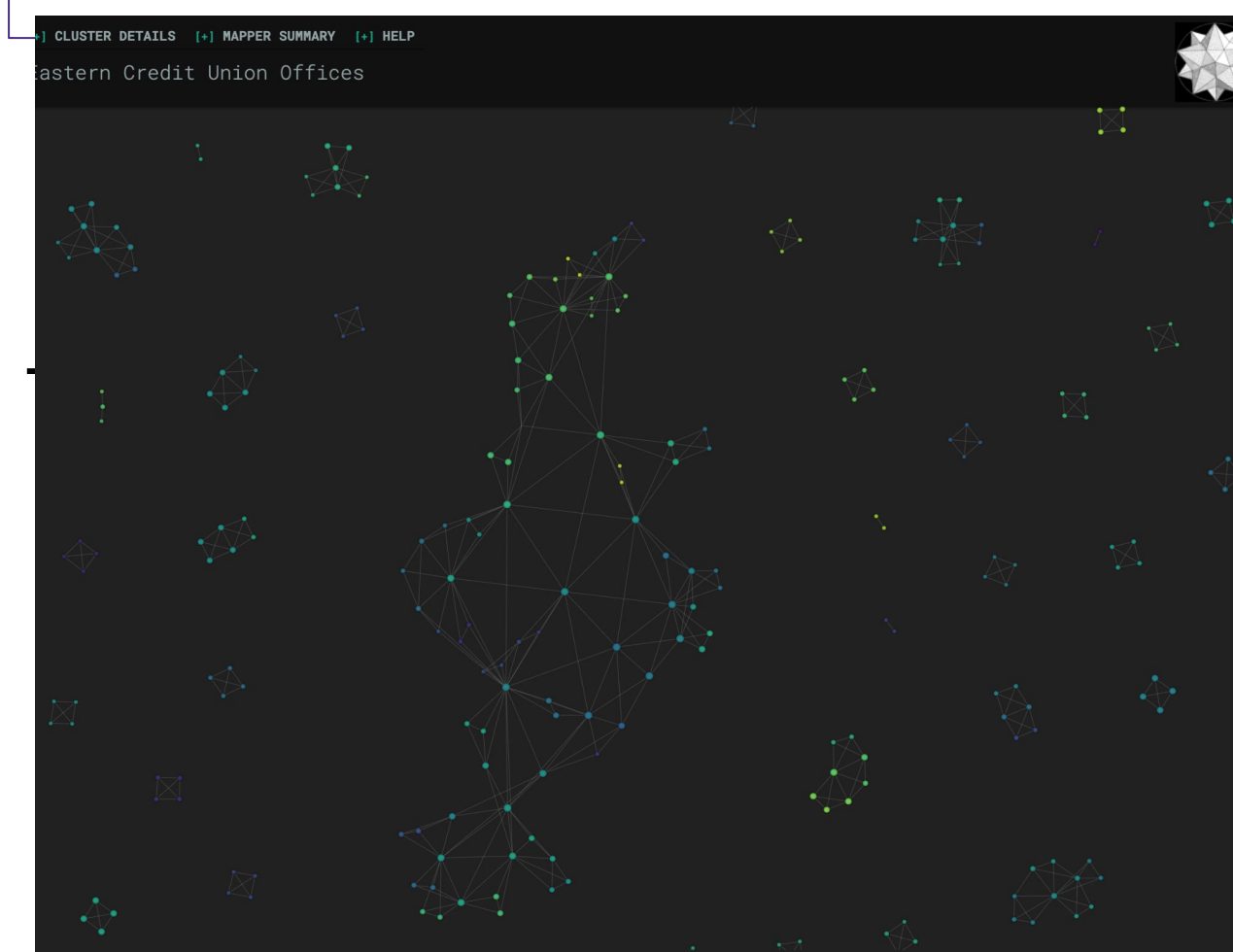
To find out where credit union offices are more common relative to the resident human population, we can create a Reeb graph based on our map coordinate data. This gives us this a visual representation of all of the credit union offices that are close together over a given region.

It would be reasonable to assume that the large cluster of clusters represents the Eastern portion of the United States, and indeed it is! We can confirm our assumptions in a scatterplot of a few of these clusters. Now let's take a look at specific type of credit union office; corporate.

If we create a scatterplot of corporate offices, we get a visual representation that is less dense in general than the previous scatterplot, but it is still difficult to tell whether corporate offices are more or less dense than we would expect for any regions.

Let's take a look at the Reeb graph. Again, it would be reasonable to assume that the large cluster represents the East. Looking at the individual clusters, however, reveals that it is actually the Great Lakes region, implying that the Great Lakes region has a disproportionate number of corporate offices. This would have been difficult to determine by looking only at the scatterplot. If we create a scatterplot of some of these points, we get the following visual:

We can still see the Great Lakes region, but no Florida this time! It would seem that corporate offices are disproportionately dense compared to the population in the Lakes region. Otherwise we would expect the Northeast corridor to be the biggest cluster. Instead the Northeast is only a few nodes, although each node has a lot of corporate offices.
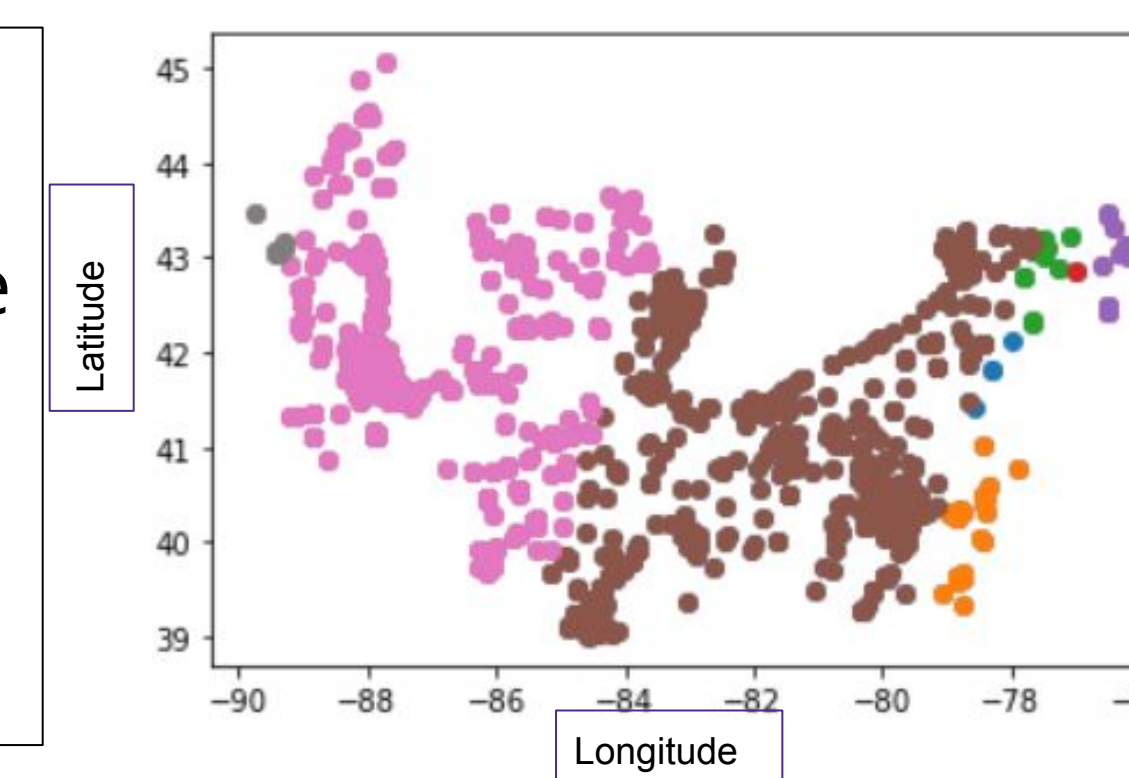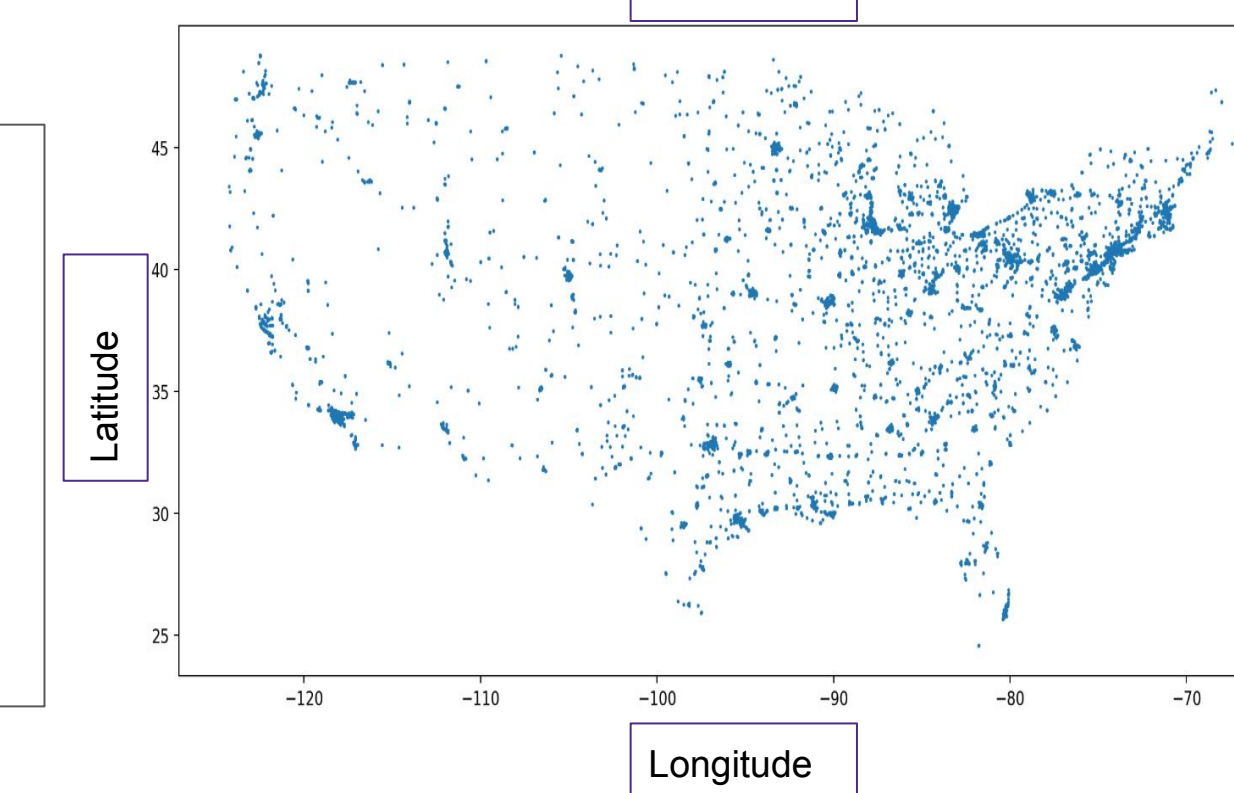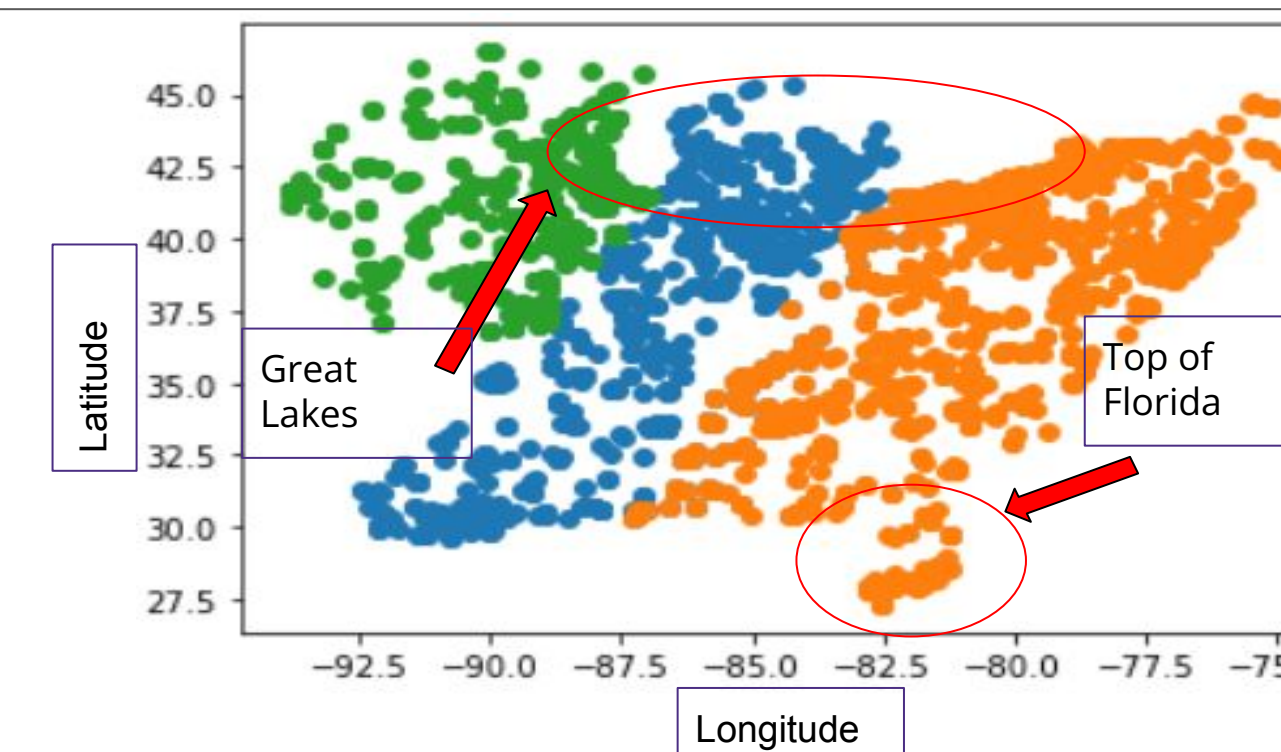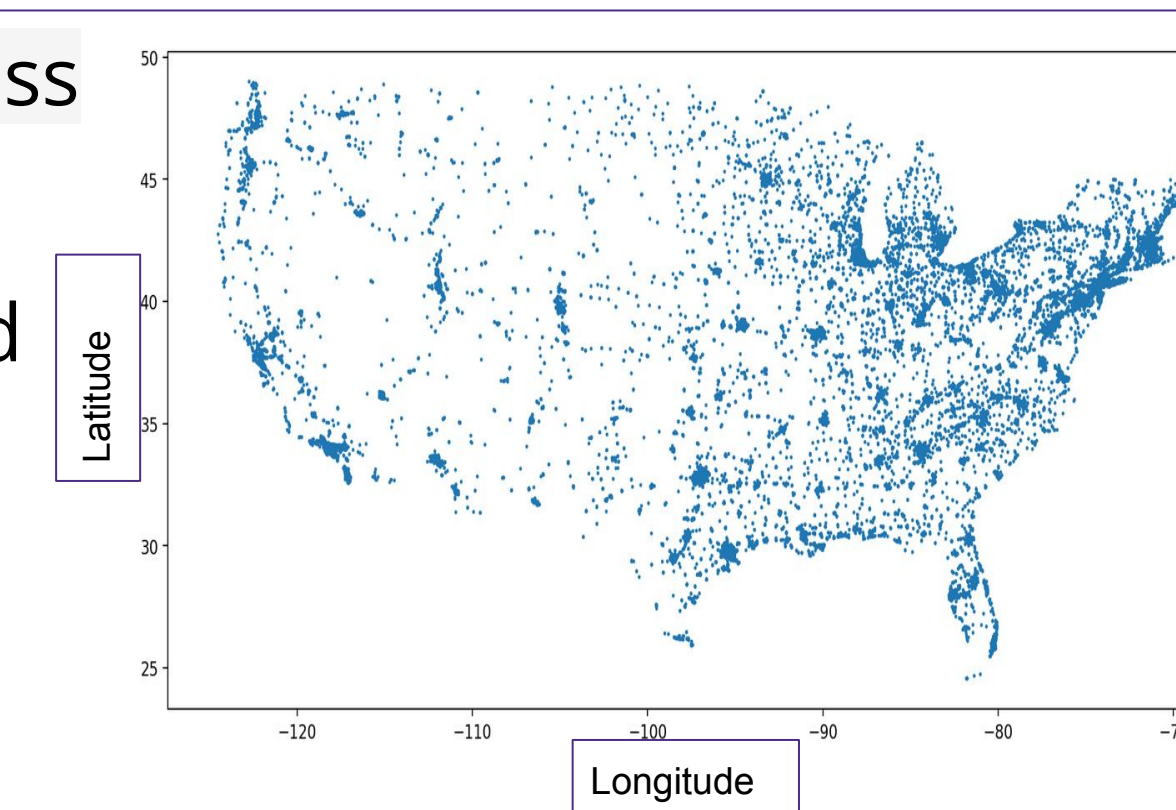
Verification

It could be the case that the Northeast corridor has even more disproportionate number of corporate offices than the Great Lakes, but because of how dense they are they are only represented by a few nodes. To verify that this isn't the case, we can take the overall population of the states and divide by the total number of corporate offices in the state. The smaller proportions show that there are more corporate offices than expected based on population.

STATE	POPULATION	# CORP. OFFICES	POP / CORP
WI	~ 6 million	191	~30,000
IL	~ 12 million	347	~35,000
NY	~ 20 million	439	~45,000
CA	~ 39 million	408	~95,000
FL	~ 21 million	165	~130,000

Discussion

An interesting question to explore in the future would be why the Great Lakes regions have a disproportionately high number of corporate offices. One possible connection is that the Universities with the best actuary programs tend to be in the Great Lakes region. We also found a major operation center for the Credit Union National Association based in Madison, Wisconsin. More exploration would be needed to determine if either of these affect the number of corporate offices in this region.

References

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