

## January-March 2025 Northern Michigan Search Interest Forecast

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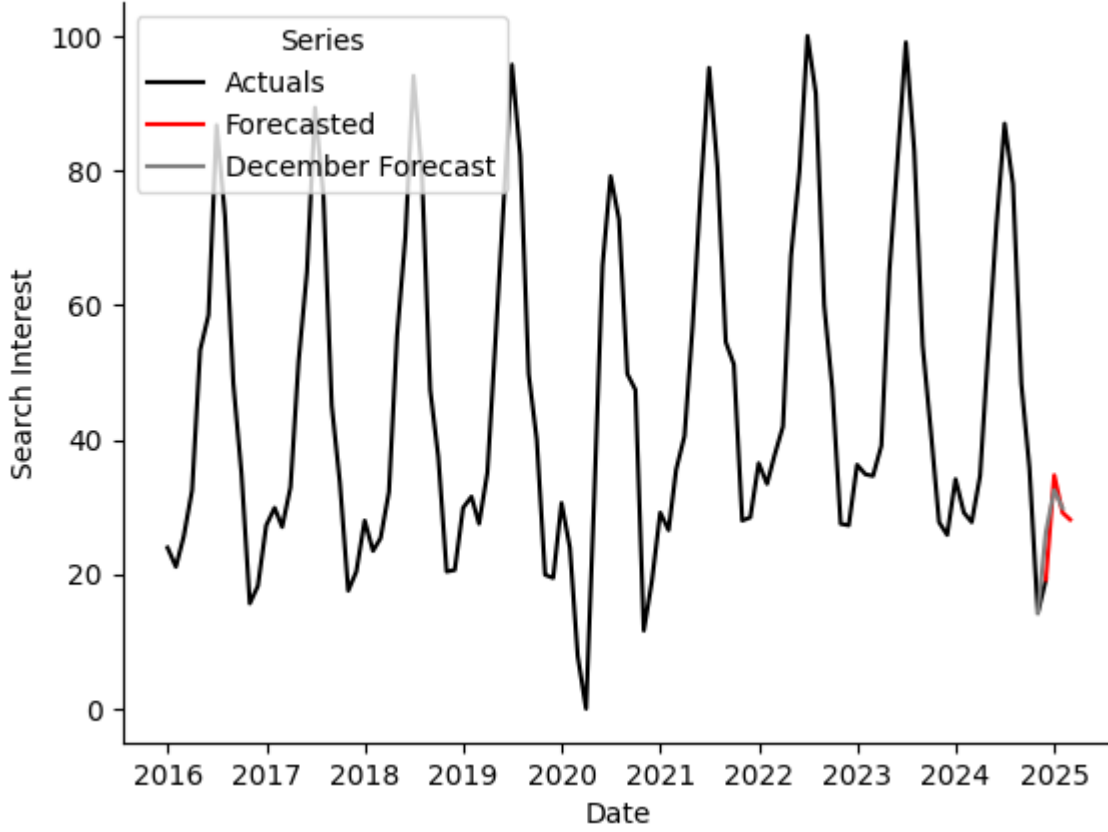
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Below are the search interest forecasts for the combined Northern Lower and combined Upper Pensinsula places for January, February, and March 2025. Note that the possible range for historical search interest is normalized to a maximum of 100 and a minimum of 0, but forecasts outside this range are permissible as these values are forecasted to be outside the historical range. Actuals during 2024 were under forecasts, especially for the Upper Peninsula. The Upper Peninsula was previously trending upward in search interest. But recent search interest is more in line with pre-2020 than 2022 & 2023.

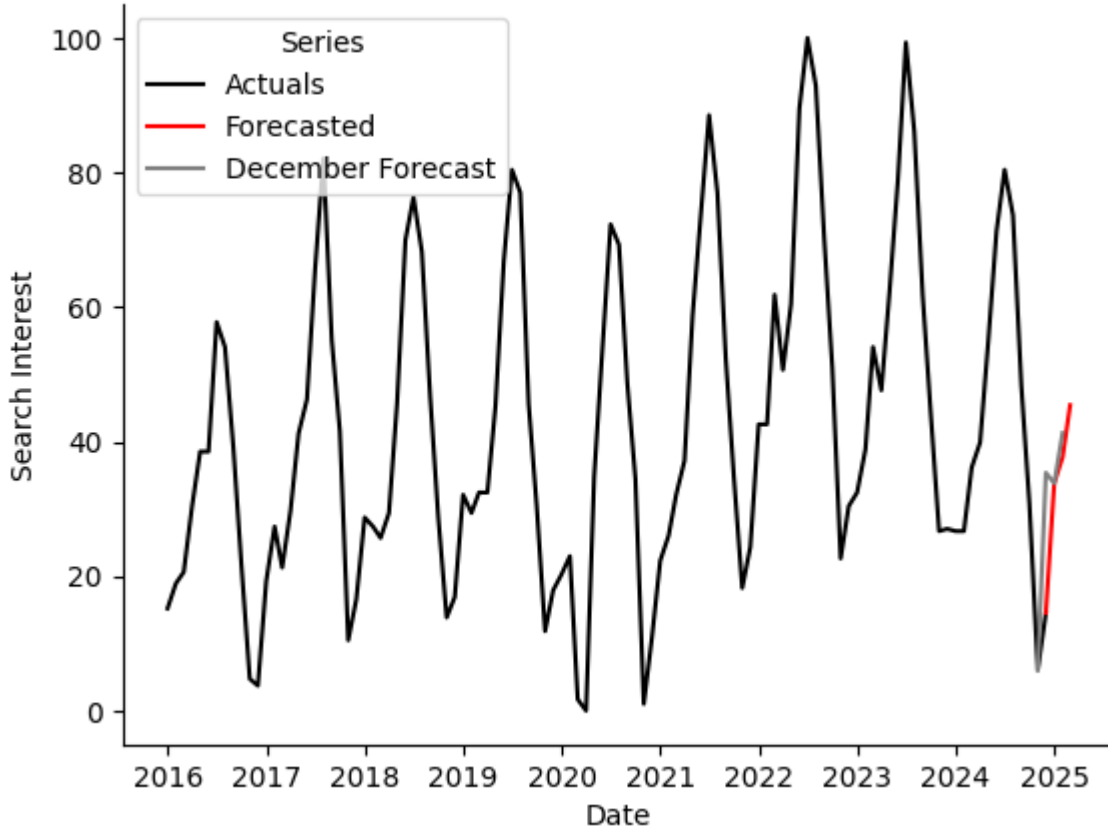
For both peninsulas, November's forecast is in grey and the current December forecast is in red.

Also provided are barcharts comparing the average search interest for the forecast months (January, February, March) to the same months in previous years. The forecast is relatively high for the Upper Peninsula. This would make sense if current trends reverse themselves due to the much higher anticipated snowfall and more interest in winter sports. Note Upper Peninsula search interest is highly variable during this time of year. The Lower Peninsula forecast is similar to last year. Lower Peninsula search interest is less impacted by winter sports.

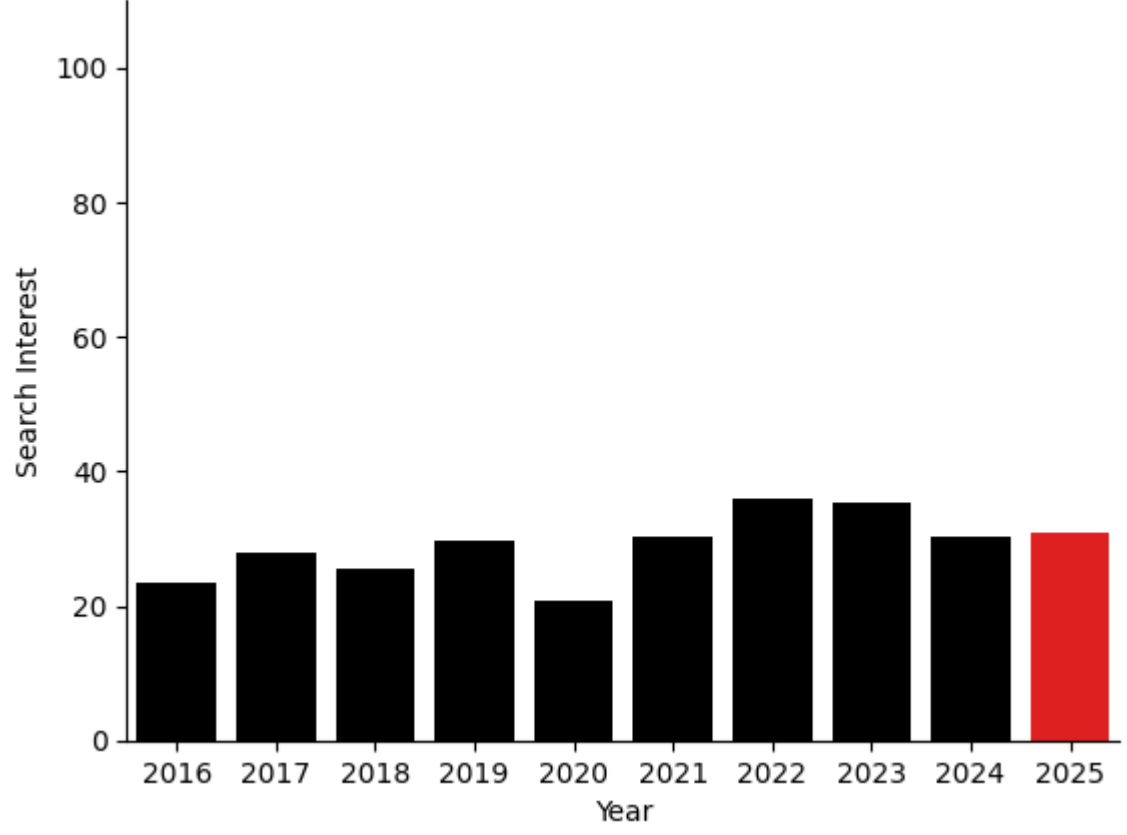
Northern Lower Places Google Search Interest Forecast



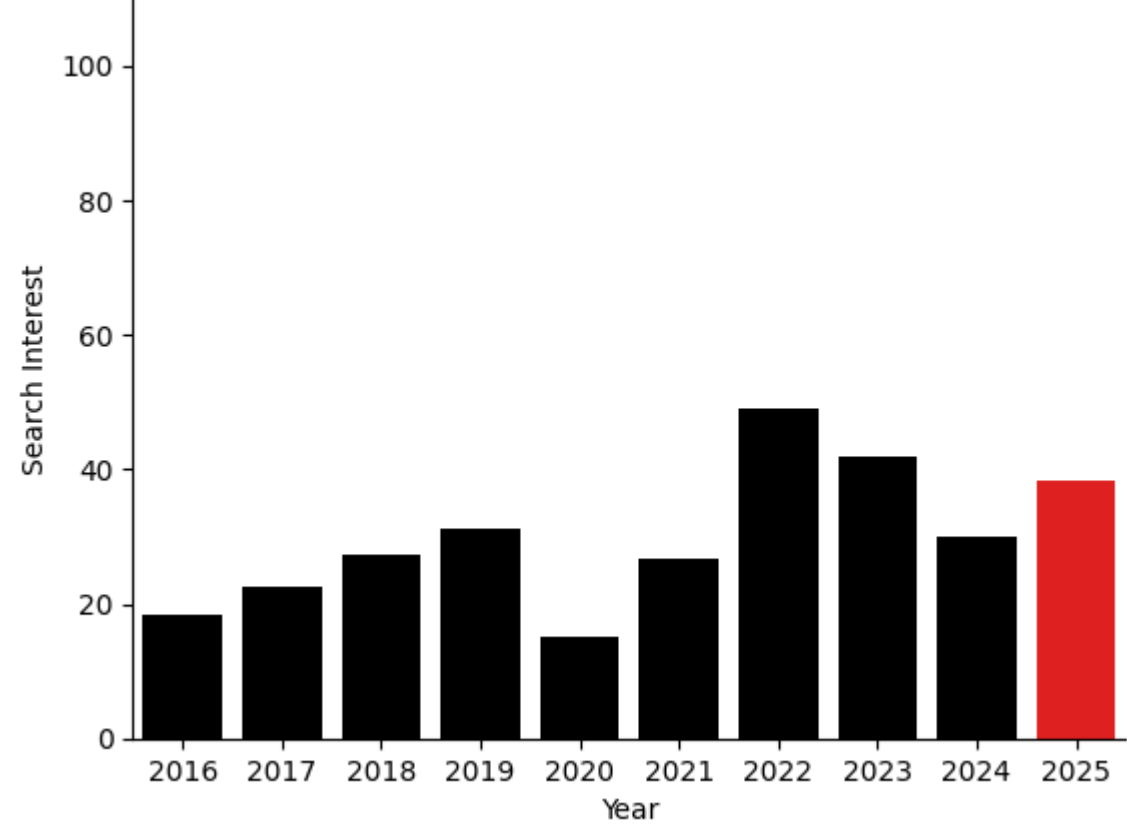
Upper Pensinsula Places Google Search Interest Forecast



Northern Lower Search Interest Averaged for January, February, and March



Upper Peninsula Search Interest Averaged for January, February, and March



The following table shows the top five places that are forecasted to have the highest search interest compared to the same time period in 2024. Caberfae is next to a ski area. We are forecasted to have much more wintery weather this year than last year.

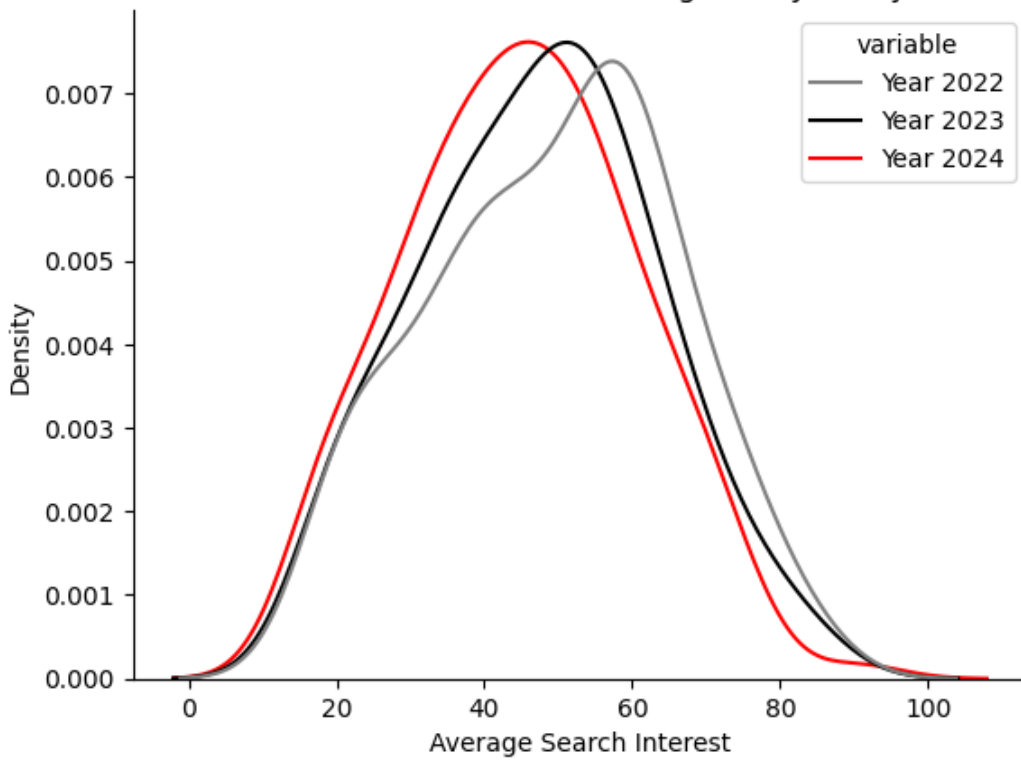
	Place	Peninsula	Difference
0	Rapid River	Upper	12.9
1	Twining	Lower	11.6
2	Daggett	Upper	10.9
3	Caberfae	Lower	10.6
4	Free Soil	Lower	8.2

Three things impact the value of the search interest forecasts for each place.

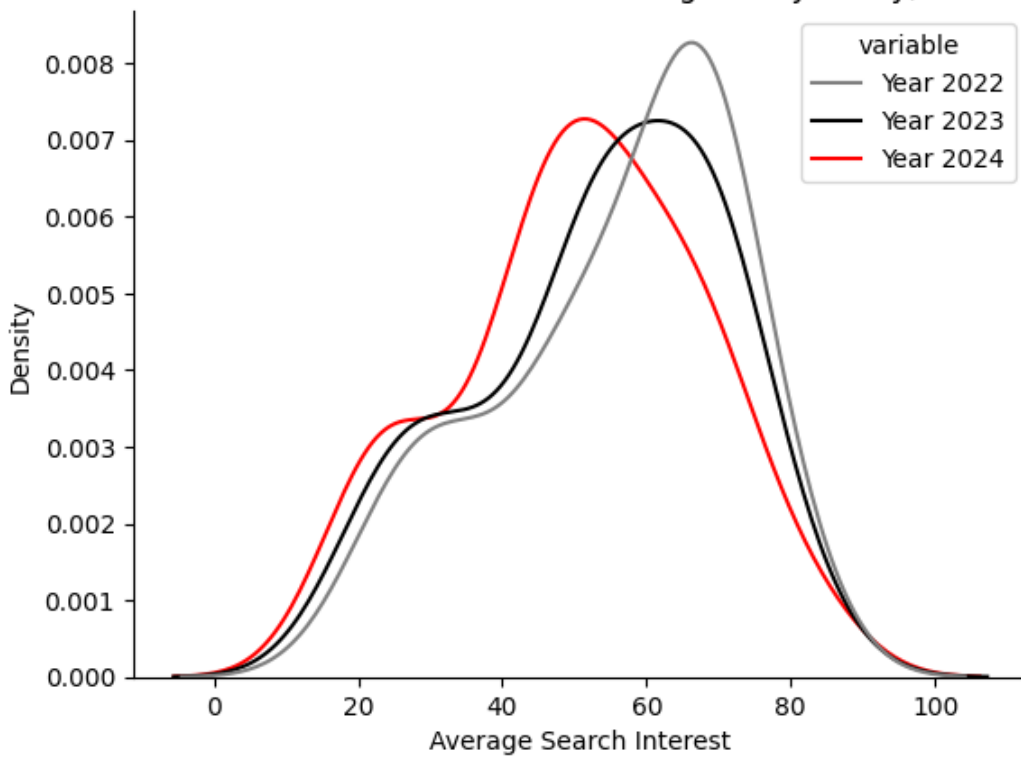
1. The previous year's monthly value for each individual place.
2. While not directly impacting the model forecast, seasonal (12 mo) differencing accounts for the fact that search interest is higher in some portions of the year than others (so previous year actual is impacted).
3. Model difference: based on forecasted weather and gas price changes, the model will predict 12 mo changes from the previous year for each individual place. These new levels are aggregated via regression to the peninsula level series.

The two KDE plots below plot the distributions of the individual place actual values for the months of January, February, March for the previous three years. Note that the values for 2024 serve as the last actual values for 2025. For both peninsulas, the last actuals for 2024 are lower than 2023 and 2022. I believe this shows the impact of a warm winter, little snow, and lack of opportunities for winter sports during 2024.

Lower Peninsula Place Level Search Interest Averaged for January, February, and March

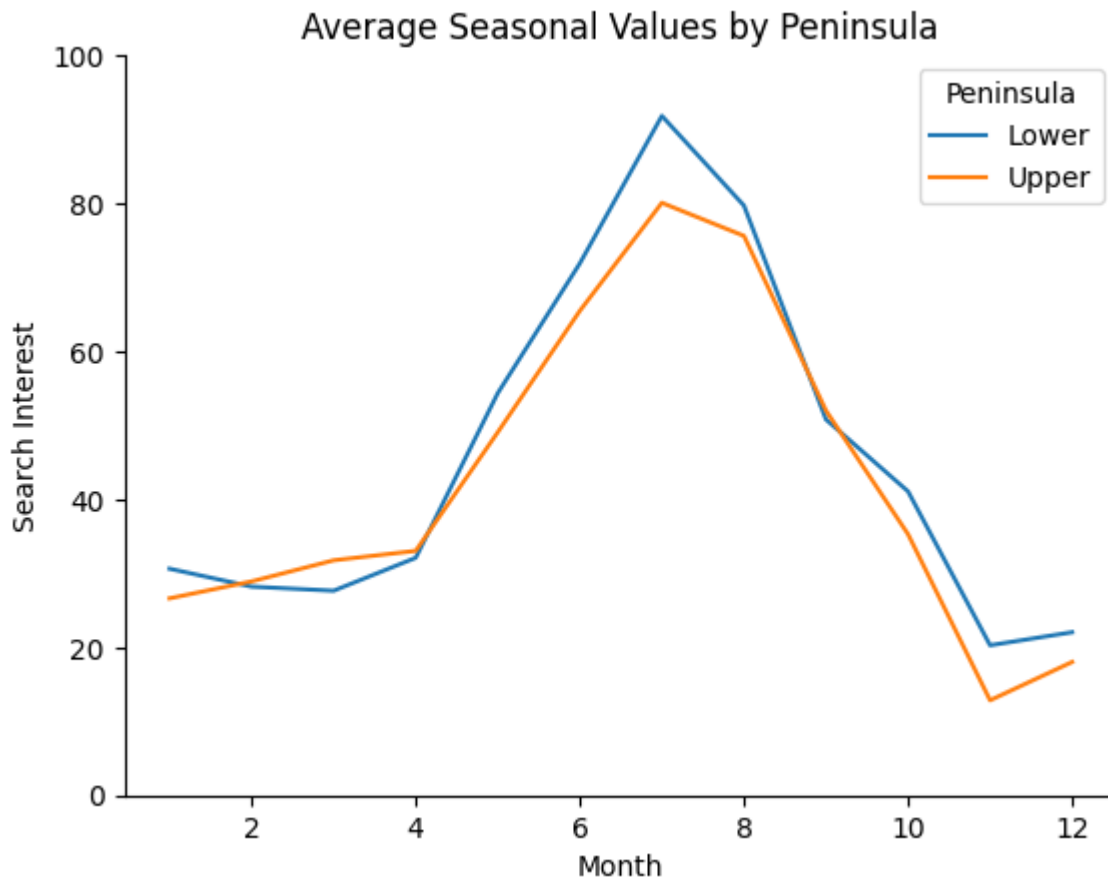


Upper Peninsula Place Level Search Interest Averaged for January, February, and March



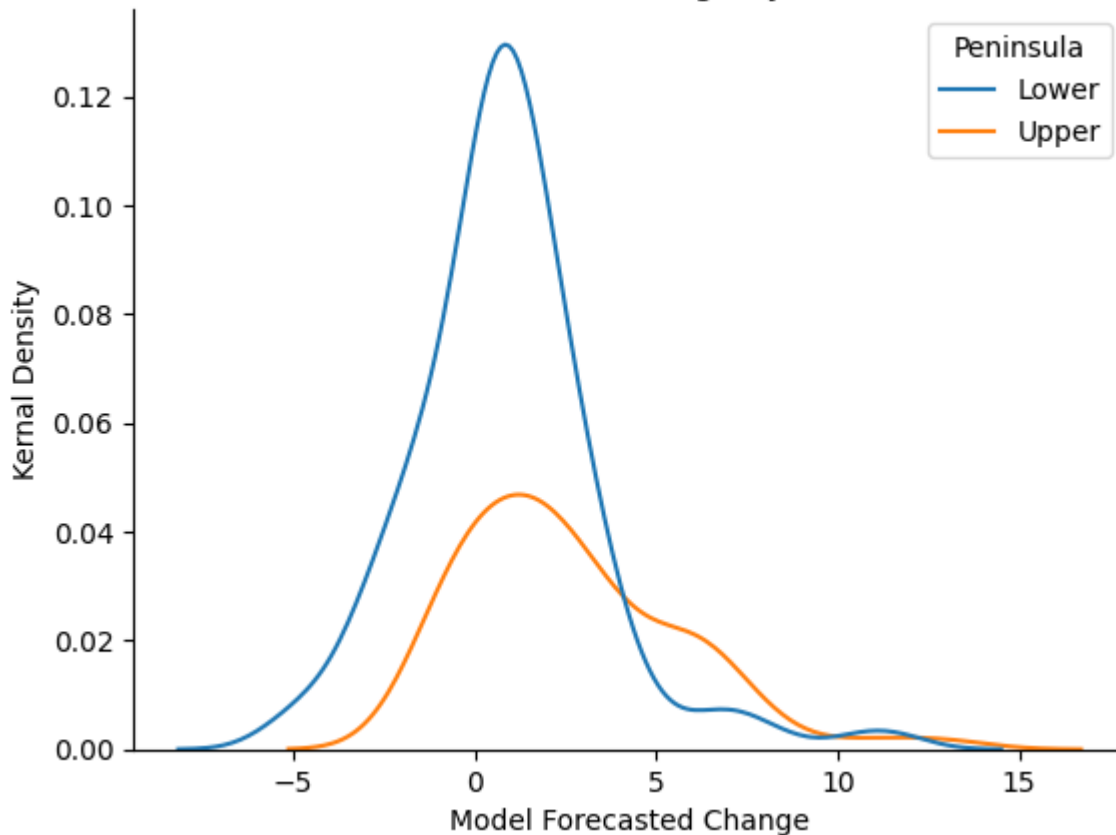
The following figure shows the aggregate average search interest for each calendar month. Both the Upper and Lower Peninsulas have a seasonal peak in July/August with the Lower Peninsula peak solidly in July.

The Upper Peninsula has higher values for January-March likely due to winter snow sports like snowmobiling. For the January-March forecast period, we should see search interest levels motivated by winter sports.



Finally, forecasts are determined by the forecasted place level change from the previous year based on weather and gasoline prices and the intercept capturing past trends. For both peninsulas, the most likely forecasted change from the previous year is positive. In fact, both distributions are right skewed with the Upper Peninsula very right skewed. The Upper Peninsula shows high impact to search interest due to winter sports. There is much more snow and cold weather forecasted this year than last year. (Note, however, that the final forecast numbers by peninsula are weighted by the size of the contribution of the place to total search interest.)

## Model Forecasted Change by Peninsula



### Places Impacted by Weather and Gas Prices

In addition to the above more aggregated analysis, I will now look at places that are impacted by weather and gasoline prices. (Many places are not impacted by these factors in the model and instead have an average increase or decrease year over year.) After identifying the places impacted by weather or gas prices, I then divide these places projected to have higher or lower search interest (on average) during the forecast months from the previous year. This is due to both the impact of weather and gasoline prices and the average trend year over year.

For the Northern Lower Peninsula, 88 of 142 places are impacted by weather or gasoline prices in the model. Of these, 56 are forecasted to have higher search interest during these three months than last year. The remaining are forecasted to have lower search interest than last year. These places are listed and the chart shows their yearly average search interest values for the three forecast months. Here, the vertical line signifies the start of the forecast period.

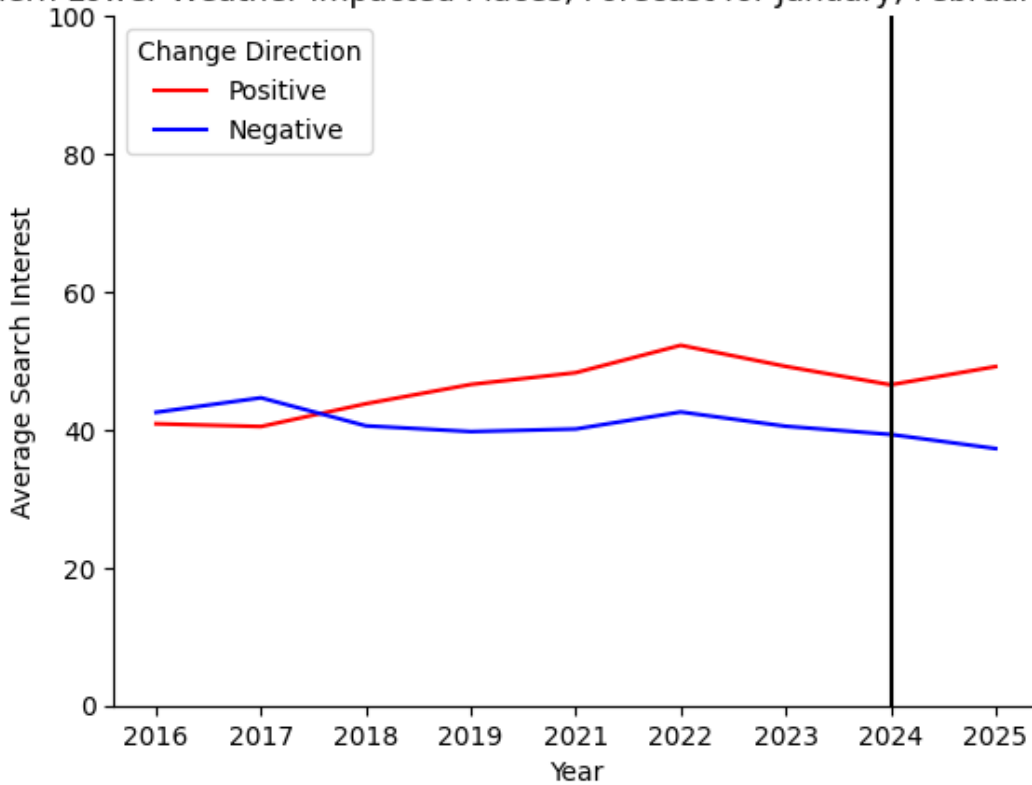
Northern Lower Places with Weather Impact Higher Interest than Last Year

['caberfae', 'leland', 'frankfort', 'crystal mountain', 'luther', 'elk rapids', 'bell aire', 'lake leelanau', 'charlevoix', 'lake city', 'manistee lake', 'indian river', 'grayling', 'fountain', 'arcadia', 'houghton lake', 'harrisville', 'boyne city', 'onaway', 'rose city', 'alanson', 'au gres', 'omena', 'benzonia', 'mesick', 'rogers city', 'omer', 'fife lake', 'standish', 'lupton', 'west branch', 'farwell', 'harrison', 'pellston', 'scottville', 'alpena', 'thompsonville', 'clare', 'kalkaska', 'cadillac', 'prudenville', 'lakes of the north', 'posen', 'boyne falls', 'free soil', 'harrietta', 'beaverton', 'gaylord', 'grawn', 'mancelona', 'jennings', 'reed city', 'advance', 'vanderbilt', 'turner', 'twining']

Northern Lower Places with Weather Impact Lower Interest than Last Year

['sand lake', 'ludington', 'mackinac', 'northport', 'suttons bay', 'traverse city', 'lake ann', 'manistee', 'east tawas', 'tawas city', 'custer', 'cedar', 'cross village', 'alden', 'elberta', 'maple city', 'ossineke', 'marion', 'ironton', 'central lake', 'wedgewood', 'oak hill', 'pilgrim', 'sterling', 'eastlake', 'lincoln', 'baldwin', 'norwood', 'alba', 'falmouth', 'chums corner', 'honor']

Northern Lower Weather Impacted Places, Forecast for January, February, and March



For the Upper Peninsula, 35 of 72 places are impacted by weather or gasoline prices in the model. Of these, 33 are forecasted to have higher search interest during these three months than last year. The remaining are forecasted to have lower search interest than last year. These places are listed and the chart shows their yearly average search interest values for the three forecast months. Here, the vertical line signifies the start of the forecast period.



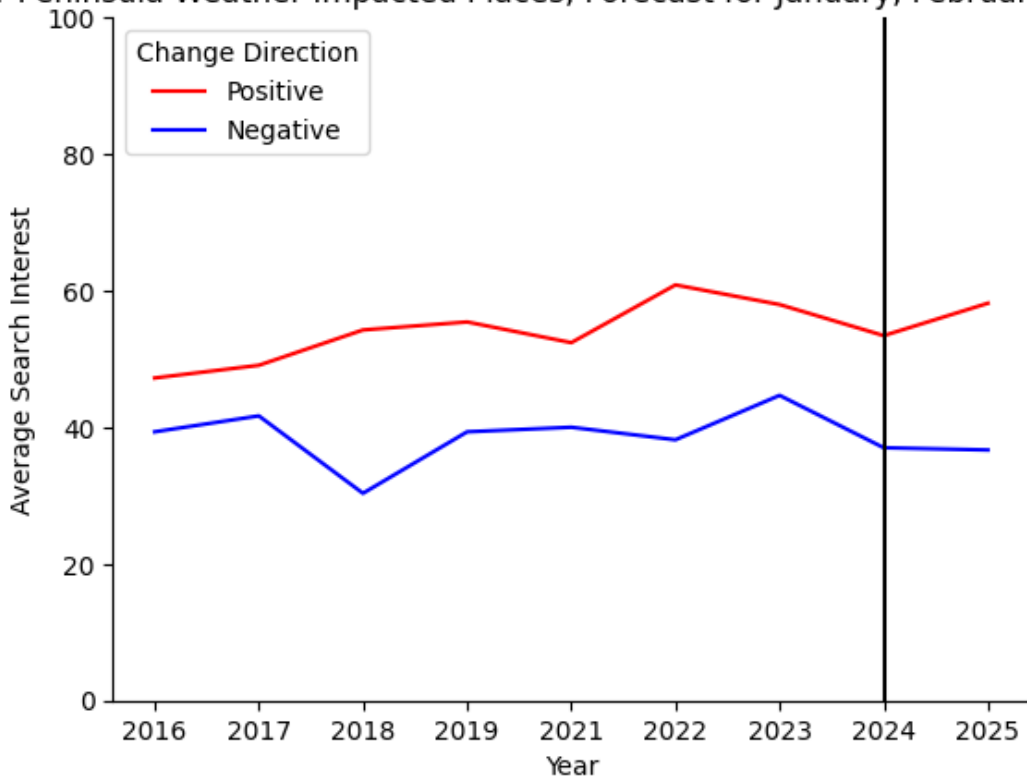
Upper Peninsula Places with Weather Impact Higher Interest than Last Year

['munising', 'ignace', 'newberry', 'sault', 'michigamme', 'houghton', 'gladstone', 'marquette', 'lake linden', 'kingsford', 'gwinn', 'mohawk', 'escanaba', 'ishpeming', 'hancock', 'watersmeet', 'rapid river', 'l'anse", 'menominee', 'bessemer', 'calumet', 'iron mountain', 'dollar bay', 'hubbell', 'laurium', 'rock', 'republic', 'ramsay', 'kincheloe', 'daggett', 'stephenson', 'caspian', 'south range']

Upper Peninsula Places with Weather Impact Lower Interest than Last Year

['bergland', 'harvey']

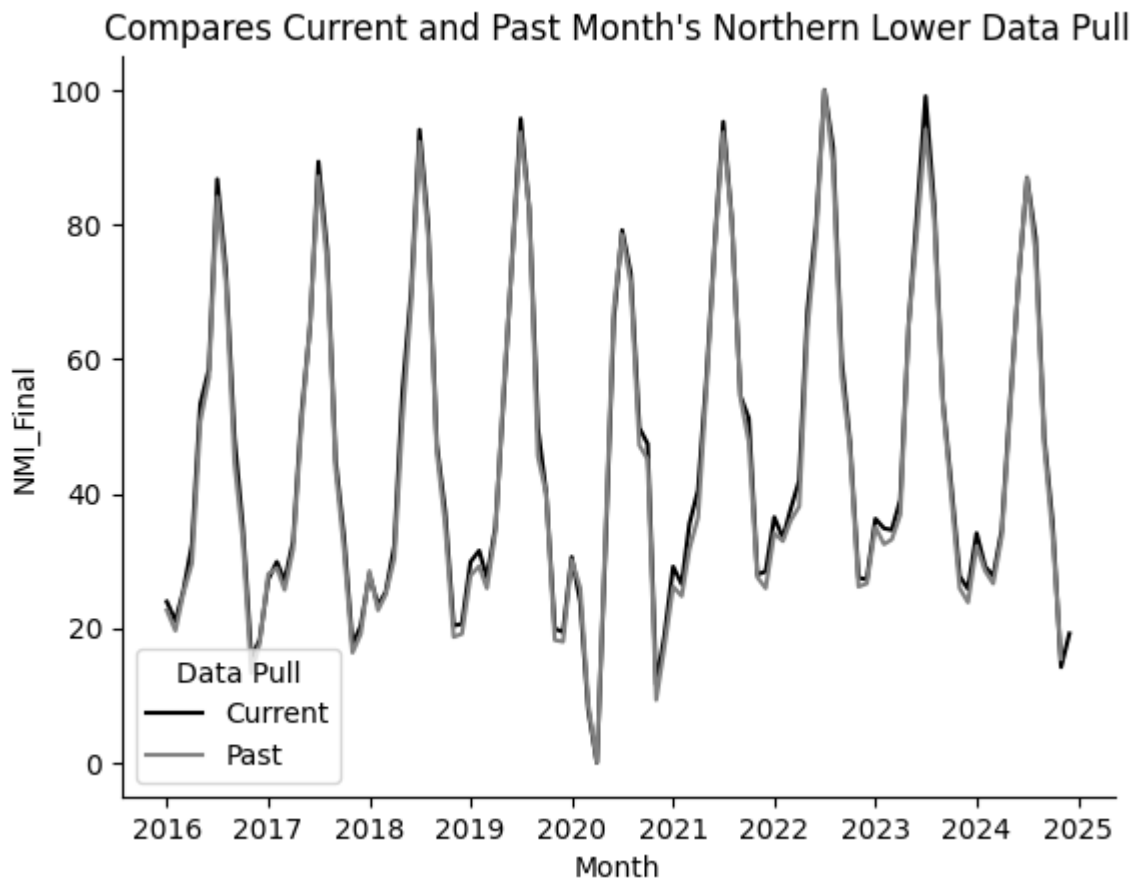
Upper Peninsula Weather Impacted Places, Forecast for January, February, and March



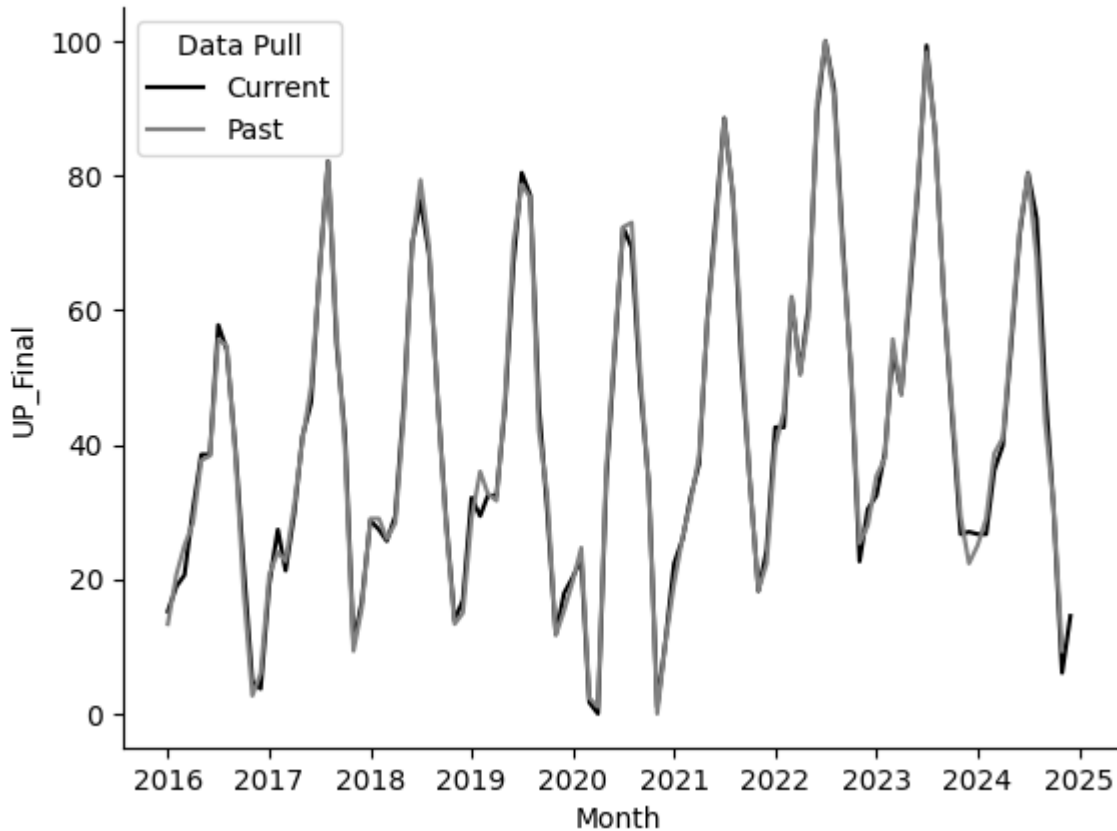
Data Variation and Weather Forecast Accuracy

In addition to what "should" impact search interest forecasts, there is also variation between search values pulled from Google trends. As I described in the original research for this project, search interest results will vary depending on whether you pull data using the pytrends package or from the Googletrends website. Pertinent to this project, results will also vary if you pull data using pytrends at different points in time. The severity of this difference changes from month to month.

While the most obvious solution to this problem is retaining historical values and keeping them constant, this is more difficult for Google trends data which is internally normalized. Thus, it's much easier to repull the entire series each time. I have a good idea of what my long term solution to this issue is, and I've started to save back each monthly data pull to help make it happen.



## Compares Current and Past Month's Upper Peninsula Data Pull



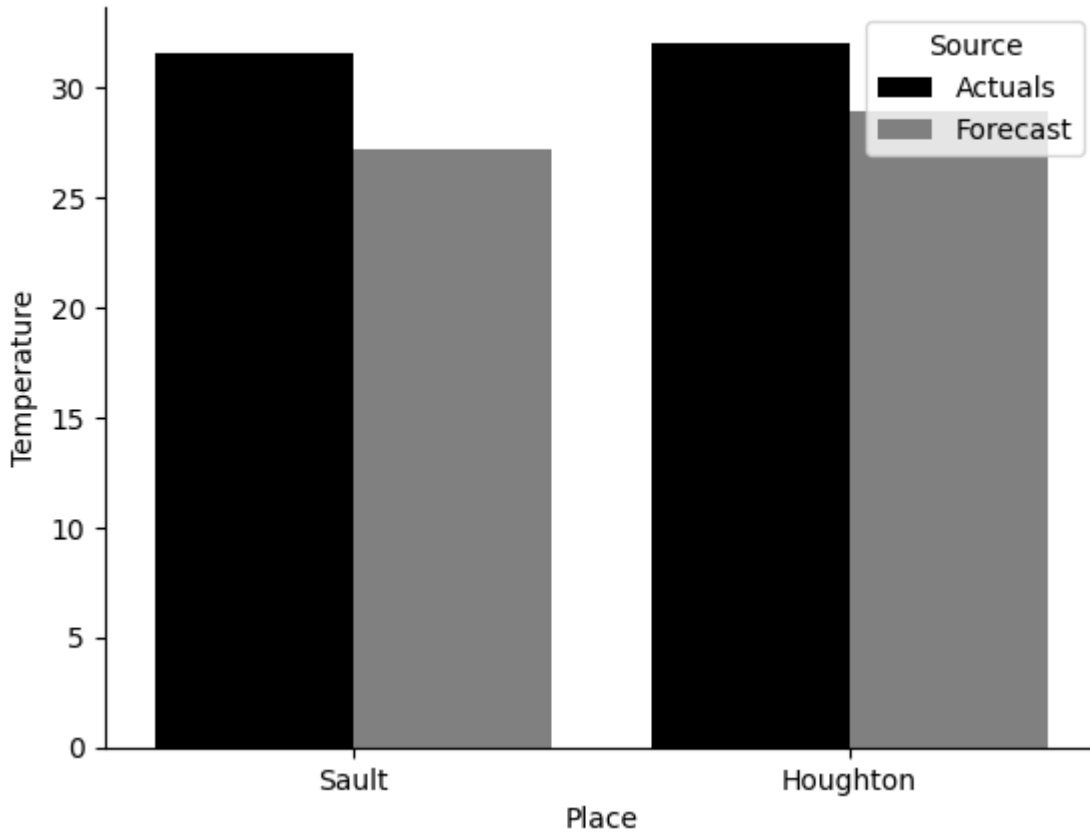
One last factor to consider is my source for weather forecasts, with a focus on temperature. All of my historical weather data used to train my models is from weather.gov. However, I source temperature forecasts from both weather.gov (average of averages) and accuweather (average maximums and average minimums). To some degree, it's difficult to compare these sources because average, maximum, and minimum temperatures are different statistics. Nonetheless, throughout this project, I've found that weather.gov usually forecasts above normal temperatures. To some extent I wonder if forecasts from a government agency are more likely to be high given politics surrounding issues like global warming.

Therefore, I will roughly track the one month forward predictive performance of the weather.gov and accuweather forecasts. First, I will look at the previous month's average temperature and determine if it actually was above historical normals. Next, I will compare the previous month's forecasted accuweather average max and min temperatures to actual values.

For December, the normal average temperature is 25.6 degrees for Houghton Lake and 22.0 degrees for Sault St Marie. The actual average temperature values were Houghton Lake 27.2 and Sault St Marie 26.1. So actual temperatures were higher than normals for December.

Based on the accuweather forecasts, we see that both maximum and minimum temperatures were higher than forecasted.

Comparison of Average Maximum Temperatures for Previous Month



Comparison of Average Minimum Temperatures for Previous Month

