project1_weather_final

March 19, 2022

1 Use SQL to get data from database

1.0.1 Show all cities in Japan

```
select *
from city_list
where country = 'Japan';
```

1.0.2 Get Nagoya-Japan data

```
select *
from city_data
where country = 'Japan'
 and city='Nagoya';
```

1.1 Get Global data

```
select *
from global_data ;
```

2 Load CSV to dataframe and check its information (missing data, column name)

[76]:
```
import pandas as pd
from os import path

from pandas import DataFrame

csv_folder = '/Users/lskd007/PycharmProjects/learn_data_analyst/csv'
# load global data
df_global = pd.read_csv(path.join(csv_folder, 'global_data.csv'))
df_global.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 266 entries, 0 to 265
Data columns (total 2 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
```

```
 0   year      266 non-null    int64
 1   avg_temp  266 non-null    float64
dtypes: float64(1), int64(1)
memory usage: 4.3 KB
```

3 Load Nagoya data to dataframe, clean missing data

[77]:
```
# load local data
df_local = pd.read_csv(path.join(csv_folder, 'nagoya_data.csv'))
df_local.dropna(inplace=True)
# check data
df_local.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 171 entries, 0 to 172
Data columns (total 4 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   year      171 non-null    int64
 1   city      171 non-null    object
 2   country   171 non-null    object
 3   avg_temp  171 non-null    float64
dtypes: float64(1), int64(1), object(2)
memory usage: 6.7+ KB
```

4 Check outlier –> It's OK

[78]:
```
# check outlier
print(df_local.avg_temp.min(), df_local.avg_temp.max())
print(df_global.avg_temp.min(), df_global.avg_temp.max())
```

```
13.43 16.45
5.78 9.83
```

5 Check min max average temperature

[79]:
```
# check max min years
df_local.sort_values('avg_temp').iloc[[0,-1]]
```

[79]:

	year	city	country	avg_temp
3	1844	Nagoya	Japan	13.43
157	1998	Nagoya	Japan	16.45

[80]:
```
# check max min years
df_global.sort_values('avg_temp').iloc[[0,-1]]
```

[80]:
```
      year  avg_temp
2     1752      5.78
265   2015      9.83
```

6 Calculate 5 years moving average

ex : print(df_global[‘avg_temp’].head(5).mean())

[81]:
```
# Moving average 5 years
df_global['moving_avg'] = df_global.avg_temp.rolling(window=5).mean()
df_global
```

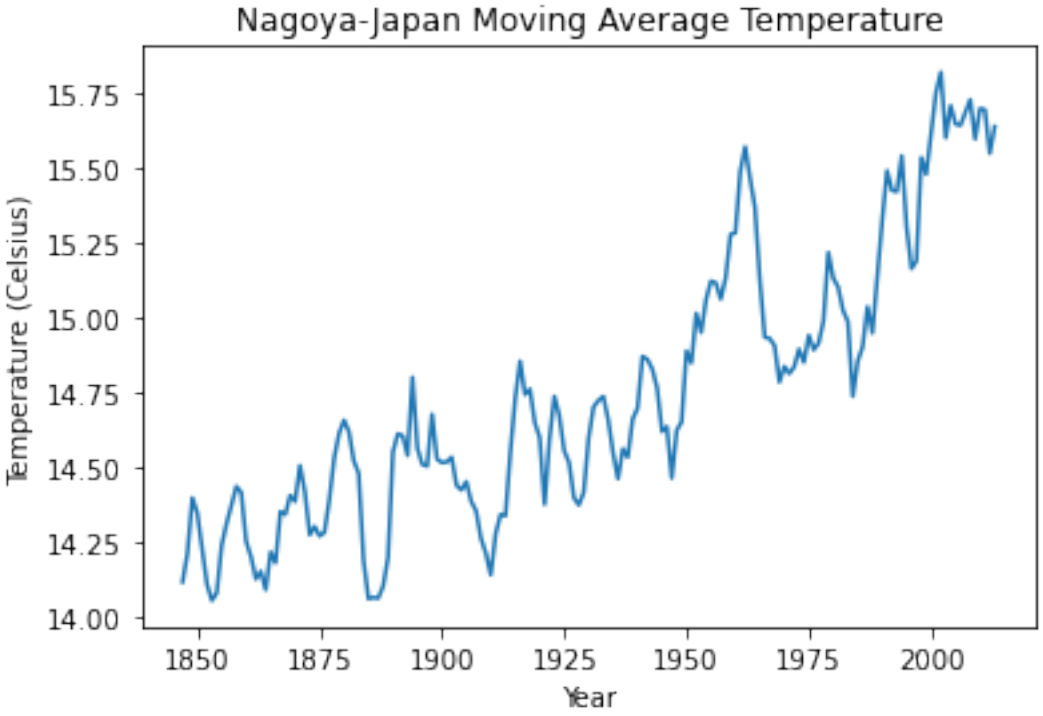
[81]:
```
      year  avg_temp  moving_avg
0     1750      8.72         NaN
1     1751      7.98         NaN
2     1752      5.78         NaN
3     1753      8.39         NaN
4     1754      8.47       7.868
..     …        …           …
261   2011      9.52       9.578
262   2012      9.51       9.534
263   2013      9.61       9.570
264   2014      9.57       9.582
265   2015      9.83       9.608

[266 rows x 3 columns]
```

[82]:
```
df_local['moving_avg'] = df_local['avg_temp'].rolling(window=5).mean()
df_local
```

[82]:
```
      year    city country  avg_temp  moving_avg
0     1841  Nagoya   Japan     13.90         NaN
3     1844  Nagoya   Japan     13.43         NaN
4     1845  Nagoya   Japan     14.20         NaN
5     1846  Nagoya   Japan     14.54         NaN
6     1847  Nagoya   Japan     14.50      14.114
..     …      …      …        …          …
168   2009  Nagoya   Japan     15.67      15.598
169   2010  Nagoya   Japan     15.87      15.700
170   2011  Nagoya   Japan     15.43      15.696
171   2012  Nagoya   Japan     15.21      15.550
172   2013  Nagoya   Japan     16.02      15.640

[171 rows x 5 columns]
```

7 Nagoya city 5 years moving average line chart

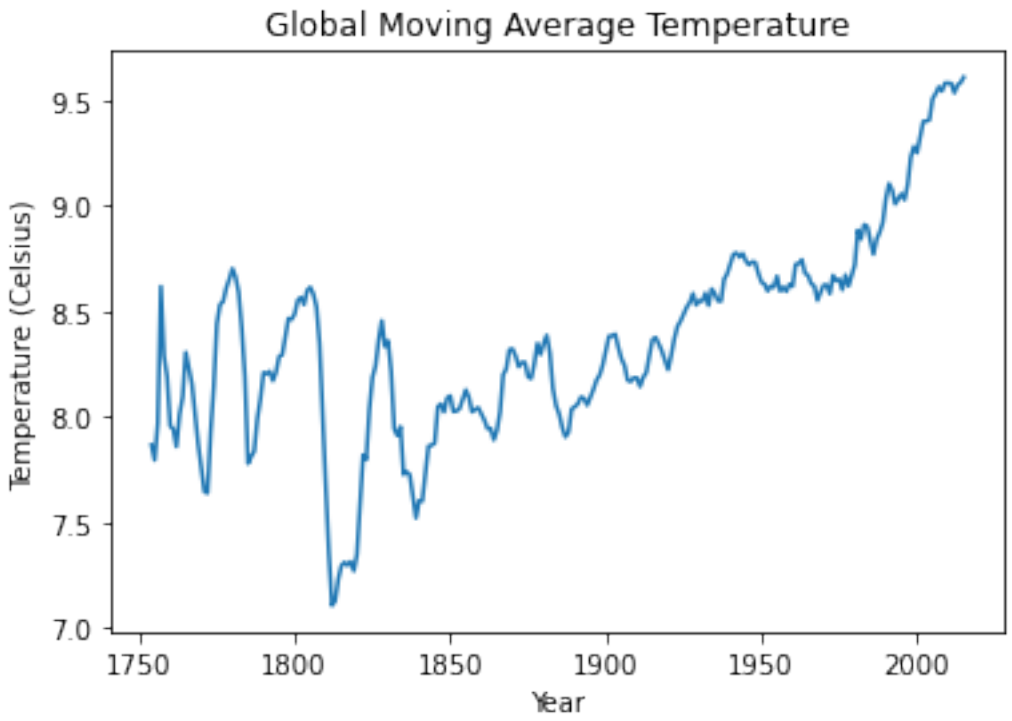
[83]:
```
import matplotlib.pyplot as plt

plt.plot(df_local['year'], df_local['moving_avg'])
plt.title("Nagoya-Japan Moving Average Temperature")
plt.xlabel("Year")
plt.ylabel("Temperature (Celsius)")
plt.show()
```



- From 1844 to 1998 temperature is on up-trend.
- The bottom is 1844, the top is 1998. after 1998 the temperature seems go down-trend or maybe side-way.

8 Global 5 years moving average Line chart

[84]:
```
plt.plot(df_global['year'], df_global['moving_avg'])
plt.title("Global Moving Average Temperature")
plt.xlabel("Year")
plt.ylabel("Temperature (Celsius)")
plt.show()
```



- Around 1750 to 1850 , the temperature is a little down-trend.
- From 1850 to current , the temperature is on up-trend, and there is no sign that this trend will stop.
- the bottom is 1752, the top is 2015.

9 Show all data in the same line chart

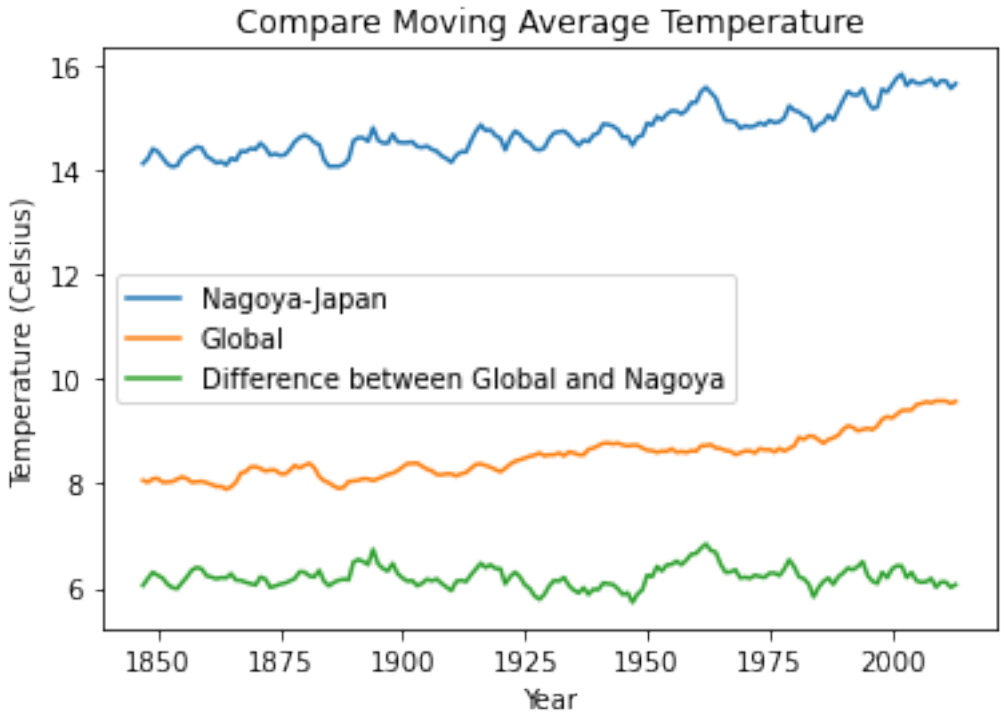
[85]:
```
# compare 2 lines chart
df_join = pd.merge(df_global, df_local, left_on='year', right_on='year')
df_join.dropna(inplace=True)
df_join
```

[85]:

	year	avg_temp_x	moving_avg_x	city	country	avg_temp_y	moving_avg_y
4	1847	8.09	8.062	Nagoya	Japan	14.50	14.114
5	1848	7.98	8.024	Nagoya	Japan	14.38	14.210
6	1849	7.98	8.090	Nagoya	Japan	14.36	14.396
7	1850	7.90	8.100	Nagoya	Japan	13.95	14.346
8	1851	8.18	8.026	Nagoya	Japan	13.93	14.224
..	…	…	…	…	…	…	…
166	2009	9.51	9.580	Nagoya	Japan	15.67	15.598
167	2010	9.70	9.580	Nagoya	Japan	15.87	15.700
168	2011	9.52	9.578	Nagoya	Japan	15.43	15.696
169	2012	9.51	9.534	Nagoya	Japan	15.21	15.550

```
170  2013         9.61          9.570  Nagoya    Japan        16.02         15.640

[167 rows x 7 columns]
```

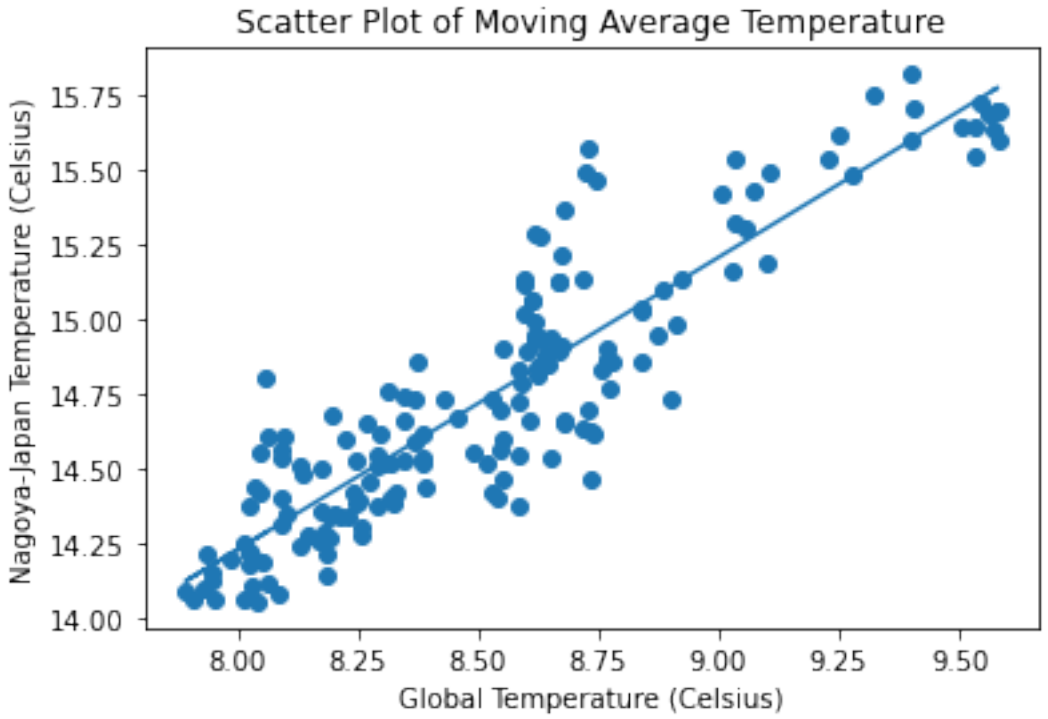
[86]:
```
x = df_join.year
global_y = df_join.moving_avg_x
nagoya_y = df_join.moving_avg_y
diff_y = nagoya_y - global_y
plt.plot(x, nagoya_y, label="Nagoya-Japan")
plt.plot(x, global_y, label="Global")
plt.plot(x, diff_y, label="Difference between Global and Nagoya")
plt.title("Compare Moving Average Temperature")
plt.xlabel("Year")
plt.ylabel("Temperature (Celsius)")
plt.legend()
plt.show()
```



[86]:

10 Scatter plot and regression line

[87]:
```
# Draw Scatter plot to see correlation of two
from numpy.polynomial.polynomial import polyfit
plt.scatter(global_y, nagoya_y)
plt.title("Scatter Plot of Moving Average Temperature")
plt.xlabel("Global Temperature (Celsius)")
plt.ylabel("Nagoya-Japan Temperature (Celsius)")
# line regression
b, m = polyfit(global_y, nagoya_y, 1)
plt.plot(global_y, m * global_y + b)
plt.show()
```



- Global and Nagoya temperature trend is similar. correlation is positive. It means that when Global temperature move up , the temperature in Nagoya will do the same.

11 How to estimate Nagoya temperature from Global temperature

[88]:
```
print(f'nagoya_temperature = {m} * global_temperature + {b}')
```

```
nagoya_temperature = 0.9807632352516298 * global_temperature + 6.380719042560417
```

12 Correlation is strong positive (corr=0.9)

[89]:
```
# calculate correlation
df_join['moving_avg_x'].corr(df_join['moving_avg_y'])
```

[89]:
```
0.9034757602350102
```

13 Conclusion

Almost the time the temperature of Global and Nagoya are increase year by year. But from 1998 , temperature in Nagoya seems going down. We can use below formular to estimate Nagoya temperature from Global temperature:

```
nagoya_temperature = 0.9807632352516298 * global_temperature + 6.380719042560417
```

13.1 Different

- From 1998 to current: Nagoya : Down-trend or side-way Global : Up-trend

13.2 Similar

- From 1844 To 1998: Nagoya : Up-trend Global : Up-trend

[89]:
```

```