weather_trend

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0.1 Exploring Weather Trends

Summary In this project, it will be analyzed the weather trends in order to check the similarities and changes in the weather between the city of Campinas (Brazil) and the average weather in the world on the period from 1832 and 2013. The two dataframes used in this study were retrieved from Udacity's database and exported as CSV files for analysis in this notebook.

Tools To analyze weather trends it will be used the following tools: pandas to data analyzes, matplotlib to plot the charts, sql to retrieve data from the database.

Sql comands The following commands were used to get the data from the database:

- select from global_data;
- select from city_data where city = 'Campinas';

0.1.1 Import libraries

```
In [0]: import pandas as pd
        import matplotlib.pyplot as plt
        from matplotlib.pyplot import figure
        print('imports completed')
```

```
imports completed
```

Load dataframes

```
In [0]: city_data_url = 'https://raw.githubusercontent.com/marcussimoni/dand-p1-whether-trends/
        global_data_url = 'https://raw.githubusercontent.com/marcussimoni/dand-p1-whether-trend

        city_data = pd.read_csv(city_data_url, sep=',')
        global_data = pd.read_csv(global_data_url, sep=',')

        print('global dataframe and city dataframe created')
```

```
global dataset and city dataset created
```

Preparing data to analyze A quick check shows some null values in the city_data dataframe and we will need to correct them before we start the study. Altogether the dataframe have 182 values in columns year, city and country but only 175 in column avg_temp. We'll fill the null values with the mean of avg_temp columns of the city_data dataframe. After the update, the total from avg_temp column will match with the other columns of the dataframe.

```
In [0]: city_data.info();
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 182 entries, 0 to 181
Data columns (total 4 columns):
year        182 non-null int64
city        182 non-null object
country     182 non-null object
avg_temp    175 non-null float64
dtypes: float64(1), int64(1), object(2)
memory usage: 5.8+ KB
```

```
In [0]: city_data[city_data.isnull().any(axis=1)]
```

```
Out[0]:     year      city country  avg_temp
        12  1844  Campinas  Brazil       NaN
        13  1845  Campinas  Brazil       NaN
        14  1846  Campinas  Brazil       NaN
        15  1847  Campinas  Brazil       NaN
        16  1848  Campinas  Brazil       NaN
        17  1849  Campinas  Brazil       NaN
        18  1850  Campinas  Brazil       NaN
```

```
In [0]: city_data['avg_temp'].fillna(city_data['avg_temp'].mean(), inplace=True)
```

city_data dataframe after replace null values

```
In [0]: city_data.info();
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 182 entries, 0 to 181
Data columns (total 4 columns):
year        182 non-null int64
city        182 non-null object
country     182 non-null object
avg_temp    182 non-null float64
dtypes: float64(1), int64(1), object(2)
memory usage: 5.8+ KB
```

We check the global_data too to confirm the existence of inconsistencies. Apparently, all values are correct.

```
In [0]: global_data.info();

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 266 entries, 0 to 265
Data columns (total 2 columns):
year        266 non-null int64
avg_temp    266 non-null float64
dtypes: float64(1), int64(1)
memory usage: 4.2 KB
```

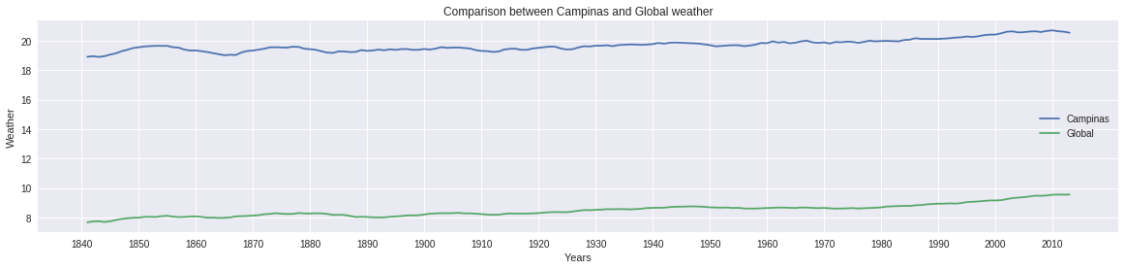
The number of lines in the two dataframes was different: the global_data dataframe has 266 rows and the city_data dataframe has 182 rows. It was necessary to equalize the total of rows in the two dataframes before display the line chart. To do that was necessary to use the same range of years on the two dataframes: between 1832 and 2013. That is the year range present on the city_data dataframe.

```
In [0]: city_data.describe()

Out[0]:                year    avg_temp
        count   182.000000  182.000000
        mean   1922.500000   19.700057
        std      52.683014    0.582299
        min    1832.000000   18.280000
        25%    1877.250000   19.252500
        50%    1922.500000   19.700057
        75%    1967.750000   20.077500
        max    2013.000000   21.300000

In [0]: global_data.describe()

Out[0]:                year    avg_temp
        count   266.000000  266.000000
        mean   1882.500000    8.369474
        std      76.931788    0.584747
        min    1750.000000    5.780000
        25%    1816.250000    8.082500
        50%    1882.500000    8.375000
        75%    1948.750000    8.707500
        max    2015.000000    9.830000

In [0]: #filtering rows to match with city_data dataframe
        global_data = global_data.query('year >= 1832 and year <= 2013')
```

The next step after preparing the data in the two dataframes is to calculate the moving average for the avg_temp column and to plot a line chart comparing the two calculated values. The moving averange will be calculated using the rolling method from pandas with the parameter window set to 10. The line chart will be plotted using matplotlib.

```
In [0]: #select year from city_data dataframe
        years = city_data['year'];

        moving_average = 10

        #calculating moving average with pandas
        city_weather = city_data['avg_temp'].rolling(window = moving_average).mean();
        global_weather = global_data['avg_temp'].rolling(window = moving_average).mean();
```

```
In [0]: #plot the data

        figure(figsize=(20,4))
        plt.plot(years, city_weather, label='Campinas');

        plt.plot(years, global_weather, label='Global');

        plt.xlabel('Years');
        plt.ylabel('Weather');
        plt.xticks(city_data.query('year % 10 == 0')['year'])
        plt.title('Comparison between Campinas and Global weather');
        plt.legend();
        plt.show();
```




```
In [0]: #mean weather from 1832 until 2013
        print('Weather mean in Campinas %.2fř' % city_data['avg_temp'].mean())
        print('Weather mean in World %.2fř' % global_data['avg_temp'].mean())
```

```
Weather mean in Campinas 19.70ř
Weather mean in World 8.49ř
```

We can make some observations from the chart:

- Campinas weather is hotter than the average of the world. the mean is around 19,70ř in Campinas and 8,49ř in the rest of the world.
- In the early years, it seems the weather to be cooler than newer days as we can see comparing the years 1840 until 2010 in the chart. The temperature seems to be increasing, not only in the city chosen for this study but in the whole world.

- The minimum temperature for Campinas is 18.28ř and 5.78ř to the world. The maximum is 21.3ř and 9.83ř respectively.