Teclov_Visualising_Time_Series_Data

March 24, 2020

1 Teclov : Visualising Time Series Data

In the section, we will explore ways to visualise data gathered over time. We will: - Plot simple time series plots - Derive variables such as month and year and use them for richer visualisations

[1]:

```
# loading libraries and reading the data

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# set seaborn theme if you prefer
sns.set(style="white")

# read data
market_df = pd.read_csv("./global_sales_data/market_fact.csv")
customer_df = pd.read_csv("./global_sales_data/cust_dimen.csv")
product_df = pd.read_csv("./global_sales_data/prod_dimen.csv")
shipping_df = pd.read_csv("./global_sales_data/shipping_dimen.csv")
orders_df = pd.read_csv("./global_sales_data/orders_dimen.csv")
```

1.1 Visualising Simple Time Series Data

Let's say you want to visualise numeric variables such as `Sales`, `Profit`, `Shipping_Cost` etc. over time.

[2]:

```
market_df.head()
```

[2]:

```
     Ord_id  Prod_id   Ship_id    Cust_id    Sales  Discount  Order_Quantity  \
0  Ord_5446  Prod_16  SHP_7609  Cust_1818   136.81      0.01              23
1  Ord_5406  Prod_13  SHP_7549  Cust_1818    42.27      0.01              13
2  Ord_5446   Prod_4  SHP_7610  Cust_1818  4701.69      0.00              26
3  Ord_5456   Prod_6  SHP_7625  Cust_1818  2337.89      0.09              43
4  Ord_5485  Prod_17  SHP_7664  Cust_1818  4233.15      0.08              35

   Profit  Shipping_Cost  Product_Base_Margin
0  -30.51           3.60                 0.56
```

```
1     4.56           0.93                 0.54
2  1148.90           2.50                 0.59
3   729.34          14.30                 0.37
4  1219.87          26.30                 0.38
```

Since the `Order_Date` variable is in the orders dataframe, let's merge it.

```
[3]: # merging with the Orders data to get the Date column
     df = pd.merge(market_df, orders_df, how='inner', on='Ord_id')
     df.head()
```

```
[3]:      Ord_id  Prod_id   Ship_id    Cust_id    Sales  Discount  Order_Quantity  \
     0  Ord_5446  Prod_16  SHP_7609  Cust_1818   136.81      0.01              23
     1  Ord_5446   Prod_4  SHP_7610  Cust_1818  4701.69      0.00              26
     2  Ord_5446   Prod_6  SHP_7608  Cust_1818   164.02      0.03              23
     3  Ord_5406  Prod_13  SHP_7549  Cust_1818    42.27      0.01              13
     4  Ord_5456   Prod_6  SHP_7625  Cust_1818  2337.89      0.09              43

         Profit  Shipping_Cost  Product_Base_Margin  Order_ID  Order_Date  \
     0   -30.51           3.60                 0.56     36262  27-07-2010
     1  1148.90           2.50                 0.59     36262  27-07-2010
     2   -47.64           6.15                 0.37     36262  27-07-2010
     3     4.56           0.93                 0.54     20513  07-07-2009
     4   729.34          14.30                 0.37     39682  09-11-2010

       Order_Priority
     0  NOT SPECIFIED
     1  NOT SPECIFIED
     2  NOT SPECIFIED
     3           HIGH
     4         MEDIUM
```

```
[4]: # Now we have the Order_Date in the df
     # It is stored as a string (object) currently
     df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 8399 entries, 0 to 8398
Data columns (total 13 columns):
Ord_id                 8399 non-null object
Prod_id                8399 non-null object
Ship_id                8399 non-null object
Cust_id                8399 non-null object
Sales                  8399 non-null float64
Discount               8399 non-null float64
Order_Quantity         8399 non-null int64
Profit                 8399 non-null float64
Shipping_Cost          8399 non-null float64
```

```
Product_Base_Margin    8336 non-null float64
Order_ID               8399 non-null int64
Order_Date             8399 non-null object
Order_Priority         8399 non-null object
dtypes: float64(5), int64(2), object(6)
memory usage: 918.6+ KB
```

Since Order_Date is a string, we need to convert it into a datetime object. You can do that using pd.to_datetime().

[5]:

```
# Convert Order_Date to datetime type
df['Order_Date'] = pd.to_datetime(df['Order_Date'])

# Order_Date is now datetime type
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 8399 entries, 0 to 8398
Data columns (total 13 columns):
Ord_id                 8399 non-null object
Prod_id                8399 non-null object
Ship_id                8399 non-null object
Cust_id                8399 non-null object
Sales                  8399 non-null float64
Discount               8399 non-null float64
Order_Quantity         8399 non-null int64
Profit                 8399 non-null float64
Shipping_Cost          8399 non-null float64
Product_Base_Margin    8336 non-null float64
Order_ID               8399 non-null int64
Order_Date             8399 non-null datetime64[ns]
Order_Priority         8399 non-null object
dtypes: datetime64[ns](1), float64(5), int64(2), object(5)
memory usage: 918.6+ KB
```

Now, since on each day, multiple orders were placed, we need to aggregate Sales using a metric such as mean, median etc., and then create a time series plot.

We will group by Order_Date and compute the sum of Sales on each day.

[6]:

```
# aggregating total sales on each day
time_df = df.groupby('Order_Date')['Sales'].sum()
print(time_df.head())

print(type(time_df))
```

```
Order_Date
2009-01-01    1052.8400
2009-01-02    5031.9000
2009-01-03    7288.1375
```

```
2009-01-04    6188.4245
2009-01-05    2583.3300
Name: Sales, dtype: float64
<class 'pandas.core.series.Series'>
```

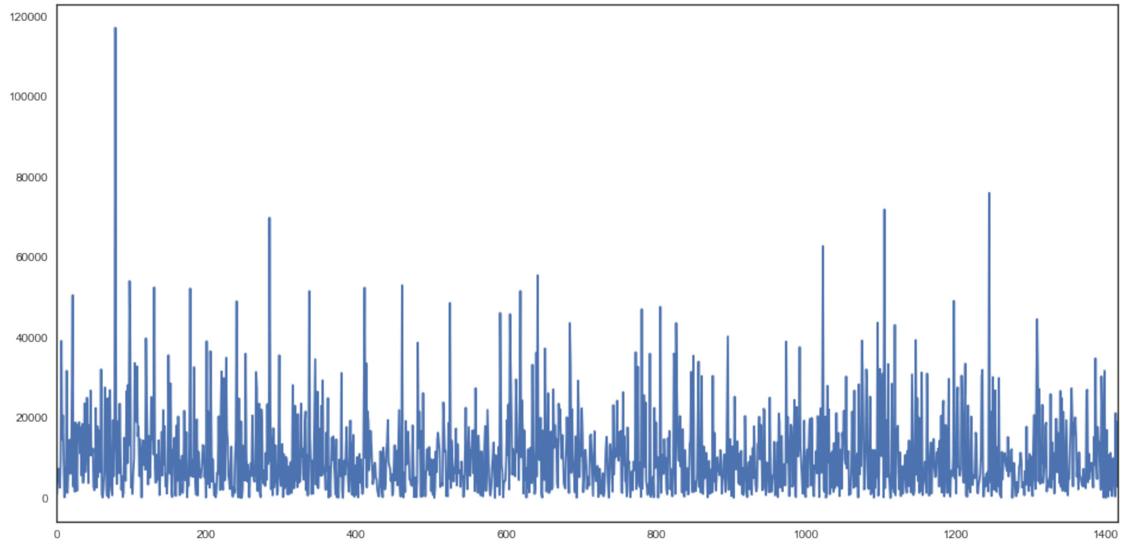
We can now create a time-series plot using `sns.tsplot()`.

[7]:
```
# time series plot

# figure size
plt.figure(figsize=(16, 8))

# tsplot
sns.tsplot(data=time_df)
plt.show()
```

```
/Users/shivank/anaconda/lib/python3.5/site-packages/seaborn/timeseries.py:183:
UserWarning: The tsplot function is deprecated and will be removed or replaced
(in a substantially altered version) in a future release.
  warnings.warn(msg, UserWarning)
```



1.1.1 Using Derived Date Metrics for Visualisation

It is often helpful to use derived variables from date such as month and year and using them to identify hidden patterns.

[8]:
```
# extracting month and year from date

# extract month
df['month'] = df['Order_Date'].dt.month
```

```
# extract year
df['year'] = df['Order_Date'].dt.year

df.head()
```

[8]:

```
     Ord_id  Prod_id   Ship_id    Cust_id    Sales  Discount  Order_Quantity  \
0  Ord_5446  Prod_16  SHP_7609  Cust_1818   136.81      0.01              23
1  Ord_5446   Prod_4  SHP_7610  Cust_1818  4701.69      0.00              26
2  Ord_5446   Prod_6  SHP_7608  Cust_1818   164.02      0.03              23
3  Ord_5406  Prod_13  SHP_7549  Cust_1818    42.27      0.01              13
4  Ord_5456   Prod_6  SHP_7625  Cust_1818  2337.89      0.09              43

    Profit  Shipping_Cost  Product_Base_Margin  Order_ID Order_Date  \
0   -30.51           3.60                 0.56     36262 2010-07-27
1  1148.90           2.50                 0.59     36262 2010-07-27
2   -47.64           6.15                 0.37     36262 2010-07-27
3     4.56           0.93                 0.54     20513 2009-07-07
4   729.34          14.30                 0.37     39682 2010-09-11

  Order_Priority  month  year
0  NOT SPECIFIED      7  2010
1  NOT SPECIFIED      7  2010
2  NOT SPECIFIED      7  2010
3           HIGH      7  2009
4         MEDIUM      9  2010
```

Now you can plot the average sales across years and months.

[9]:

```
# grouping by year and month
df_time = df.groupby(["year", "month"]).Sales.mean()
df_time.head()
```

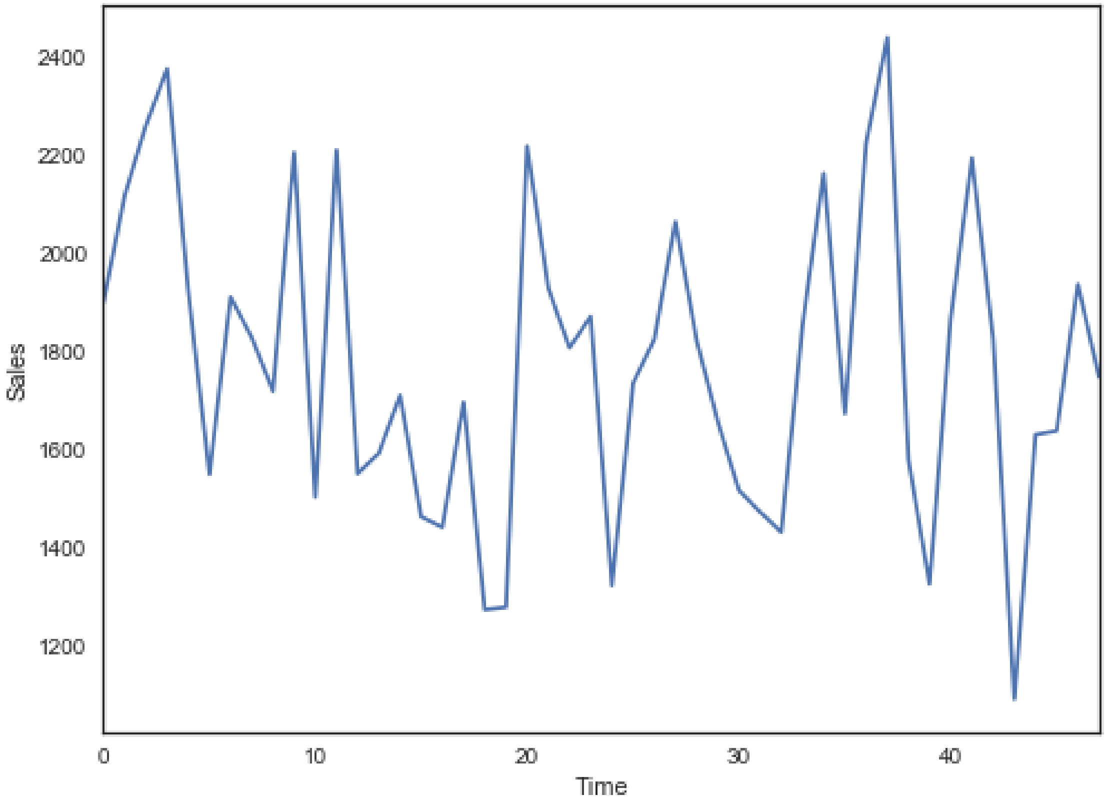
[9]:

```
year  month
2009  1        1898.475090
      2        2116.510723
      3        2258.661599
      4        2374.155868
      5        1922.317055
Name: Sales, dtype: float64
```

[10]:

```
plt.figure(figsize=(8, 6))
# time series plot
sns.tsplot(df_time)
plt.xlabel("Time")
plt.ylabel("Sales")
plt.show()
```

```
/Users/shivank/anaconda/lib/python3.5/site-packages/seaborn/timeseries.py:183:
UserWarning: The tsplot function is deprecated and will be removed or replaced
(in a substantially altered version) in a future release.
  warnings.warn(msg, UserWarning)
```



There is another way to visualise numeric variables, such as `Sales`, across the year and month. We can pivot the `month` column to create a wide-format dataframe, and then plot a heatmap.

[11]:

```
# Pivoting the data using 'month'
year_month = pd.pivot_table(df, values='Sales', index='year', columns='month',␣
 ↪aggfunc='mean')
year_month.head()
```

[11]:

```
month            1            2            3            4            5  \
year
2009   1898.475090  2116.510723  2258.661599  2374.155868  1922.317055
2010   1549.664361  1591.532297  1708.934944  1461.935539  1440.393540
2011   1321.671562  1733.378070  1822.860614  2062.716921  1822.033936
2012   2220.831551  2438.166961  1578.284028  1325.253694  1865.744629

month            6            7            8            9           10  \
year
```

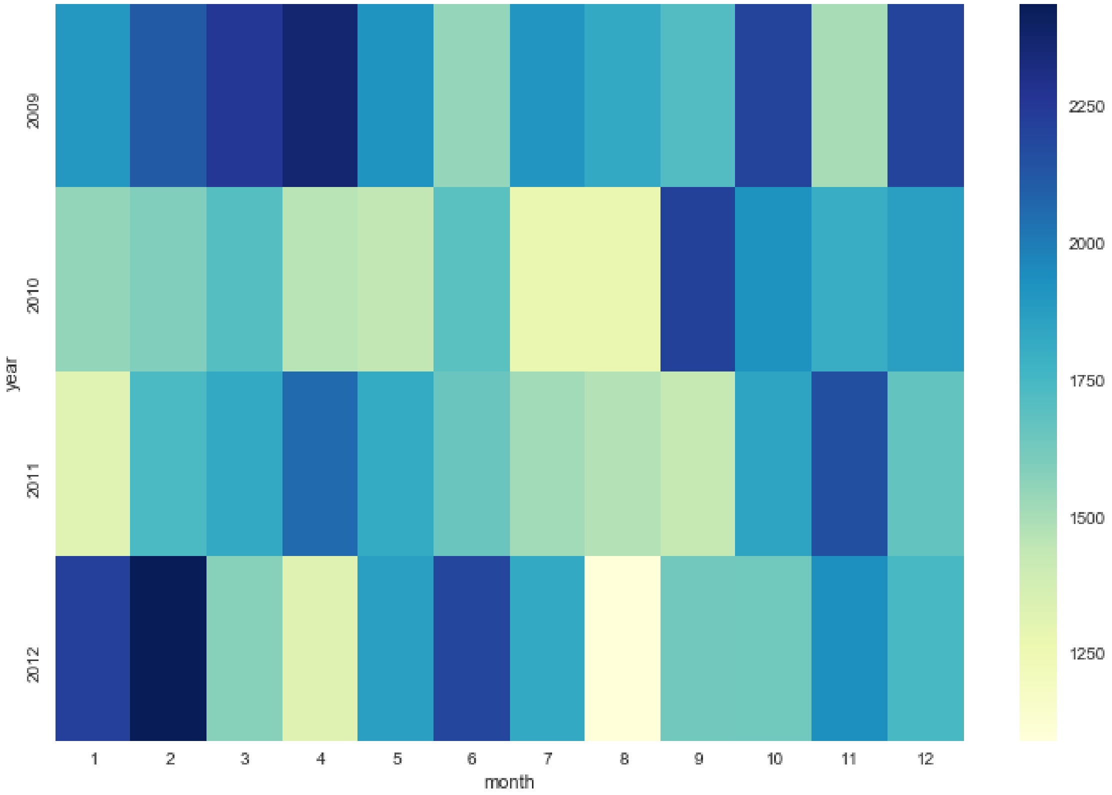
```
2009    1548.093259  1909.084469  1827.095921  1717.295494  2203.961070
2010    1695.397085  1272.653408  1277.917503  2216.599136  1927.250907
2011    1655.599644  1515.576260  1471.700741  1430.616748  1851.404564
2012    2192.228263  1824.935942  1090.950643  1628.963780  1636.951775

month            11           12
year
2009    1502.192743  2209.047484
2010    1806.324648  1869.720956
2011    2161.479056  1672.187881
2012    1935.183039  1747.047528
```

You can now create a heatmap using `sns.heatmap()`.

[12]:
```
# figure size
plt.figure(figsize=(12, 8))

# heatmap with a color map of choice
sns.heatmap(year_month, cmap="YlGnBu")
plt.show()
```



1.1.2 Addtional Reading on Time Series Plots and Heatmaps

1. Seaborn heatmaps (documentation)