uyencode-Copy2

September 24, 2021

```
In [1]: import pandas as pd
        from pandas.plotting import autocorrelation_plot
        import numpy as np
        import matplotlib.pyplot as plt
        import seaborn as sns
        import plotly.graph_objects as go
        from statsmodels.tsa.seasonal import seasonal_decompose #library for time series analy
        from statsmodels.tsa.stattools import adfuller
        from statsmodels.tsa.arima_model import ARIMA
        import statsmodels
        statsmodels.__version__

Out[1]: '0.12.0'

In [6]: df = pd.read_csv('dataset_2017_2020.csv')
        df["year"] = df.transaction_date.dt.year


        ---------------------------------------------------------------------------

        AttributeError                            Traceback (most recent call last)

        <ipython-input-6-6e825a347b5d> in <module>
          1 df = pd.read_csv('dataset_2017_2020.csv')
    ----> 2 df["year"] = df.transaction_date.dt.year


        /usr/lib/python3.7/site-packages/pandas/core/generic.py in __getattr__(self, name)
       5130             or name in self._accessors
       5131         ):
    -> 5132             return object.__getattribute__(self, name)
       5133         else:
       5134             if self._info_axis._can_hold_identifiers_and_holds_name(name):


        /usr/lib/python3.7/site-packages/pandas/core/accessor.py in __get__(self, obj, cls)
        185             # we're accessing the attribute of the class, i.e., Dataset.geo
        186             return self._accessor
```

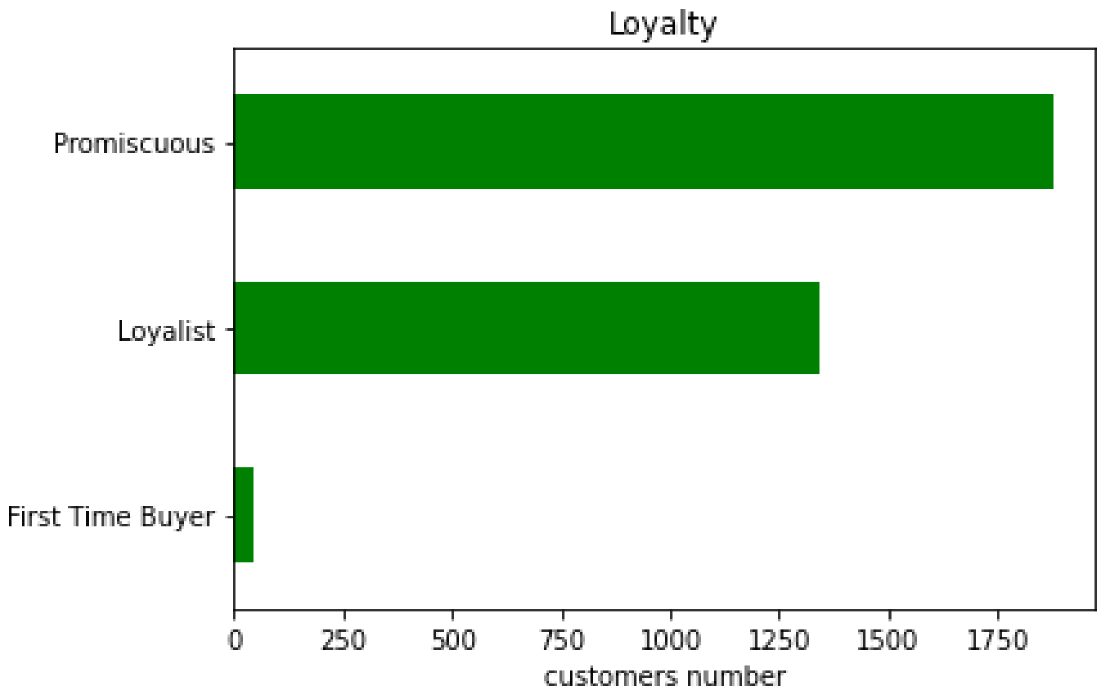
```
--> 187         accessor_obj = self._accessor(obj)
    188         # Replace the property with the accessor object. Inspired by:
    189         # https://www.pydanny.com/cached-property.html


    /usr/lib/python3.7/site-packages/pandas/core/indexes/accessors.py in __new__(cls, data
    478             return PeriodProperties(data, orig)
    479
--> 480         raise AttributeError("Can only use .dt accessor with datetimelike values")


    AttributeError: Can only use .dt accessor with datetimelike values
```

```
In [8]: df.transaction_date = pd.to_datetime(df.transaction_date)

In [9]: tmp = df.groupby(['year']).agg(number_baskets=('basket_id', pd.Series.nunique)).reset_
        tmp.head()
        fig = plt.figure() #from this point, we start plotting.
        plt.bar(tmp.year, tmp.number_baskets, color='blue') # color = ['green', 'yellow', 'blu
        plt.xticks(tmp.year)
        plt.xlabel('Year')
        plt.ylabel('Baskets number')
        plt.title('Baskets estimation')
        plt.show();
```

```
    ---------------------------------------------------------------------------

    KeyError                                  Traceback (most recent call last)

    <ipython-input-9-c8092fa3759c> in <module>
----> 1 tmp = df.groupby(['year']).agg(number_baskets=('basket_id', pd.Series.nunique)).res
      2 tmp.head()
      3 fig = plt.figure() #from this point, we start plotting.
      4 plt.bar(tmp.year, tmp.number_baskets, color='blue') # color = ['green', 'yellow',
      5 plt.xticks(tmp.year)


    /usr/lib/python3.7/site-packages/pandas/core/frame.py in groupby(self, by, axis, level
   6518             squeeze=squeeze,
   6519             observed=observed,
-> 6520             dropna=dropna,
   6521         )
   6522


    /usr/lib/python3.7/site-packages/pandas/core/groupby/groupby.py in __init__(self, obj,
    531                     observed=observed,
    532                     mutated=self.mutated,
--> 533                     dropna=self.dropna,
    534                 )
    535


    /usr/lib/python3.7/site-packages/pandas/core/groupby/grouper.py in get_grouper(obj, ke
    779                     in_axis, name, level, gpr = False, None, gpr, None
    780                 else:
--> 781                     raise KeyError(gpr)
    782             elif isinstance(gpr, Grouper) and gpr.key is not None:
    783                 # Add key to exclusions


    KeyError: 'year'
```

```
In [14]: df.groupby(['loyalty', 'transaction_date']).agg(revenue=('price', sum)).reset_index()
         data = []
         for d in df.loyalty.unique():
             tmp = df[df.loyalty==d].groupby(['transaction_date']).agg(revenue=('price', sum))
             data.append(go.Scatter(x=tmp.transaction_date, y=tmp.revenue, name = d, line=dict
         go.Figure(
             data=data,
             layout = go.Layout(
                 title ='Loyalty trends',
                 yaxis=dict(
                     title='Revenue'
                 )
             )
         ).show(renderer = 'iframe')
```

```
In [15]: from matplotlib import pyplot as plt
         df.groupby('loyalty').agg(totals=('customer_id',pd.Series.nunique)) \
             .plot(kind='barh', legend = False, title = 'Loyalty',color='green')
         plt.ylabel('')
         plt.xlabel('customers number');
```



```
In [52]: top_50 = df.groupby(['commodity']).agg(total_revenue=('price',sum)) \
             .sort_values('total_revenue', ascending = False).head(50)

         go.Figure(
             data = go.Bar(x=top_50.index, y=top_50['total_revenue']),
             layout = go.Layout(
                 title ='Top 50 commodities',
                 yaxis=dict(
                     title='Revenue'
                 )
             )
         ).show(renderer = 'iframe')

In [53]: tmp = df.groupby(['household_type','commodity','loyalty']).agg(total_revenue=('price'
         pd.concat(
             [tmp[tmp.household_type == hh] \
                  .sort_values('total_revenue', ascending=False) \
              .head(5) for hh in tmp.household_type.unique()])
```

```
Out[53]:              household_type       commodity      loyalty  total_revenue
         51        1 adult with kids            Beef     Loyalist        3101.82
         119       1 adult with kids          Cheese     Loyalist        1098.37
         269       1 adult with kids     Frozen meat     Loyalist        1094.03
         493       1 adult with kids           Salad     Loyalist        1060.64
         370       1 adult with kids      Lunch meat     Loyalist        1051.19
```

```
656      2 adults with kids            Beef  Promiscuous        4257.57
847      2 adults with kids     Frozen meat  Promiscuous        1666.60
718      2 adults with kids          Cheese  Promiscuous        1573.54
759      2 adults with kids      Deli meats  Promiscuous        1484.53
1041     2 adults with kids           Salad  Promiscuous        1417.97
1199  2 adults with no kids            Beef  Promiscuous        2303.50
1198  2 adults with no kids            Beef     Loyalist        1294.30
1624  2 adults with no kids  Seafood-frozen  Promiscuous        1211.79
1623  2 adults with no kids  Seafood-frozen     Loyalist         844.26
1265  2 adults with no kids          Cheese  Promiscuous         811.16
1776          Single female            Beef  Promiscuous        1116.91
1775          Single female            Beef     Loyalist         520.88
2135          Single female  Seafood-frozen  Promiscuous         480.10
1828          Single female          Cheese  Promiscuous         373.73
1947          Single female     Frozen meat  Promiscuous         368.11
2264            Single male            Beef  Promiscuous        1589.37
2263            Single male            Beef     Loyalist        1207.48
2665            Single male  Seafood-frozen  Promiscuous         685.72
2664            Single male  Seafood-frozen     Loyalist         639.56
2371            Single male      Deli meats  Promiscuous         588.10
```

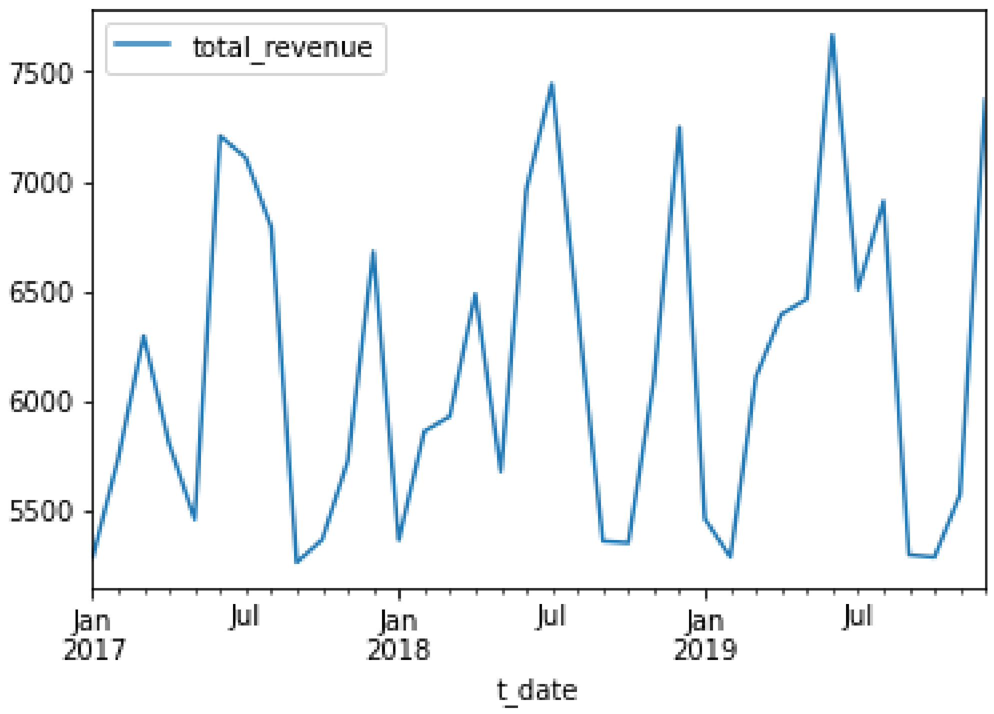
```
In [59]: tmp = df.groupby(['household_type', 'commodity','loyalty']).agg(total_revenue=('price
         topcom = pd.concat(
             [tmp[tmp.household_type == hh] \
                  .sort_values('total_revenue', ascending=False) \
               .head() for hh in tmp.household_type.unique()]).reset_index(drop=True)

         for d in topcom.household_type.unique():
             tmp1 = topcom[topcom.household_type==d].groupby(['commodity']).agg(revenue=('total
             data.append(go.Bar(x=tmp1.commodity, y=tmp1.revenue, name = d))

         go.Figure(
             data = data,
             layout = go.Layout(
                 title ='Top commodities per Household',
                 yaxis=dict(
                     title='Revenue'
                 )
             )
         ).show(renderer = 'iframe')
```

```
In [21]: df['transaction_date'] = df.transaction_date.str[:10]
         df['t_date'] = pd.to_datetime(df.transaction_date)
         df['t_date'] = df.t_date + pd.offsets.MonthBegin(-1)
```

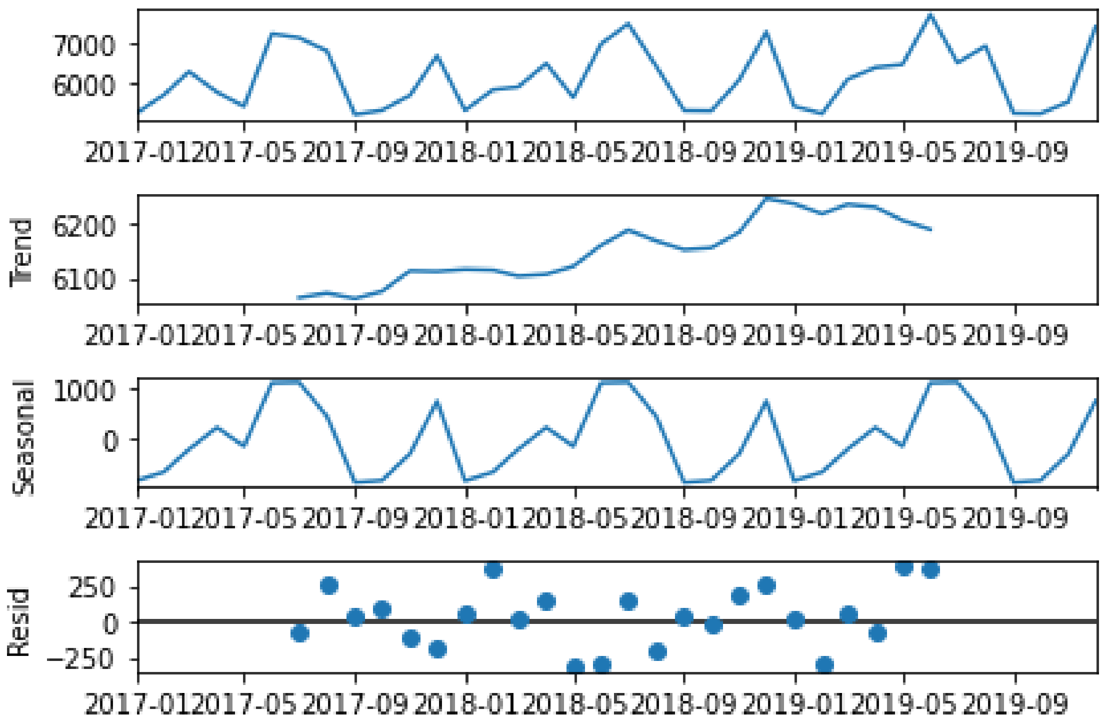
```
In [22]: ts = df.groupby(['t_date']).agg(total_revenue=('price', sum)).reset_index()
```

```
In [23]: yearstrendta = ts.loc[ts.t_date < '2020-01-01'].set_index('t_date')
         yearstrendta.shape
         yearstrendta.plot()
```

```
Out[23]: <AxesSubplot:xlabel='t_date'>
```



```
In [24]: ts_components = seasonal_decompose(yearstrendta)
         ts_components.plot();
```



```
In [25]: test_adf = adfuller(yearstrendta)

         print('ADF test = ', test_adf[0])
         print('p-value = ', test_adf[1])
```

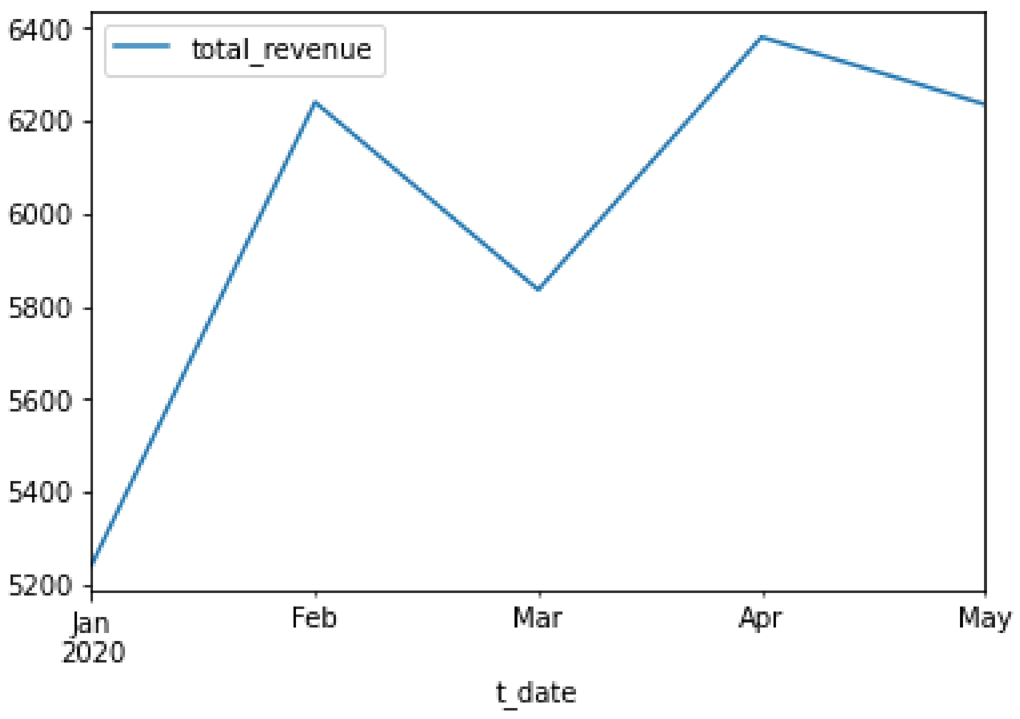
```
ADF test =  -3.918223615399647
p-value =  0.0019047503928043205
```

```
In [29]: test = ts.loc[ts.t_date >= '2020-01-01'].set_index('t_date')
         print(test)
```

```
            total_revenue
t_date
2020-01-01        5242.21
2020-02-01        6240.52
2020-03-01        5835.69
2020-04-01        6380.56
2020-05-01        6235.96
```

```
In [49]: test.shape
         test.plot()
```

```
Out[49]: <AxesSubplot:xlabel='t_date'>
```



```
In [50]: test_adf = adfuller(test)

         print('ADF test = ', test_adf[0])
         print('p-value = ', test_adf[1])

ADF test =  -3.9576875339525737
p-value =  0.0016490190062388047


In [31]: whole = ts.set_index('t_date').squeeze().copy()
         history = whole.take(range(36))
         future = test.squeeze().copy()

In [33]: for t in range(len(future)):
             model = ARIMA(history, order=(3,0,0), freq='MS')
             model_fit = model.fit(disp=0)
             output = model_fit.forecast(steps=1)
             yhat = output[0].round(2)
             stderr = output[1].round(2)
             confint = output[2].round(2)
             month = future.index[t]
             obs = future[t].round(2)
             print(month)
             print('prediction:', yhat, ', expected:', obs, ', stderr:', stderr, ', conf. int:
```

```
            history = whole.take(range(36 + t+1))
```

```
2020-01-01 00:00:00
prediction: [6817.02] , expected: 5242.21 , stderr: [646.84] , conf. int: [[5549.24 8084.8 ]]
2020-02-01 00:00:00
prediction: [5966.32] , expected: 6240.52 , stderr: [683.5] , conf. int: [[4626.69 7305.95]]
2020-03-01 00:00:00
prediction: [5921.42] , expected: 5835.69 , stderr: [675.54] , conf. int: [[4597.39 7245.44]]
2020-04-01 00:00:00
prediction: [6357.59] , expected: 6380.56 , stderr: [666.86] , conf. int: [[5050.58 7664.6 ]]
2020-05-01 00:00:00
prediction: [6166.4] , expected: 6235.96 , stderr: [658.45] , conf. int: [[4875.86 7456.93]]
```

```
In [47]: model = ARIMA(history, order=(3,0,0), freq='MS')
         model_fit = model.fit(disp=0)
         output = model_fit.forecast(steps=12)
         output[0].round(2)
```

```
Out[47]: array([6194.29, 6049.11, 6086.92, 6125.1 , 6166.17, 6152.32, 6133.31,
                6121.49, 6127.61, 6135.68, 6138.97, 6136.15])
```