Importing Python libraries

In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
from matplotlib import cm
import matplotlib.pyplot as plt
from datetime import datetime
import datetime
import yfinance as yf
import plotly.graph_objs as go
from plotly.subplots import make_subplots
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
%matplotlib inline

import warnings
warnings.filterwarnings("ignore")
```

```
"
"
"
"
"



TSLA Stock



"
"
"
"
"
```

Loading dataset

In [2]:
```
data = yf.Ticker("TSLA")
data = data.history(period='10y')
```

Exploratory Data analysis

Five top records of data

In [3]:
```
data.head()
```

Out[3]:

Date	Open	High	Low	Close	Volume	Dividends	Stock Splits
2011-07-28	5.520	5.710	5.508	5.634	4693500	0	0.0
2011-07-29	5.560	5.680	5.500	5.634	4741000	0	0.0
2011-08-01	5.734	5.796	5.642	5.754	5824500	0	0.0
2011-08-02	5.738	5.840	5.454	5.468	7747000	0	0.0
2011-08-03	5.500	5.566	5.268	5.440	8972500	0	0.0

Five last records of data

In [4]:
```
data.tail()
```

Out[4]:

Date	Open	High	Low	Close	Volume	Dividends	Stock Splits
2021-07-22	656.440002	662.169983	644.599976	649.260010	15105700	0	0.0
2021-07-23	646.359985	648.799988	637.299988	643.380005	14581300	0	0.0
2021-07-26	650.969971	668.200012	647.109985	657.619995	25044100	0	0.0
2021-07-27	663.400024	666.500000	627.239990	644.780029	32756900	0	0.0
2021-07-28	646.994995	654.969910	639.400085	645.530029	13031584	0	0.0

Coloumns/features in data

In [5]:
```
data.columns
```

Out[5]:
```
Index(['Open', 'High', 'Low', 'Close', 'Volume', 'Dividends', 'Stock Splits'],
dtype='object')
```

Length of data

In [6]:
```
print('lenght of data is', len(data))
```

```
lenght of data is 2517
```

Shape of data

In [7]:
```
data.shape
```

Out[7]:
```
(2517, 7)
```

Data information

In [8]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 2517 entries, 2011-07-28 to 2021-07-28
Data columns (total 7 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   Open          2517 non-null   float64
 1   High          2517 non-null   float64
 2   Low           2517 non-null   float64
 3   Close         2517 non-null   float64
 4   Volume        2517 non-null   int64  
 5   Dividends     2517 non-null   int64  
 6   Stock Splits  2517 non-null   float64
dtypes: float64(5), int64(2)
memory usage: 157.3 KB
```

Data types of all coloumns

In [9]:
```
data.dtypes
```

Out[9]:
```
Open            float64
High            float64
Low             float64
Close           float64
Volume            int64
Dividends         int64
Stock Splits    float64
dtype: object
```

Checking missing Values

In [10]:
```
data[data.isnull().any(axis=1)].head()
```

Out[10]:

Date	Open	High	Low	Close	Volume	Dividends	Stock Splits

Count of missing values

In [11]:
```
np.sum(data.isnull().any(axis=1))
```

Out[11]:
```
0
```

Is there any missing values?

In [12]:
```
data.isnull().values.any()
```

Out[12]:
```
False
```

Counts of missing values in each column

In [13]:
```
data.isnull().sum()
```

Out[13]:
```
Open            0
High            0
Low             0
Close           0
Volume          0
Dividends       0
Stock Splits    0
dtype: int64
```

Data Description

In [14]:
```
data.describe()
```

Out[14]:

	Open	High	Low	Close	Volume	Dividends	Stock S
count	2517.000000	2517.000000	2517.000000	2517.000000	2.517000e+03	2517.0	2517.00(
mean	102.938684	105.140934	100.527120	102.963715	3.432870e+07	0.0	0.00
std	174.326681	178.123961	169.932428	174.305065	2.880589e+07	0.0	0.09
min	4.386000	4.622000	4.300000	4.390000	1.198000e+06	0.0	0.00(
25%	35.660000	36.476002	34.736000	35.717999	1.638250e+07	0.0	0.00(
50%	47.702000	48.599998	46.902000	47.768002	2.753400e+07	0.0	0.00(
75%	66.089996	67.491997	65.152000	66.332001	4.284700e+07	0.0	0.00(
max	891.380005	900.400024	871.599976	883.090027	3.046940e+08	0.0	5.00(

Data Correlation

In [15]:
```
aa=data[['Close','Open','Low','High','Volume']]
rets=aa.pct_change()
cor=rets.corr(method='pearson')
cor
```

Out[15]:

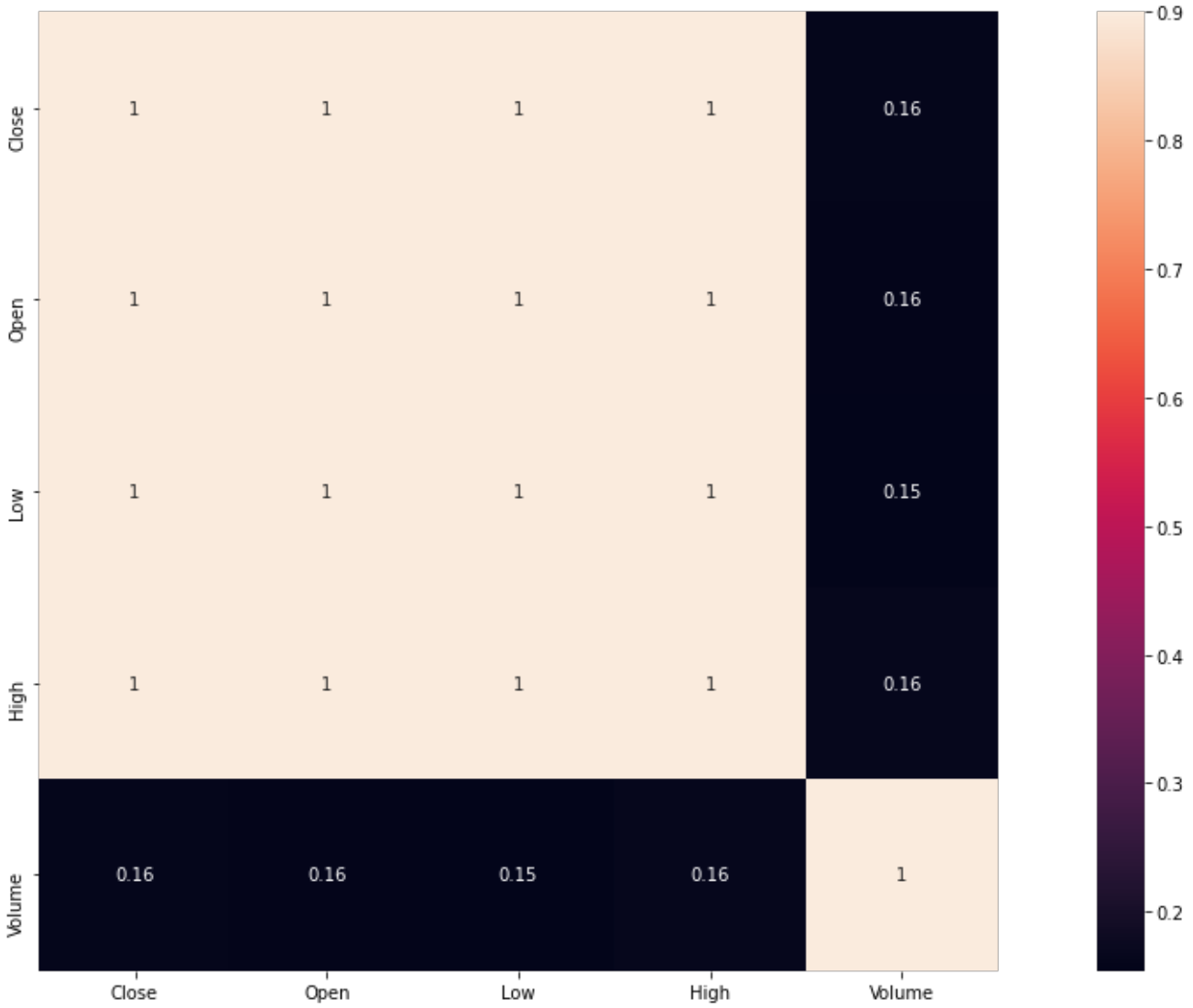
	Close	Open	Low	High	Volume
Close	1.000000	0.357096	0.702217	0.753340	0.054724
Open	0.357096	1.000000	0.733567	0.719263	0.030559
Low	0.702217	0.733567	1.000000	0.726926	-0.165083
High	0.753340	0.719263	0.726926	1.000000	0.265168
Volume	0.054724	0.030559	-0.165083	0.265168	1.000000

In [16]:

```
corrmat = aa.corr()
plt.subplots(figsize=(20, 10))
sns.heatmap(corrmat, vmax=.9, square=True, annot = True)
```

Out[16]:

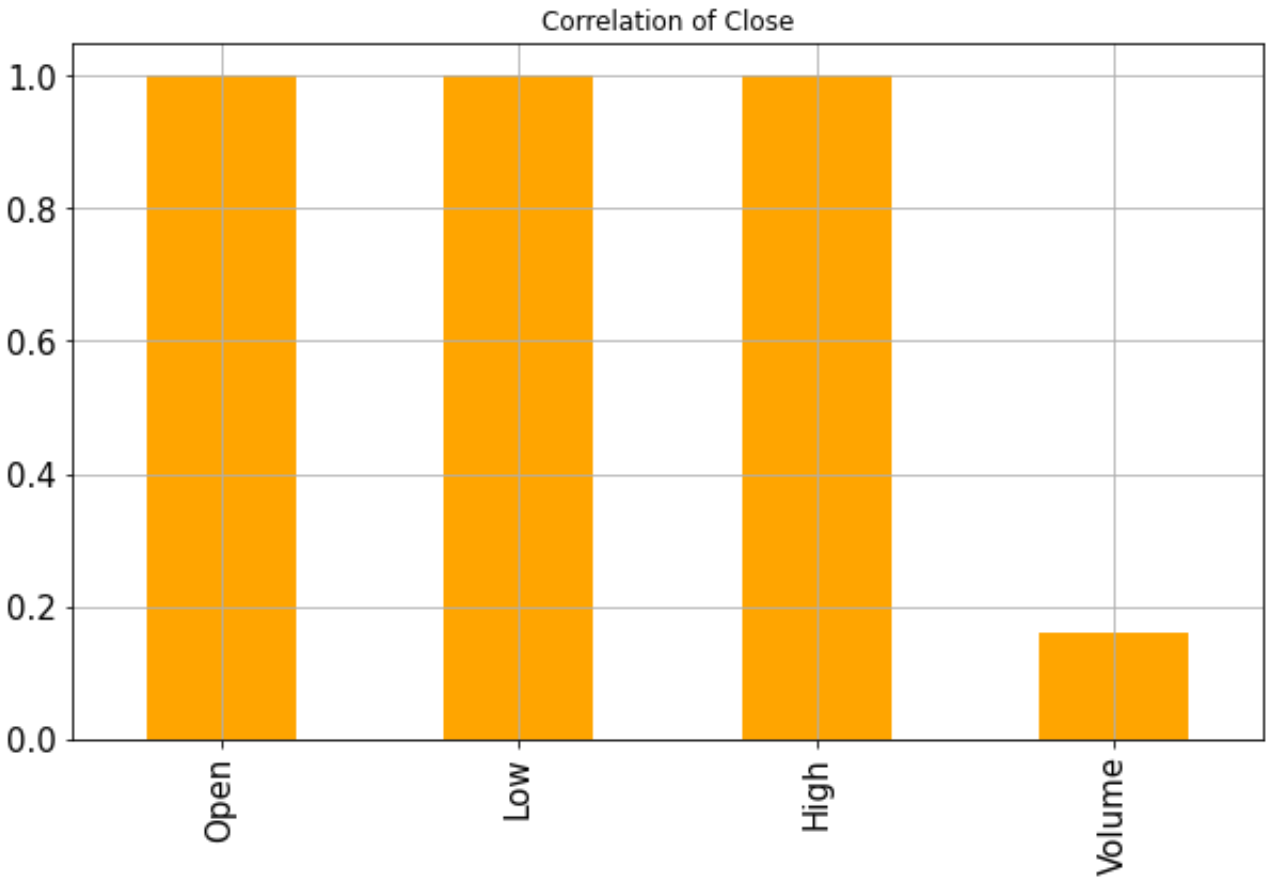
```
<AxesSubplot:>
```



Correlation with Close

In [17]:
```
a = aa.drop(columns=['Close'], axis=1)
a.corrwith(aa['Close']).plot.bar(
                figsize = (10, 6), title = "Correlation of Close", fontsize =
                rot = 90, grid = True, color='orange')
```

Out[17]:
```
<AxesSubplot:title={'center':'Correlation of Close'}>
```

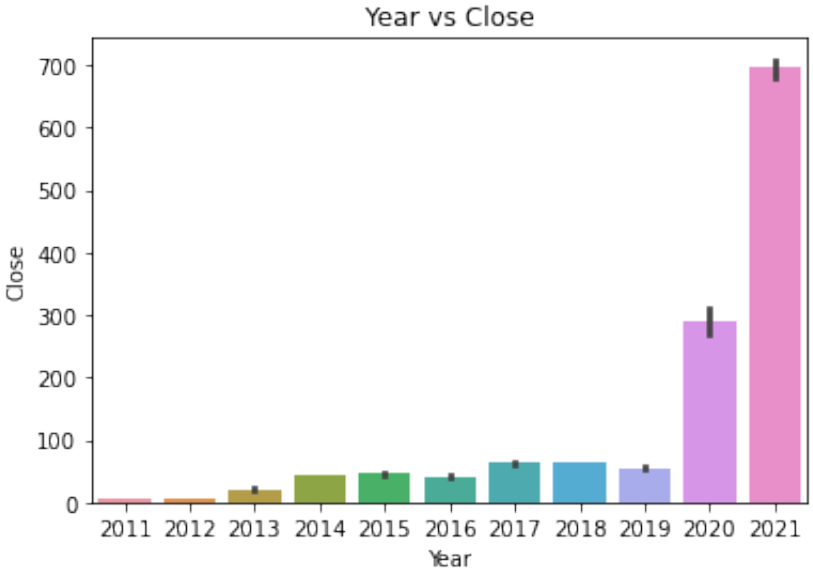


Spliting date into day, month and year

In [18]:
```
data['date'] = data.index
data['Month'] = data['date'].dt.month
data['Day'] = data['date'].dt.day
data['Year'] = data['date'].dt.year
```

Close price with respect to year

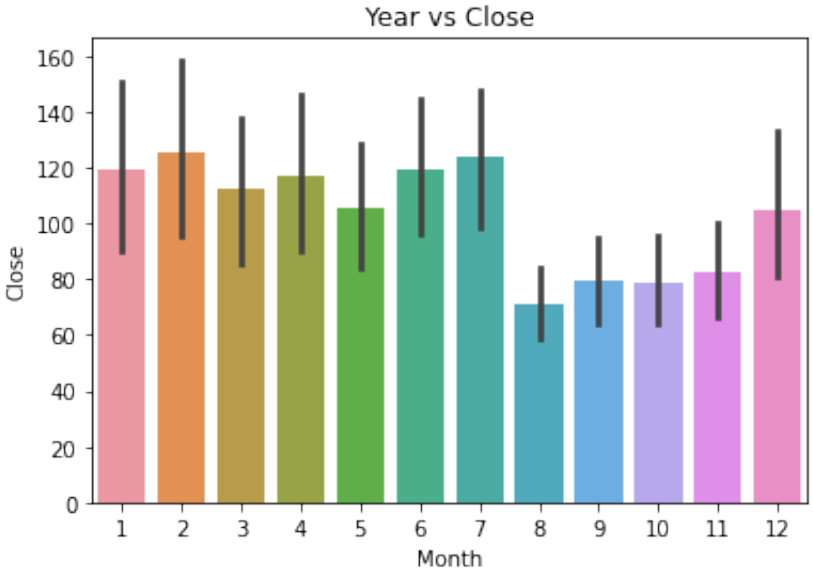
In [19]:
```
sns.barplot(x='Year', y='Close', data=data).set(title='Year vs Close')
plt.show()
```



Close price with respect to Month

In [20]:

```
sns.barplot(x='Month', y='Close', data=data).set(title='Year vs Close')
plt.show()
```

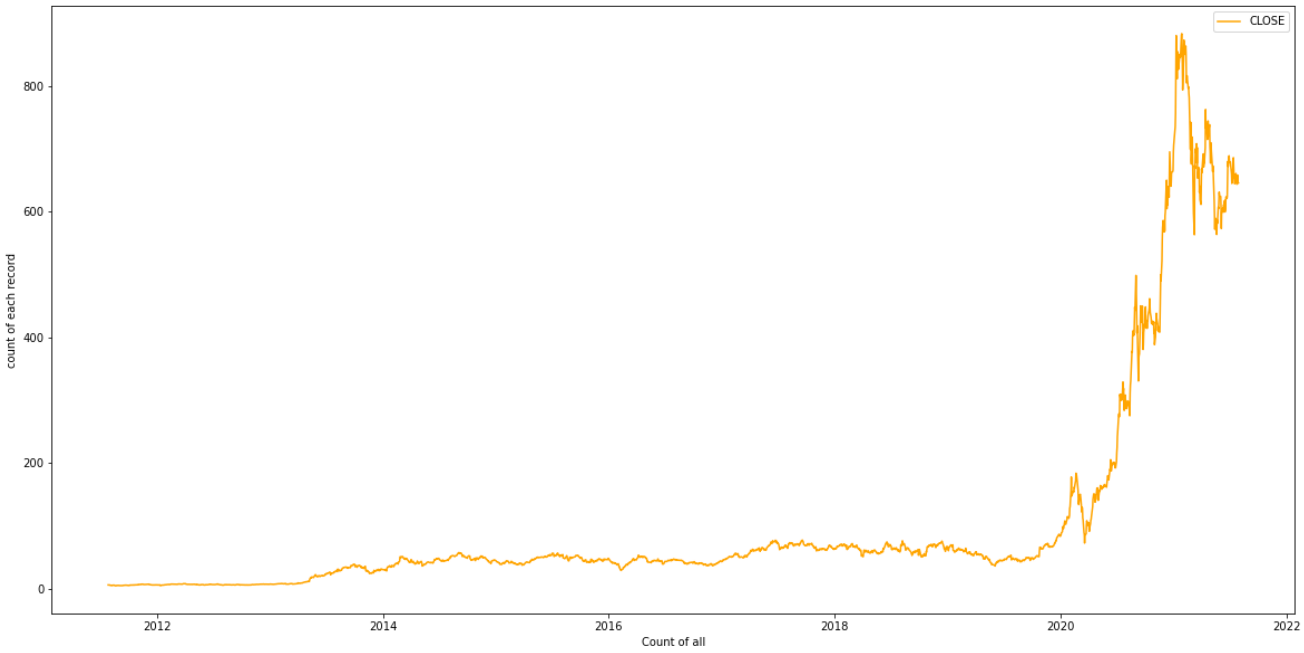


Data Visualization

CLOSE price values plot

In [21]:

```
plt.figure(figsize=(20, 10))
plt.subplot(1,1,1)
plt.plot(data.index, data['Close'].values,color='orange',label='CLOSE')
plt.xlabel('Count of all')
plt.ylabel('count of each record')
plt.legend(loc='best')
plt.show()
```



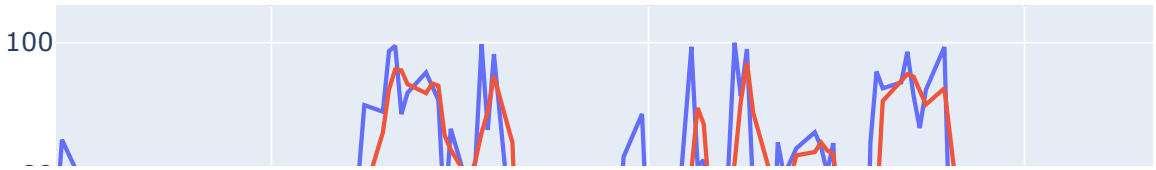
Data Preparation

---

stochastic features

In [22]:

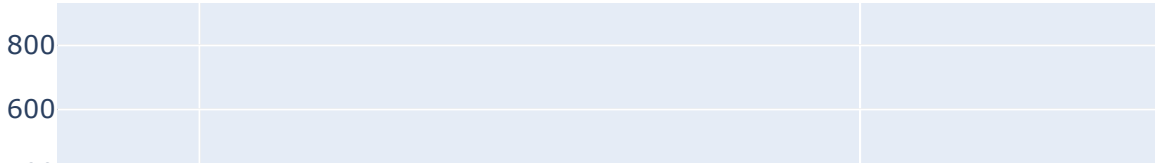
```
def stochastic(df, k, d):
    low_min  = df['Low'].rolling(window=k).min()
    high_max = df['High'].rolling( window=k).max()
    df['stochastic_k'] = 100 * (df['Close'] - low_min)/(high_max - low_min)
    df['stochastic_d'] = df['stochastic_k'].rolling(window=d).mean()
    return df

stochs = stochastic(data, k=14, d=3)
fig = go.Figure()
fig.add_trace(go.Scatter(x=data.index, y=stochs.stochastic_k.tail(365), name=
fig.add_trace(go.Scatter(x=data.index, y=stochs.stochastic_d.tail(365), name=
fig.show()
```



EMA, MACD, MACD single features

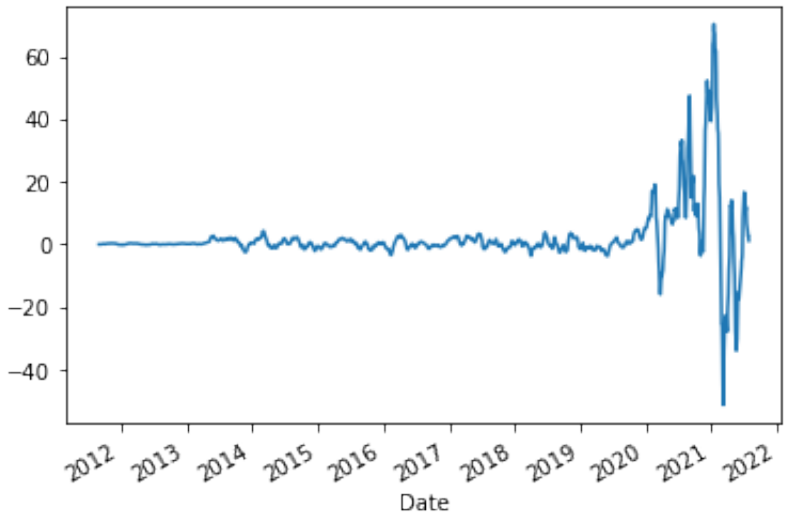
In [23]:

```
EMA_12 = pd.Series(data['Close'].ewm(span=12, min_periods=12).mean())
EMA_26 = pd.Series(data['Close'].ewm(span=26, min_periods=26).mean())
MACD = pd.Series(EMA_12 - EMA_26)
data['MACD']=pd.Series(EMA_12 - EMA_26)
MACD_signal = pd.Series(MACD.ewm(span=9, min_periods=9).mean())
fig = make_subplots(rows=2, cols=1)
fig.add_trace(go.Scatter(x=data.index, y=data.Close, name='Close'), row=1, co
fig.add_trace(go.Scatter(x=data.index, y=EMA_12, name='EMA 12'), row=1, col=1
fig.add_trace(go.Scatter(x=data.index, y=EMA_26, name='EMA 26'), row=1, col=1
fig.add_trace(go.Scatter(x=data.index, y=MACD, name='MACD'), row=2, col=1)
fig.add_trace(go.Scatter(x=data.index, y=MACD_signal, name='Signal line'), ro
fig.show()
```



In [24]:
```
data['MACD'].plot()
```

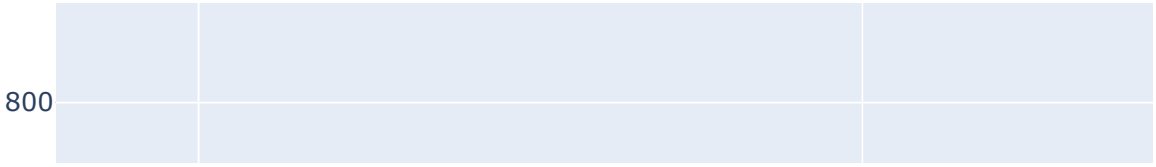
Out[24]: <AxesSubplot:xlabel='Date'>



Moving average features

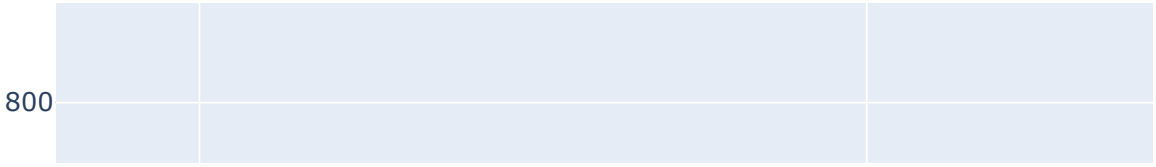
In [25]:

```
data['EMA_50'] = data['Close'].ewm(50).mean().shift()
data['EMA_200'] =data['Close'].ewm(200).mean().shift()
data['MA_50'] = data['Close'].rolling(50).mean()
data['MA_200'] = data['Close'].rolling(200).mean()
fig = go.Figure()
fig.add_trace(go.Scatter(x=data.index, y=data.EMA_50, name='EMA 50'))
fig.add_trace(go.Scatter(x=data.index, y=data.EMA_200, name='EMA 200'))
fig.add_trace(go.Scatter(x=data.index, y=data.Close, name='Close', line_color
fig.show()
```



In [26]:

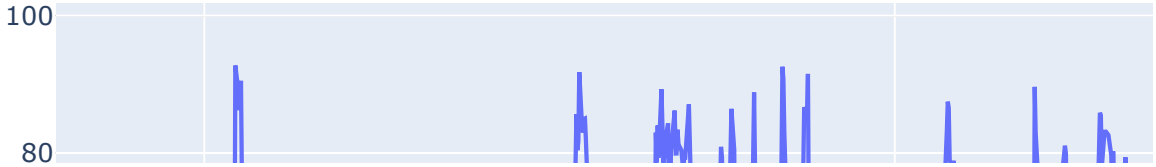
```
fig = go.Figure()
fig.add_trace(go.Scatter(x=data.index, y=data.MA_50, name='MA 50'))
fig.add_trace(go.Scatter(x=data.index, y=data.MA_200, name='MA 200'))

fig.add_trace(go.Scatter(x=data.index, y=data.Close, name='Close', line_color
fig.show()
```



Relative Strength Index RSI 7 and 14 features

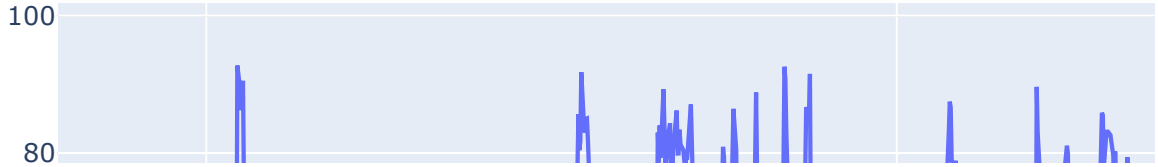
In [27]:

```
def RSI(df, n=14):
    close = df['Close']
    delta = close.diff()
    delta = delta[1:]
    pricesUp = delta.copy()
    pricesDown = delta.copy()
    pricesUp[pricesUp < 0] = 0
    pricesDown[pricesDown > 0] = 0
    rollUp = pricesUp.rolling(n).mean()
    rollDown = pricesDown.abs().rolling(n).mean()
    rs = rollUp / rollDown
    rsi = 100.0 - (100.0 / (1.0 + rs))
    return rsi


data['RSI 7'] = RSI(data).fillna(0)
fig = go.Figure(go.Scatter(x=data.index, y=data['RSI 7']))
fig.show()
```



In [28]:

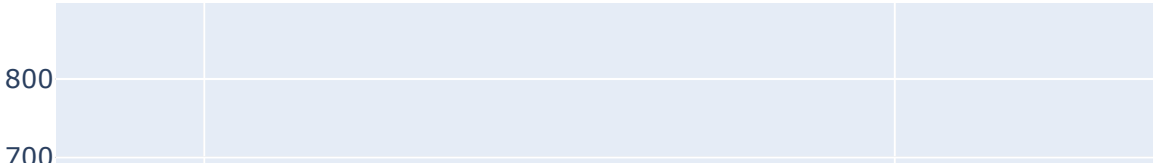
```
data['RSI 14'] = RSI(data).fillna(0)
fig = go.Figure(go.Scatter(x=data.index, y=data['RSI 14']))
fig.show()
```



Bollinger bands features

In [29]:
```
def bbands(price, length=30, numsd=2):
    ave = price.rolling(window = length, center = False).mean()
    sd = price.rolling(window = length, center = False).std()
    upband = ave + (sd*numsd)
    dnband = ave - (sd*numsd)
    return np.round(ave,3), np.round(upband,3), np.round(dnband,3)

data['BB_Middle_Band'], data['BB_Upper_Band'], data['BB_Lower_Band'] = bbands
```

In [30]:
```
fig = go.Figure(go.Scatter(x=data.index, y=data['BB_Middle_Band']))
fig.show()
```



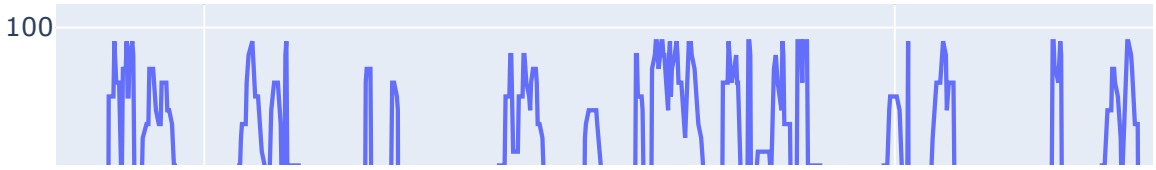
Calculation of Aroon Oscillator features

In [31]:

```
def aroon(df, tf=25):
    aroonup = []
    aroondown = []
    x = tf
    while x< len(df.index):
        aroon_up = ((df['High'][x-tf:x].tolist().index(max(df['High'][x-tf:x]
        aroon_down = ((df['Low'][x-tf:x].tolist().index(min(df['Low'][x-tf:x]
        aroonup.append(aroon_up)
        aroondown.append(aroon_down)
        x+=1
    return aroonup, aroondown
```

In [32]:
```
listofzeros = [0] * 25
up, down = aroon(data)
aroon_list = [x - y for x, y in zip(up,down)]
if len(aroon_list)==0:
    aroon_list = [0] * data.shape[0]
    data['Aroon_Oscillator'] = aroon_list
else:
    data['Aroon_Oscillator'] = listofzeros+aroon_list
```

In [33]:
```
fig = go.Figure(go.Scatter(x=data.index, y=data['Aroon_Oscillator']))
fig.show()
```



Average Directional Index features

In [34]:

```
data['ATR'] = data['Close'].rolling(window=14).mean()
def DMI(df, period):
    df['UpMove'] = df['High'] - df['High'].shift(1)
    df['DownMove'] = df['Low'].shift(1) - df['Low']
    df['Zero'] = 0

    df['PlusDM'] = np.where((df['UpMove'] > df['DownMove']) & (df['UpMove'] >
    df['MinusDM'] = np.where((df['UpMove'] < df['DownMove']) & (df['DownMove'

    df['plusDI'] = 100 * (df['PlusDM']/df['ATR']).ewm(span=period,min_periods
    df['minusDI'] = 100 * (df['MinusDM']/df['ATR']).ewm(span=period,min_perio

    df['ADX'] = 100 * (abs((df['plusDI'] - df['minusDI'])/(df['plusDI'] + df[
DMI(data, 14)
```

In [35]:

```
fig = go.Figure(go.Scatter(x=data.index, y=data['ADX']))
fig.show()
```

In [36]:
```
data.to_csv('TSLA_Stock.csv', index=False)
```