

Python初級數據分析員證書

(五) 進階Python數據分析及可視化技巧

12. Plotly 套件 Part 2

 plotly | Graphing Libraries


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12. Plotly 套件 Part 2

Recap

在上一章中，我們學到了

- Bubble chart
- Interactive graphing
- Discrete colour and continuous colour
- Facet plots
- Plotly Express
- Matplotlib vs Plotly

 plotly | Graphing Libraries

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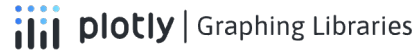
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12. Plotly 套件 Part 2

Chapter Summary

- Time Series Data and Plotly
- Series.isna, dropna, fillna, df.rank
- Range slider
- Multiple plot with graph_objects
- Candlestick chart
- OHLC chart



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Time Series Data

在第 8 章中Pandas part 2, 我們瞭解到, **time series data** 是通過重複測量獲得的觀測值**隨著時間的流逝**的集合. 在圖形上繪製點, 並將其中一個軸 (通常**x-axis**) 將永遠是**時間**。

時間序列數據是許多不同領域中結構化數據的重要形式, 例如**金融**、**經濟學**、**生態學**、**神經科學**、和 **物理**。

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時間序列繪圖 - Plotly

時間序列可以使用以下任一方式表示 `plotly.express` 功能

(`px.line`, `px.scatter`, `px.bar` etc) or `plotly.graph_objects` Charts 物件

(`go.Scatter`, `go.Bar` etc).

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API data from WorldBank

許多組織使用以下方式打開他們的資料庫 API, WorldBank.org 是其中之一，也支援 Python 庫。

```
pip install wbgapi
```

Collecting wbgapi

Downloading wbgapi-1.0.12-py3-none-any.whl (36
Requirement already satisfied: PyYAML in /Users/l
api) (6.0)

Collecting tabulate

Downloading tabulate-0.9.0-py3-none-any.whl (35
Requirement already satisfied: requests in /User
bgapi) (2.28.1)

wbgapi 1.0.12

pip install wbgapi

<https://blogs.worldbank.org/opendata/introducing-wbgapi-new-python-package-accessing-world-bank-data>

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API data from WorldBank

首先import wbgapi as wb. 然後我們搜索'hong kong'

```
import wbgapi as wb
```

```
wb.search('hong kong')
```

Country-Series

ID	Name	Field
CHN~SG.POP.MIGR.FE.ZS	China~Female migrants (% of international migrant stock)	Country-Series ...For statistic
CHN~SM.POP.TOTL	China~International migrant stock, total	Country-Series ...using model Special /
CHN~SP.ADO.TFRT	China~Adolescent fertility rate (births per 1,000 women ages 15-19)	Country-Series The data

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API data from WorldBank

幾十年來有很多數據，組織良好且免費。而且它在Pandas DataFrame 中提供，甚至比許多付費服務都要好。



```
wb.source.info()
```

id	name	code	concepts	lastupdated
1	Doing Business	DBS	3	2021-08-18
2	World Development Indicators	WDI	3	2023-03-30
3	Worldwide Governance Indicators	WGI	3	2022-09-23
5	Subnational Malnutrition Database	SNM	3	2016-03-21
6	International Debt Statistics	IDS	4	2022-12-06

1	wb.economy.info()		
GUY	Guyana	LCN	UMC
HIC	High income		
HKG	Hong Kong SAR, China	EAS	HIC
HND	Honduras	LCN	LMC

wb.series.info()	
id	value
AG.AGR.TRAC.NO	Agricultural machinery, tractors
AG.CON.FERT.PT.ZS	Fertilizer consumption (% of fertilizer production)
AG.CON.FERT.ZS	Fertilizer consumption (kilograms per hectare of arable land)
AG.LND.AGRI.K2	Agricultural land (sq. km)

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Capture Hong Kong GDP data and plot via plotly

拉動香港的GDP數據。由於列是以年為單位的，我們使用 T (轉置) 將它們切換為行。

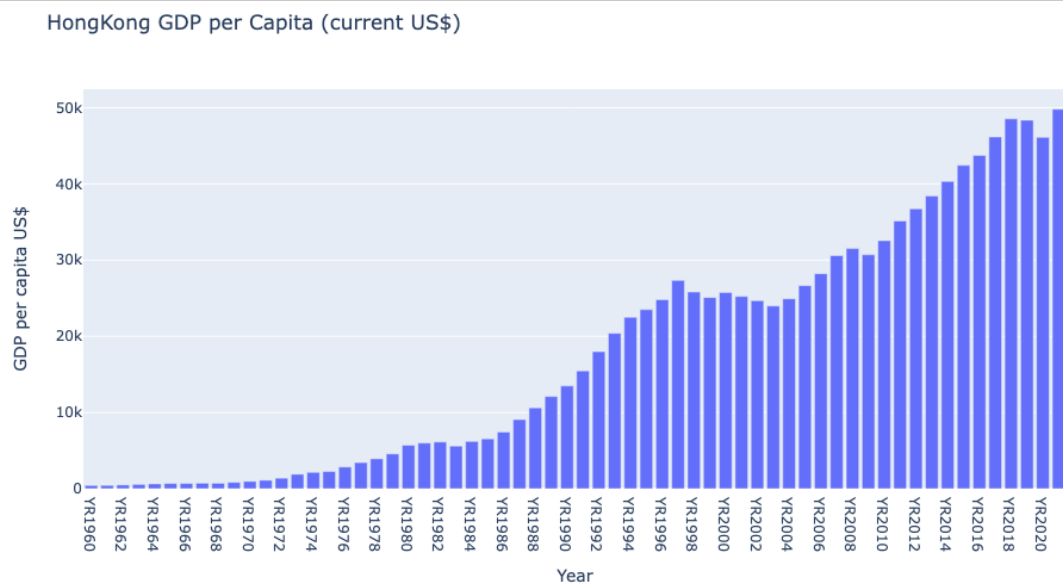
```
1 # HongKong GDP per capita (current US$)
2 df = wb.data.DataFrame(['NY.GDP.PCAP.CD'], ['HKG']).T
3 df
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Hong Kong GDP per Capita



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WorldBank API Usage info



world bank api python


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Tools

About 13,500,000 results (0.33 seconds)



World Bank

<https://blogs.worldbank.org/opendata/introducing-wbgapi-new-python-package-accessing-world-bank-data>

Introducing WBGAPI: A new python package for accessing ...

17 Feb 2021 — 1. WBGAPI makes databases easier to understand and use. The World Bank API sometimes gives the illusion that all indicators reside in one big ...

<https://blogs.worldbank.org/opendata/introducing-wbgapi-new-python-package-accessing-world-bank-data>


THE WORLD BANK
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12. Plotly 套件 Part 2

High Income Econmy GDP

Pull High Income Countries.

```

1 # High Income Economy GDP
2 df_hic = wb.data.DataFrame('NY.GDP.PCAP.CD', economy=wb.income.members('HIC'), numericTimeKeys=True, labels=True)
3 df_hic

```

	Country	1960	1961	1962	1963	1964	1965	1966	1967	1968	...	2012
economy												
CHE	Switzerland	1787.360348	1971.316323	2131.391652	2294.182847	2501.293190	2620.475547	2784.733548	2960.722586	3121.889031	...	85836.207677
URY	Uruguay	491.213493	604.176627	659.611697	587.006885	744.879993	705.398553	668.328011	584.850133	578.588983	...	15206.872620
NLD	Netherlands	1068.784587	1159.392357	1240.677894	1328.036649	1541.947365	1708.096356	1835.801424	1991.360686	2185.248659	...	50070.141605
DNK	Denmark	NaN	NaN	NaN	NaN	NaN	NaN	2487.136181	2700.746290	2776.135390	...	58507.508052
FRA	France	1333.881573	1430.434624	1585.735311	1758.856659	1928.999402	2060.299715	2209.000173	2363.669669	2553.975843	...	40870.852365

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Select top 30 largest GDP in 2021 and transpose the years columns to rows.

```
1 df_hic = df_hic.nlargest(30, 2021).T

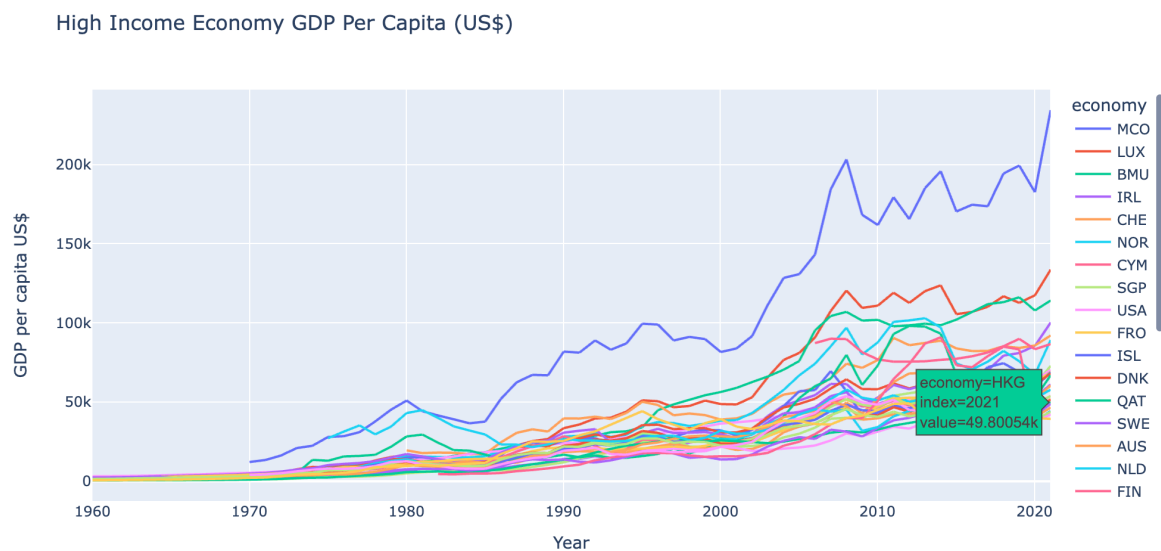
1 fig = px.line(df_hic, x=df_hic.index, y=df_hic.columns,
2               title="High Income Economy GDP Per Capita (US$)"
3               ).update_layout(xaxis_title="Year",
4                               yaxis_title="GDP per capita US$")
5 fig.show()
```

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12. Plotly 套件 Part 2

Hong Kong ranked Top 23 GDP in 2021



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Hong Kong GDP rank in 1960

```

1 df_1960 = wb.data.DataFrame('NY.GDP.PCAP.CD', skipAggs=True,
2                             time=1960, numericTimeKeys=True, labels=True)
3 df_1960

```

	Country	NY.GDP.PCAP.CD
economy		
ZWE	Zimbabwe	276.643363
ZMB	Zambia	228.567399
YEM	Yemen, Rep.	NaN
PSE	West Bank and Gaza	NaN
VIR	Virgin Islands (U.S.)	NaN

```

1 df_1960['NY.GDP.PCAP.CD'].isna().sum()
117

```

As there are NaN data in almost half the countries, we should not use `dropna()` to delete the data.

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Hong Kong GDP rank in 1960

```

1 df_1960 = wb.data.DataFrame('NY.GDP.PCAP.CD', skipAggs=True,
2                             time=1960, numericTimeKeys=True, labels=True).fillna(0)
3 df_1960

```

	Country	NY.GDP.PCAP.CD
economy		
ZWE	Zimbabwe	276.643363
ZMB	Zambia	228.567399
YEM	Yemen, Rep.	0.000000
PSE	West Bank and Gaza	0.000000
VIR	Virgin Islands (U.S.)	0.000000

We use `fillna` with zero to handle the NaN properly.

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Hong Kong GDP rank in 1960

```
1 df_1960['Rank'] = df_1960['NY.GDP.PCAP.CD'].rank(ascending=False)
2 df_1960.nlargest(5, 'NY.GDP.PCAP.CD')
```

	Country	NY.GDP.PCAP.CD	Rank
economy			
	USA	United States	3007.123445
	NZL	New Zealand	2312.949992
	CAN	Canada	2259.250511
	LUX	Luxembourg	2242.015817
	SWE	Sweden	2114.002973

我們添加一個 Rank 列和.rank() 基於GDP.

ascending=False 表示排名頂部的最大數位。這種排名過程在數據分析中經常使用。

```
1 df_1960.loc[df_1960.index=='HKG']
```

	Country	NY.GDP.PCAP.CD	Rank
economy			
	HKG	Hong Kong SAR, China	424.056554

Filter the DF then we know Hong Kong rank top 34 in 1960. 🙌🙌🙌

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12. Plotly 套件 Part 2

Time Series plot with Range Slider

Pull finance data from yfinance library.

```
1 import yfinance as yf
2
3 nvda = yf.download("NVDA", start="2013-01-01", end="2023-01-01")
```

```
[*****100%*****] 1 of 1 completed
```

```
1 nvda
```

	Open	High	Low	Close	Adj Close	Volume
Date						
2013-01-02	3.140000	3.182500	3.127500	3.180000	2.936782	47883600
2013-01-03	3.180000	3.217500	3.145000	3.182500	2.939091	29888800

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Time Series plot with Range Slider

```

1 fig = px.line(nvda, x=nvda.index, y=nvda['Close'],
2               title="NVidia Share Price (US$)"
3               ).update_layout(yaxis_title="Share Price (close) US$")
4 fig.update_xaxes(rangeslider_visible=True,
5                 rangeselector=dict(
6                     buttons=list([
7                         dict(count=1, label="12m", step="month", stepmode="backward"),
8                         dict(count=1, label="2y", step="year", stepmode="backward"),
9                         dict(count=1, label="YTD", step="year", stepmode="todate"),
10                        dict(step="all")
11                    ]))
12 fig.show()

```

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Time Series plot with Range Slider



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12. Plotly 套件 Part 2

Multiple plots with graph_objects

We can import multiple stock data into a single DF, but pay attention to the columns.

```
1 df_chip = yf.download(["NVDA", "TSM"], start="2013-01-01", end="2023-01-01")
2 df_chip
```

[*****100%*****] 2 of 2

Date	Adj Close	Close		High	
	NVDA	TSM	NVDA	TSM	NVDA
2013-01-02	2.936782	13.400276	3.180000	18.100000	3.182500
2013-01-03	2.939090	13.392871	3.182500	18.090000	3.217500
2013-01-04	3.036060	13.296628	3.287500	17.959999	3.297500
2013-01-07	2.948326	13.104136	3.192500	17.700001	3.295000
2013-01-08	2.883680	12.985683	3.122500	17.540001	3.210000

```
1 df_chip.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 2518 entries, 2013-01-02 to 2022-12-30
Data columns (total 12 columns):
#   Column                                Non-Null Count  Dtype
---  ---                                ---
0   (Adj Close, NVDA)                    2518 non-null   float64
1   (Adj Close, TSM)                    2518 non-null   float64
2   (Close, NVDA)                       2518 non-null   float64
3   (Close, TSM)                        2518 non-null   float64
4   (High, NVDA)                        2518 non-null   float64
5   (High, TSM)                         2518 non-null   float64
6   (Low, NVDA)                         2518 non-null   float64
7   (Low, TSM)                          2518 non-null   float64
8   (Open, NVDA)                        2518 non-null   float64
9   (Open, TSM)                         2518 non-null   float64
10  (Volume, NVDA)                      2518 non-null   int64
11  (Volume, TSM)                       2518 non-null   int64
dtypes: float64(10), int64(2)
memory usage: 255.7 KB
```

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12. Plotly 套件 Part 2

Access multiple series with a common column name

Access specific series like these.

```
1 df_chip['Close'][['NVDA', 'TSM']]
```

Date	NVDA	TSM
2013-01-02	3.180000	18.100000
2013-01-03	3.182500	18.090000
2013-01-04	3.287500	17.959999
2013-01-07	3.192500	17.700001
2013-01-08	3.122500	17.540001

```
1 df_chip['Close']['NVDA']
```

Date	
2013-01-02	3.180000
2013-01-03	3.182500
2013-01-04	3.287500
2013-01-07	3.192500
2013-01-08	3.122500

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12. Plotly 套件 Part 2

Multiple plots with graph_objects

為了更易於自定義設置，請使用 `graph_objects` library.

使用 `for` 循環繪製每隻股票。

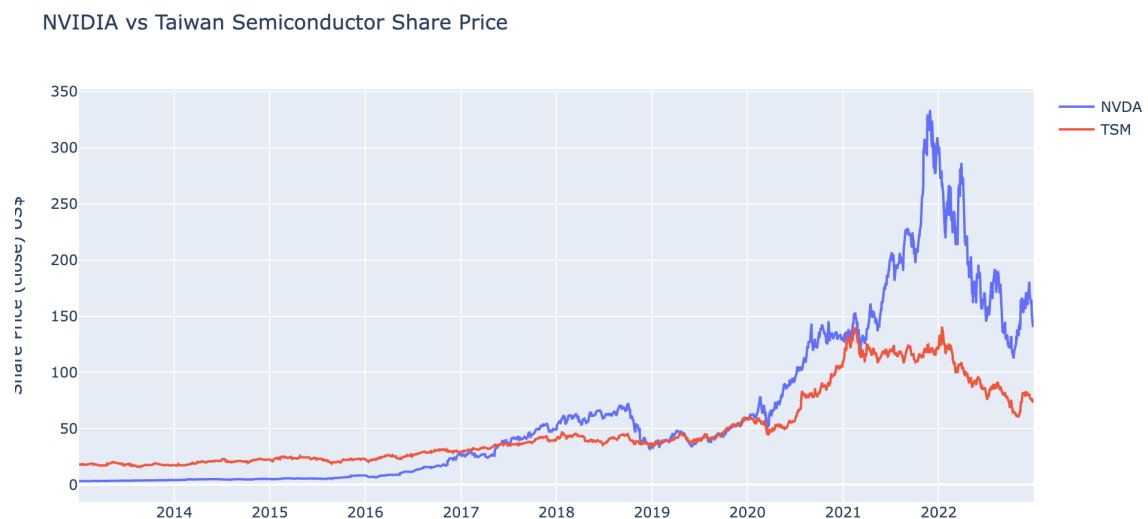
```
1 import plotly.graph_objects as go
2 fig = go.Figure()
3
4 for i in df_chip['Close']:
5     fig.add_scatter(x=df_chip.index, y=df_chip['Close'][i], name=i)
6
7 fig.update_layout(title="NVIDIA vs Taiwan Semiconductor Share Price",
8                   yaxis_title="Share Price (close) US$")
9 fig.show()
```

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12. Plotly 套件 Part 2

Multiple plots with graph_objects



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12. Plotly 套件 Part 2

Close and Adj. Close

您可能會發現有兩種類型的 Close。調整后的收盤價為 **weighted and adjusted** 任何股票分割、股息支付、普通股數量增加或減少后的價格等。收盤價是實際的市場收盤價。為 **分析價值問題**，比如收益和賬面價值如何影響股價，我們通常使用 Adj. Close。

```
1 df_chip.filter(regex='Close').sample(3)
```

為 **technical analysing**, especially taken **Open, Hi, Low** 考慮到因素，我們傾向於使用 Close。由於從未調整過 Open, Hi, Low。

	Adj Close		Close	
	NVDA	TSM	NVDA	TSM
Date				
2017-04-07	24.760082	27.380384	25.0825	32.869999
2019-02-08	36.764843	33.693165	37.0425	37.790001
2017-02-21	27.376019	26.930569	27.7675	32.330002

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12. Plotly 套件 Part 2

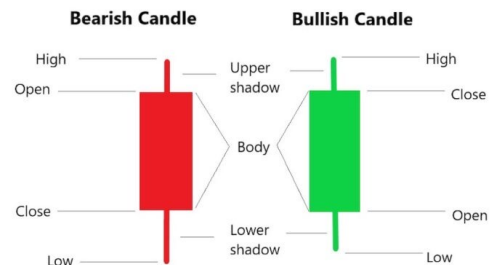
Candlestick Chart

Plotly 支援易於編碼的蠟燭圖。

```
1 df_a = yf.download("AAPL", start="2022-09-01", end="2023-01-01")
2 df_a
```

[*****100%*****] 1 of 1 completed

	Open	High	Low	Close	Adj Close	Volume
Date						
2022-09-01	156.639999	158.419998	154.669998	157.960007	157.457993	74229900
2022-09-02	159.750000	160.360001	154.970001	155.809998	155.314819	76957800
2022-09-06	156.470001	157.089996	153.690002	154.529999	154.038879	73714800
2022-09-07	154.820007	156.669998	153.610001	155.960007	155.464355	87449600
2022-09-08	154.639999	156.360001	152.679993	154.460007	153.969116	84923800



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12. Plotly 套件 Part 2

Candlestick Chart

```

1 import plotly.graph_objects as go
2 fig = go.Figure(data=[go.Candlestick(x=df_a.index,
3                                     open=df_a['Open'],
4                                     high=df_a['High'],
5                                     low=df_a['Low'],
6                                     close=df_a['Close'])]).update_layout(
7     title="Apple INC. Share Price (Close) US$",
8     yaxis_title="Close Price US$")
9 fig.show()

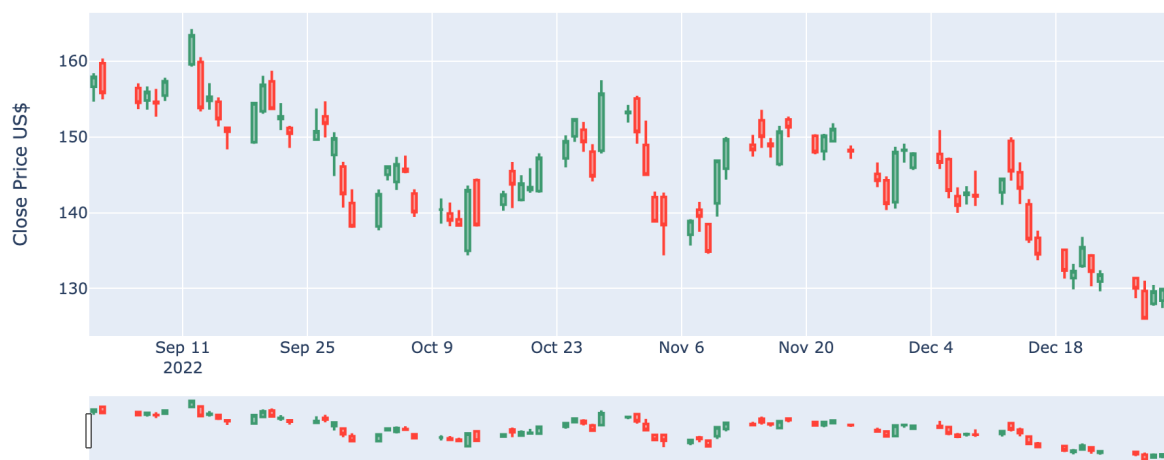
```

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12. Plotly 套件 Part 2

Apple INC. Share Price (Close) US\$



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12. Plotly 套件 Part 2

Change candle color and disable rangelsider

如果我們想更改預設繪圖設置，我們可以定義如下。

```
1 import plotly.graph_objects as go
2 fig = go.Figure(data=[go.Candlestick(x=df_a.index,
3     open=df_a['Open'],
4     high=df_a['High'],
5     low=df_a['Low'],
6     close=df_a['Close'],
7     increasing_line_color='blue', decreasing_line_color='red')]).update_layout(
8     title="Apple INC. Share Price (Close) US$",
9     yaxis_title="Close Price US$",
10    xaxis_rangeslider_visible=False)
11 fig.show()
```

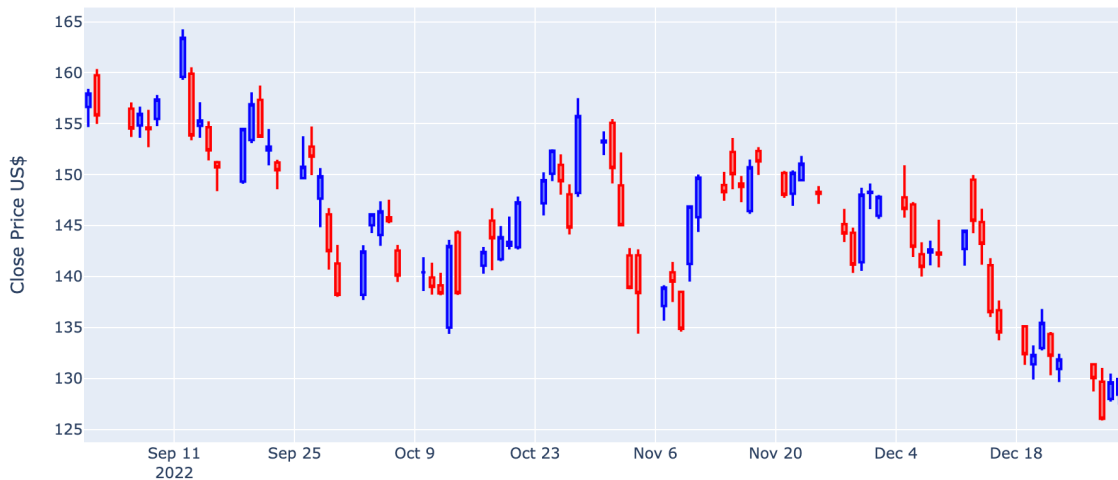
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12. Plotly 套件 Part 2

Change candle color and disable rangelsider

Apple INC. Share Price (Close) US\$



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12. Plotly 套件 Part 2

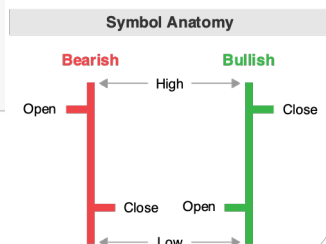
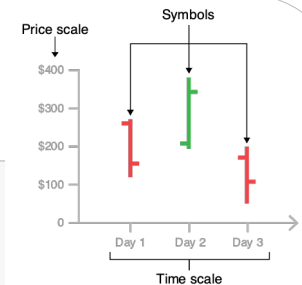
OHLC chart

OHLC (open high low close) chart 類似於candlestick chart.

```

1 fig = go.Figure(data=go.Ohlc(x=df_a.index,
2                               open=df_a['Open'],
3                               high=df_a['High'],
4                               low=df_a['Low'],
5                               close=df_a['Close'])).update_layout(
6     title="Apple INC. Share Price (Close) US$",
7     yaxis_title="Close Price US$",)
8 fig.show()

```



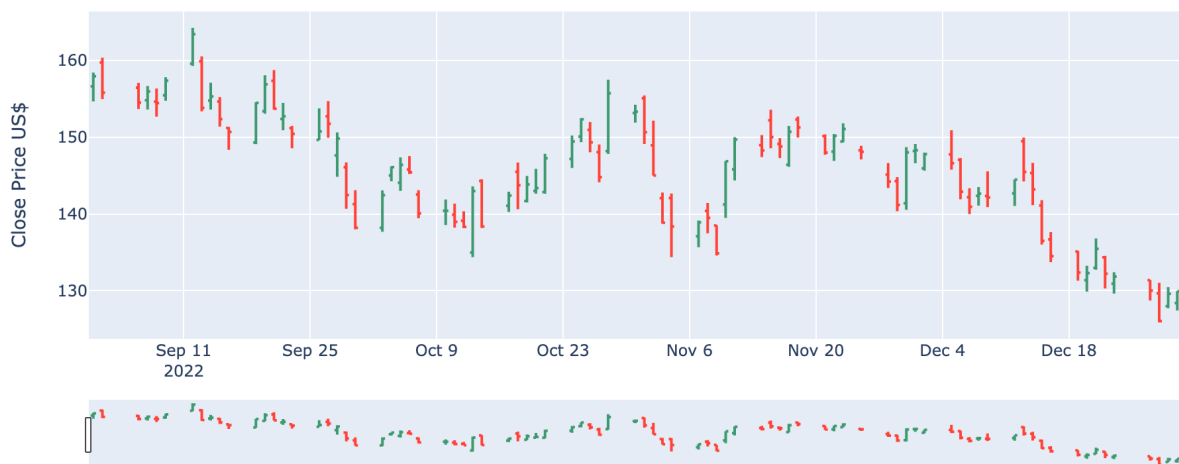
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12. Plotly 套件 Part 2

OHLC chart

Apple INC. Share Price (Close) US\$



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12. Plotly 套件 Part 2

Moving Average and Exponential Moving Average

Moving Average (MA) 有時被稱為簡單移動平均線 (SMA), 可能是最常用的指標。以及指數移動平均線 (EMA), 這對近期股價很敏感。

```
1 df_g = yf.download("GOOG", start="2022-01-01", end="2023-01-01")
2 df_g
```

[*****100%*****] 1 of 1 completed

	Open	High	Low	Close	Adj Close	Volume
Date						
2022-01-03	144.475494	145.550003	143.502502	145.074493	145.074493	25214000
2022-01-04	145.550507	146.610001	143.816147	144.416504	144.416504	22928000

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12. Plotly 套件 Part 2

Create MA20 and EMA20 series

創造 20 days MA and EMA 列。請注意，有20 NaN 在MA20，對於整體的數據分析，我們應該去掉所有的NaN 行。如果你MA20 on 2022-01-03, 你應該從周圍拉取數據1 個月前。

```
1 df_g['MA20'] = df_g["Close"].rolling(20).mean()
2 df_g['EMA20'] = df_g["Close"].ewm(span=20, adjust=False).mean()
3 df_g
```

	Open	High	Low	Close	Adj Close	Volume	MA20	EMA20
Date								
2022-01-03	144.475494	145.550003	143.502502	145.074493	145.074493	25214000	NaN	145.074493
2022-01-04	145.550507	146.610001	143.816147	144.416504	144.416504	22928000	NaN	145.011828
2022-01-05	144.181000	144.298004	137.523499	137.653503	137.653503	49642000	NaN	144.311035
2022-01-06	137.497498	139.686005	136.763504	137.550995	137.550995	29050000	NaN	143.667222
2022-01-07	137.904999	138.254745	135.789001	137.004501	137.004501	19408000	NaN	143.032677
...
2022-12-23	87.620003	90.099998	87.620003	89.809998	89.809998	17815000	94.423999	92.968646
2022-12-27	89.309998	89.500000	87.535004	87.930000	87.930000	15470900	94.007999	92.488775
2022-12-28	87.500000	88.519997	86.370003	86.459999	86.459999	17879600	93.558999	91.914606
2022-12-29	87.029999	89.364998	86.989998	88.949997	88.949997	18280700	92.933999	91.632262
2022-12-30	87.364998	88.830002	87.029999	88.730003	88.730003	19190300	92.306499	91.355857

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12. Plotly 套件 Part 2

Candlestick close with MA20 & EMA20 line

```

1 df_g = df_g.dropna()

1 import plotly.graph_objects as go
2
3 fig = go.Figure()
4
5 fig.add_candlestick(x=df_g.index, open=df_g['Open'], high=df_g['High'],
6                     low=df_g['Low'], close=df_g['Close'],
7                     increasing_line_color='blue', decreasing_line_color='red',
8                     name='Close' )
9
10 fig.add_scatter(x=df_g.index, y=df_g['MA20'], name='MA20')
11 fig.add_scatter(x=df_g.index, y=df_g['EMA20'], name='EMA20')
12
13 fig.update_layout(title="Alphabet Inc. (GOOG) Share Price (Close) US$",
14                   yaxis_title="Close Price US$",
15                   xaxis_rangeslider_visible=True,
16                   width=1000, height=800)
17 fig.show()

```

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12. Plotly 套件 Part 2

Candlestick close with MA20 & EMA20 line



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12. Plotly 套件 Part 2

Critics on MA and EMA

移動平均線數據也用於財務會計和行銷分析。這是一種比較特定時期歷史數據的簡單方法。

指數移動平均線對近期數據敏感，因此平均週期不應過長，否則毫無意義。

雖然這兩種方法經常被所謂的專欄作家用於預測，但除非你能證明趨勢在所有情況下的正確性達到95%，否則它不是統計方法。

我們可能會在後面的章節中發現這一點。

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12. Plotly 套件 Part 2

Chapter Wrap Up

Plotly Graph Object 是自定義繪圖的庫。在繪圖之前，請確保數據位於Pandas DF(免麻煩) 和 沒有NaN.

逐步建立您的地塊，並參考官方檔。

API data format (json) and API pypi library 使數據更易於訪問。現在不需要經常在網上潦草。



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Reference

Official Website:

<https://plotly.com/python/>



Plotly Graph Objects:


<https://plotly.com/python/graph-objects/>

WorldBank API:

- <https://blogs.worldbank.org/opendata/introducing-wbgapi-new-python-package-accessing-world-bank-data>
- <https://nbviewer.org/github/tgherzog/wbgapi/blob/master/examples/wbgapi-cookbook.ipynb>
- <https://pypi.org/project/wbgapi/>

GitHub Open Source Code:

<https://github.com/plotly/plotly.py>

 **plotly** | Graphing Libraries

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