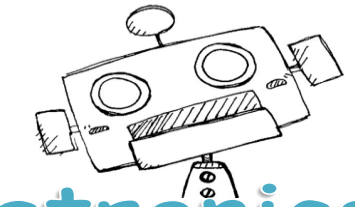
National Taiwan University
Department of Bio-industrial Mechatronics Engineering
Bio-mechatronics Lab

基本資料處理及繪圖工具

Python and R

2017.08.11, Chiu-Wang Tseng



Biomechatronics

Outline

基本資料處理

- 資料讀取
- 資料排列
- 統計運算
- 繪圖

資料處理應用

- **motor.txt**

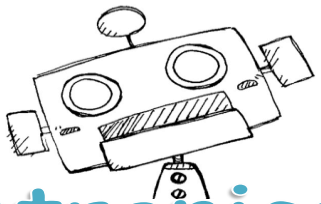
程式編輯環境

- 環境變數設定
- **Ipython notebook**
- **RStudio**

Python

- **Ipython notebook**
- **cmd → pip3 install jupyter notebook**
- **cmd → cd target_folder**
  → jupyter notebook

基本資料處理



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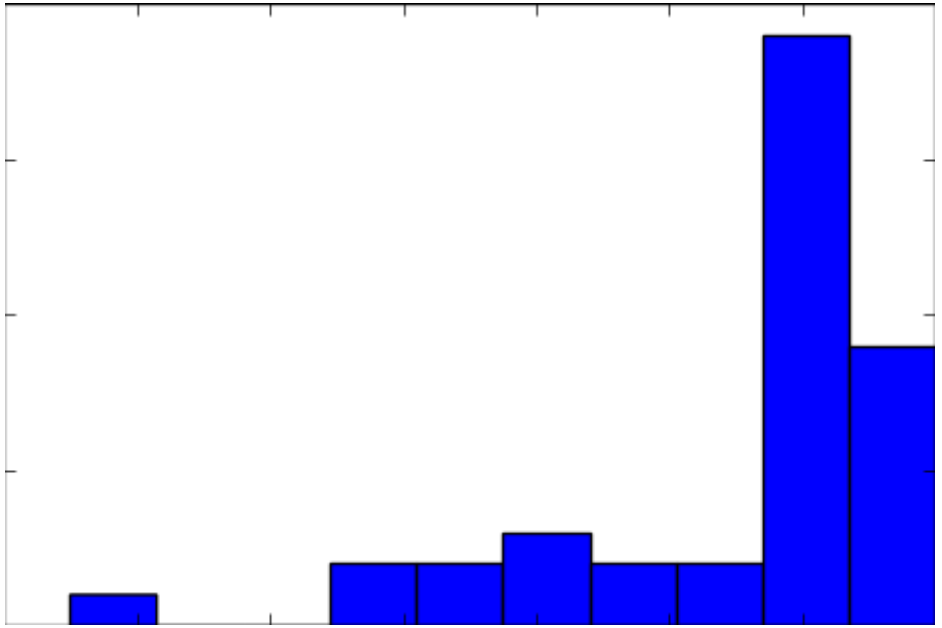
成績分析及繪圖

- 計算平均值、標準差
- 畫出分數分佈圖
  - **Histogram**
- **grade.csv**



資料讀取

- 資料儲存於文件中

- 常見儲存資料格式
  - xlsx
  - txt
  - csv
  - npy
  - none

資料讀取

- Python
  - Numpy and csv
    → pip3 install numpy
  - Read ‘grade.csv’

```
import numpy as np
import csv
file_name = 'grade.csv'
with open(file_name, 'r') as f:
    data = list(csv.reader(f, delimiter=','))
data = np.array(data)
```

- 觀察data的資料

```
print(data.shape)
print(data)
```

資料讀取

- 呼叫**1st raw**的資料 **data[0, :]**
- 呼叫**2nd column**的資料 **data[:, 1]**

資料型態

- 觀察data中的資料型態

```
type(data[0, 0])
```

- 資料型態轉換

```
data = data.astype('float')
type(data[0, 0])
```

資料排列

- 通常會將同類型資料排序成**raw data**
- 或是依不同演算法的需求排列
- **Numpy: reshape, vstack, hstack, …**

資料排列

- **reshape**

```
data1 = data.reshape([-1])
data1.shape
```

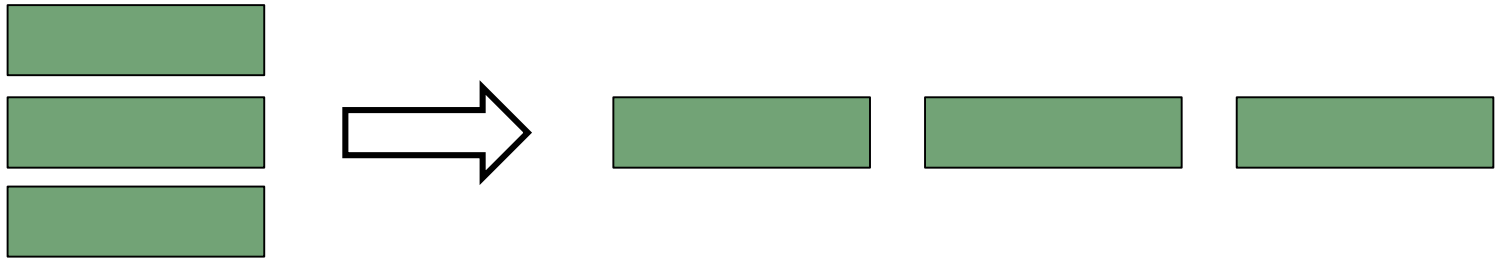
- **hstack**

```
data2 = np.hstack((data[0, :], data[1, :], data[2, :], data[3, :], data[4, :]))
data2.shape
```

- 比較兩種轉換方式

```
data1 == data2
```

小練習：利用**vstack**，將資料疊成**1**個**column**



統計運算

- 在一般的敘述統計中，最在乎的是平均值及標準差

- 推論統計的統計量在此不予討論
  - **Python**的統計函式庫：**numpy, scipy**

統計運算

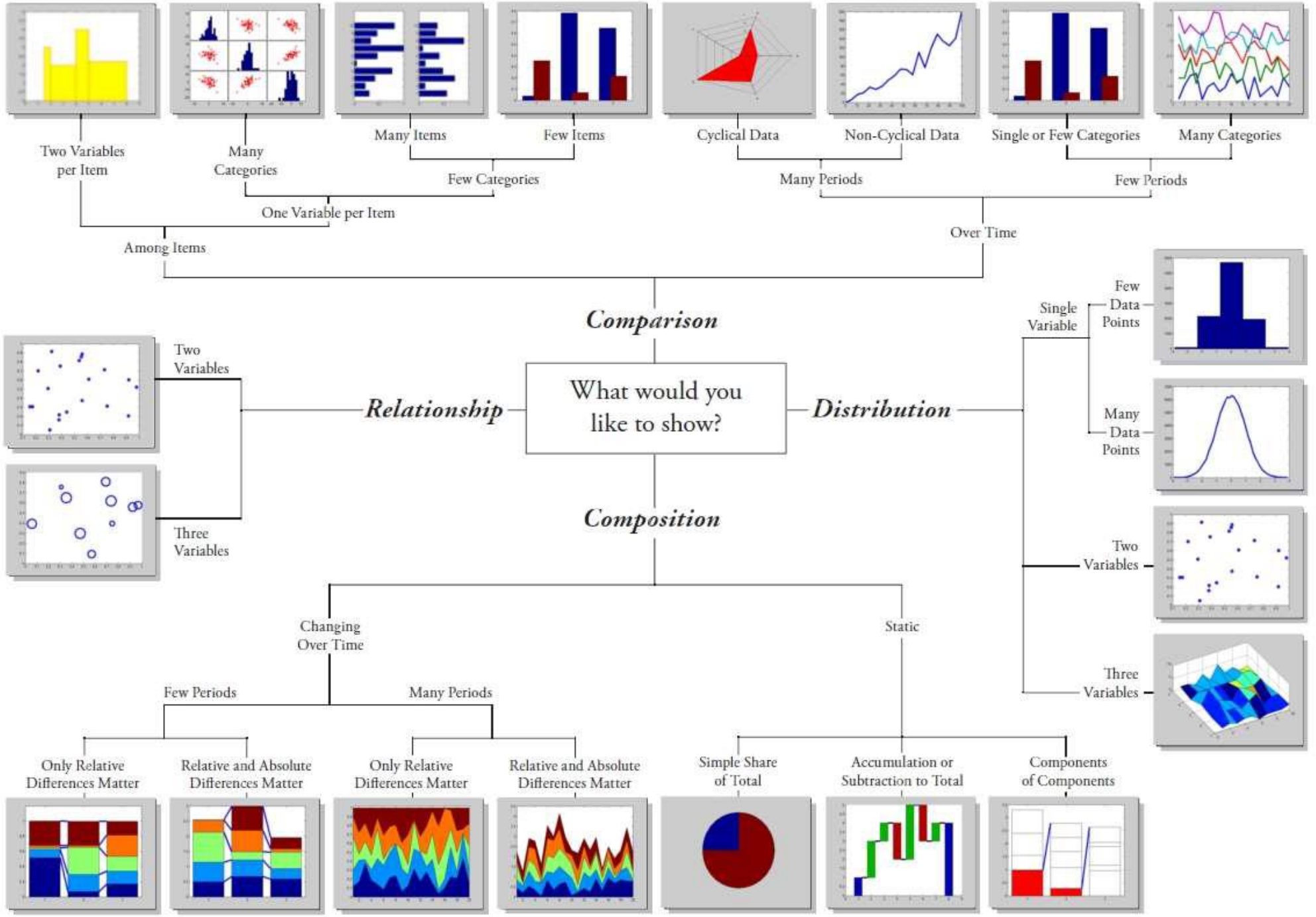
- 平均值 **np.mean(data1)**
- 標準差 **np.std(data1)**
- 進一步的統計運算，可以參考**python**的**scipy module**

統計運算

- **Test:**
  - 不使用上述函數，直接計算平均值及標準差

$$s = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \overline{x})^2}{N-1}}.$$

樣本標準差：分母為N-1
母體標準差：分母為N


What would you like to show?
Comparison
Relationship
Distribution
Composition
Two Variables per Item
Many Categories
Many Items
Few Items
Few Categories
One Variable per Item
Among Items
Cyclical Data
Non-Cyclical Data
Many Periods
Single or Few Categories
Many Categories
Few Periods
Over Time
Two Variables
Three Variables
Single Variable
Few Data Points
Many Data Points
Two Variables
Three Variables
Changing Over Time
Few Periods
Many Periods
Only Relative Differences Matter
Relative and Absolute Differences Matter
Only Relative Differences Matter
Relative and Absolute Differences Matter
Static
Simple Share of Total
Accumulation or Subtraction to Total
Components of Components

繪圖

- 我們擁有的資料是成績
  - 如何向別人呈現這些資料？

- **Histogram**
  - 呈現考試成績分佈情形

繪圖

- **matplotlib → pip3 install matplotlib**

- 小練習：畫一個**sin**函數

```
import matplotlib.pyplot as plt
x = np.arange(0, 10, 0.1)
y = np.sin(x)
plt.plot(x, y, '-r')
plt.title('sin func')
plt.show()
```

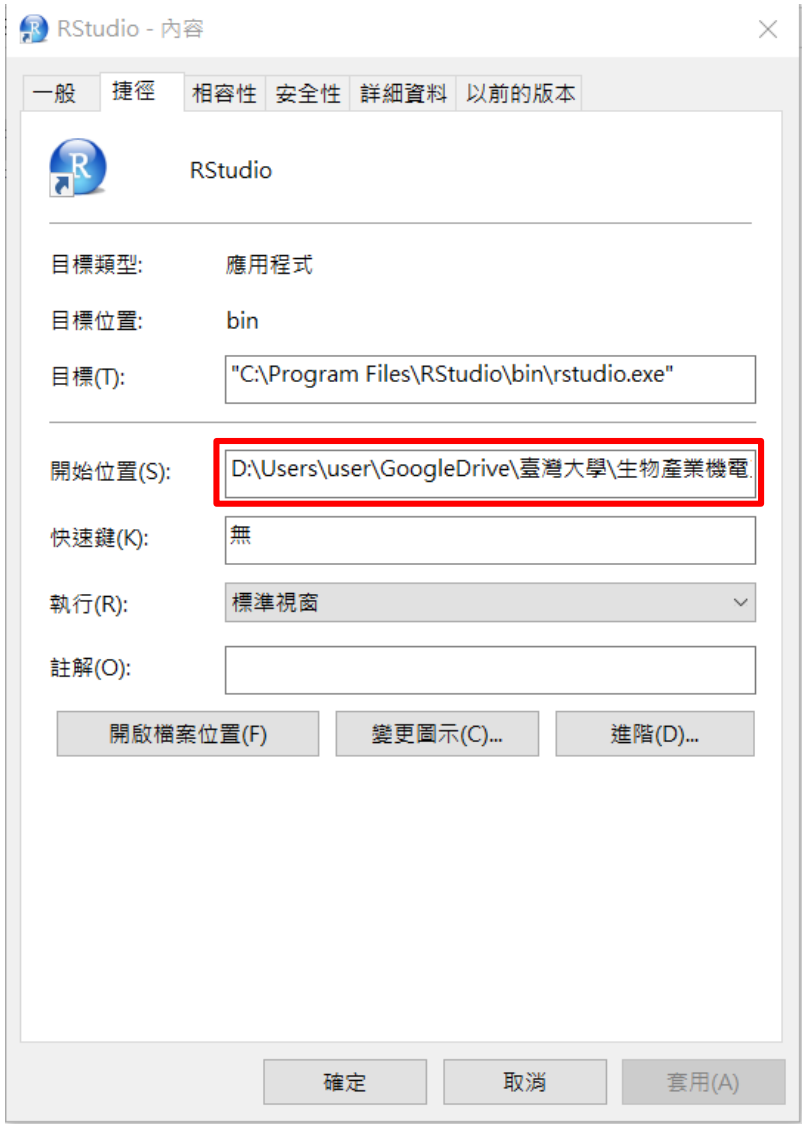
繪圖

- **Histogram**

```
plt.hist(data1)
plt.show()
```

R

- 安裝 **RStudio**
- 設定開始位置
  - 與**MATLAB**相同，要有一個工作位置



資料讀取

- Read 'grade.csv'

```
d = read.csv("grade.csv", header=FALSE)
```

- 觀察data的資料

```
d
dim(d)
```

- 此時資料格式為frame

  → 轉換為較熟悉的matrix

```
d = data.matrix(frame=d)
```

- 觀察第3列第5行的資料

```
d[3, 5]
```

在R語言中，index的起始數與python不同，與MATLAB相同

資料讀取

- 呼叫**1st raw**的資料 `d[1, ]`
- 呼叫**2nd column**的資料 `d[, 2]`

資料型態

- 觀察data中的資料型態

```
class(d)
class(d[1, 1])
typeof(d)
typeof(d[1, 1])
```

- 資料型態轉換

```
as.double(d)
```

資料排列

- 通常會將同類型資料排序成**raw data**
- 或是依不同演算法的需求排列
- **as.double, union, rbind, cbind, c, ...**

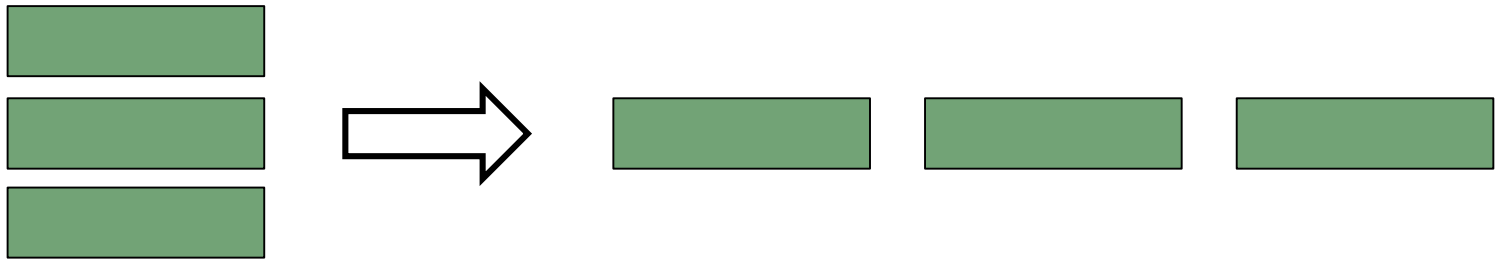
資料排列

- **as.double**

```
d1 = as.double(d)
```

- **c**

```
d2 = c(d[1,], d[2,], d[3,], d[4,], d[5,])
```



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- 推論統計的統計量在此不予討論

統計運算

- 平均値

```
mean(d2)
```

- 標準差

```
sd(d2)
sqrt(var(d2))
```

統計運算

- **Test:**
  - 不使用上述函數，直接計算平均值及標準差

$$s = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \overline{x})^2}{N-1}}.$$

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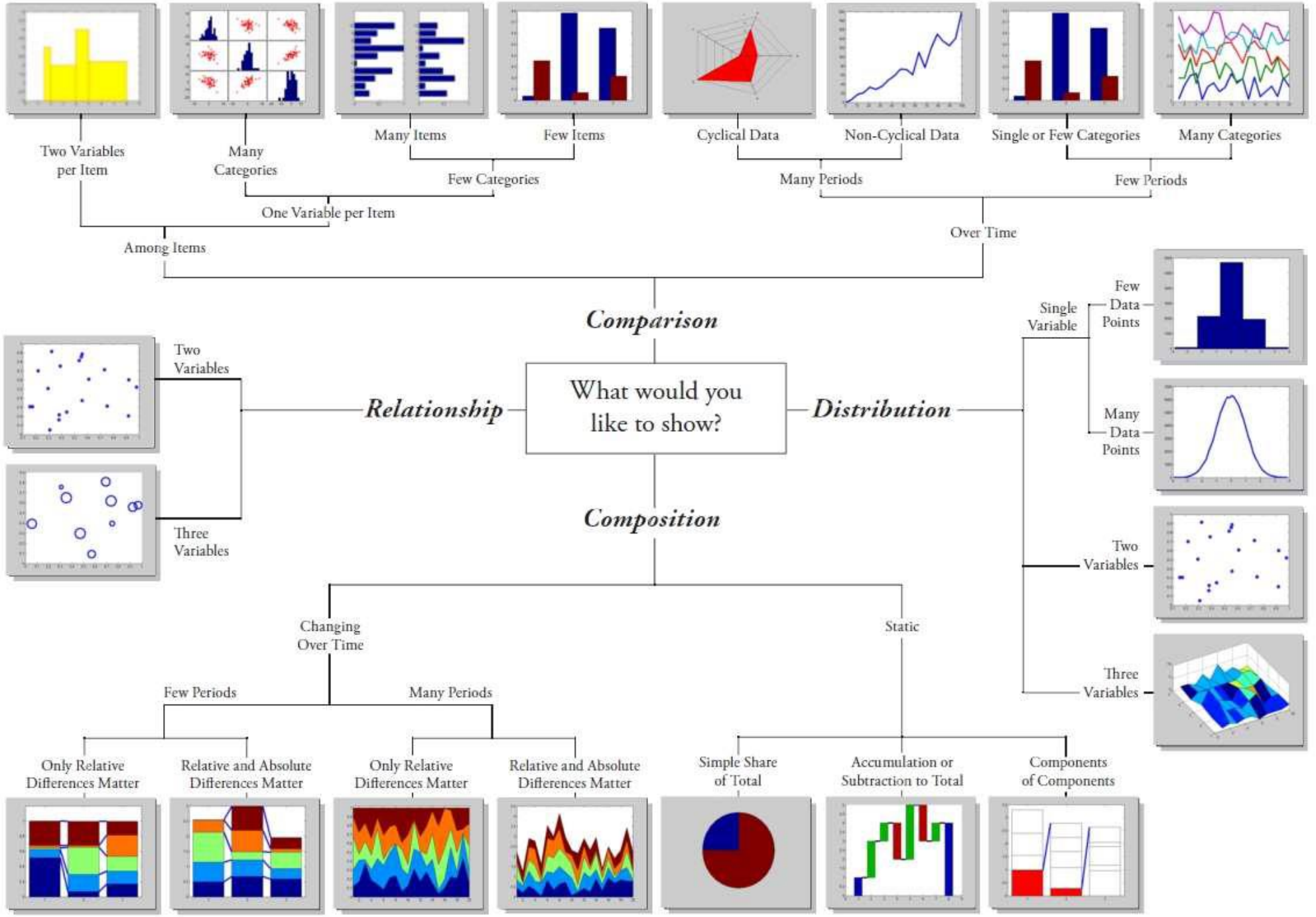
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繪圖

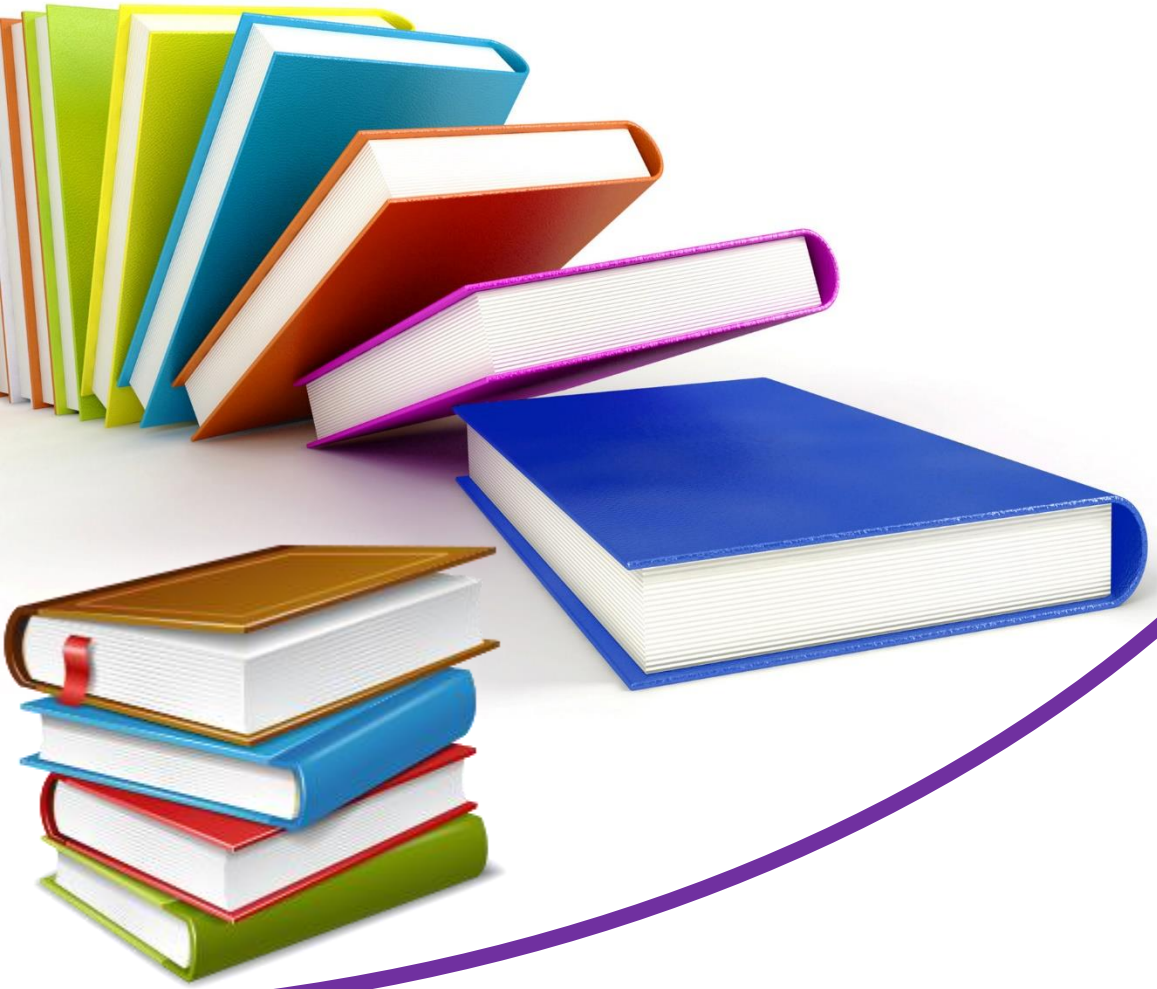
- 小練習：畫一個sin函數

```
x = seq(0, 10, 0.1)
y = sin(x)
plot(x, y, 'l')
```

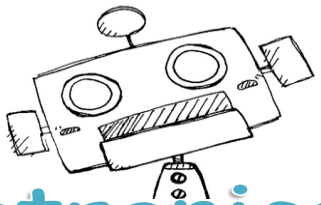
繪圖

- **Histogram**

```
hist(d2)
hist(d)
hist(d2, breaks=10)
hist(d2, breaks=5)
hist(d2, breaks=seq(0, 100, 10))
```



資料處理應用



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資料處理及分析

- **motor.txt**
  - 轉速、時間

- **PTT spider**
  - https://github.com/WarrenTseng/ptt_spider

Thanks for your attention