A large, abstract graphic on the left side of the slide features several thick, flowing blue and white wavy lines that curve from the top left towards the bottom right. A dotted line follows a similar path through the center of the graphic.

Introduction to R markdown

Dynamic documents for R

Wush Wu, Johnson Hsieh, George Chao, Noah Chen

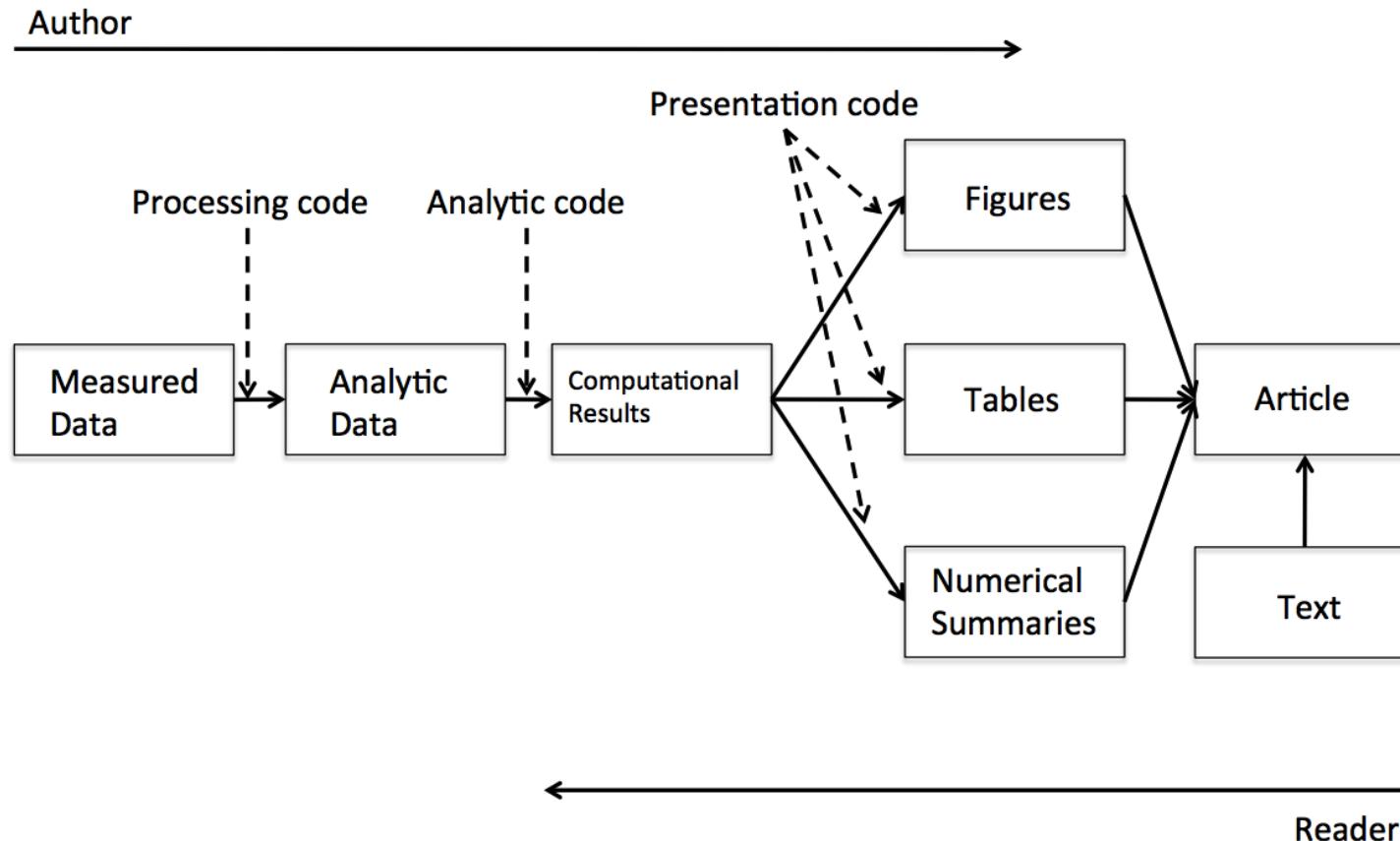


What does data analyst do



<http://goo.gl/52THNf>

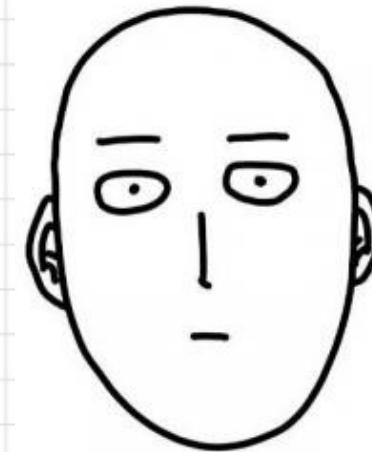
What does data analyst actually do



<https://www.coursera.org/course/repdata>

Why you need R Markdown

- 資料分析做不完
- 說明文件沒空寫
- 教授要求換方法
- 老闆說要改流程
- 客戶要我做做看
- 年度報告要總結



.....

<http://goo.gl/gK6p>

Why you need R Markdown



<http://goo.gl/YijrlI>

What is R Markdown

A convenient tool to generate reproducible document.

- [Markdown](#)
 - Lightweight markup language
 - Remove HTML tag for higher readability.
 - Inline HTML is available.
- R markdown
 - Markdown + embedded R code chunks
 - (.Rmd) -> (.md) -> (.html, .docx, .pdf)

Why R Markdown

- 製作reproducible的報告、投影片: **document**、 **slides**
- 想寫數學式子好展現自己的專業 $e = mc^2$: **mathjax**
- 只有一份source code, 不需要額外複製圖片到報告中: **.rmd**
- 需求更改時, 可以動態改變報告內容: **integrated shiny**
- 增加資料分析演算法的可讀性: **code and text**
- HTML的報告和投影片的格式方便瀏覽: **html**
- IDE? RStudio提供支援: **Knit Button**

Installation

- 最新版的RStudio已經包含R Markdown功能
- 你也可以透過以下指令安裝R Markdown套件：

```
install.packages("rmarkdown")
```

R Markdown 快速導覽

Overview

The screenshot shows an RStudio interface with the following content:

```
IntroRmd.Rmd
```

YAML Metadata

```
1 ---  
2 title: "Introduction to R markdown"  
3 author: "Johnson Hsieh"  
4 date: "2015年1月28日"  
5 output: html_document  
6 ---
```

Markdown

```
7  
8 # Markdown part  
9 This is an R Markdown document, whihc is a simple formatting  
syntax for authoring HTML, PDF, and MS Word documents.
```

R Code Chunk

```
11 ## R Code Chunk  
12 `r`  
13 summary(cars)  
14 plot(cars)  
15 `r`
```

Markdown

The screenshot shows the RStudio interface with a Markdown file named "example.Rmd" on the left and its preview on the right.

Left Panel (example.Rmd):

```
1 Header 1
2 -----
3 This is an R Markdown document. Markdown is a
| simple formatting syntax for authoring web pages.
4
5 Use an asterisk mark, to provide emphasis such as
| italics* and **bold**.
6
7 Create lists with a dash:
8 - Item 1
9 - Item 2
10 - Item 3
11
12 You can write `in-line` code with a back-tick.
13
14 ```
15 Code blocks display
16 with fixed-width font
17 ```
18
19 > Blockquotes are offset
20
```

Right Panel (Preview HTML):

Header 1

This is an R Markdown document. Markdown is a simple formatting syntax for authoring web pages.

Use an asterisk mark, to provide emphasis such as *italics* and **bold**.

Create lists with a dash:

- Item 1
- Item 2
- Item 3

You can write in-line code with a back-tick.

Code blocks display
with fixed-width font

Blockquotes are offset

R Code Chunks

The screenshot shows the RStudio interface. On the left, the code editor window displays an R Markdown file named "chunks.Rmd". The content includes a section header "R Code Chunks" and an R code chunk that generates a plot. On the right, the "Preview HTML" window shows the rendered output. The title "R Code Chunks" is displayed, followed by a text block: "With R Markdown, you can insert R code chunks including plots:". Below this is the rendered R code, which includes a quick summary and a ggplot2 plot. The plot shows the relationship between speed and dist, with a blue line and shaded area representing a smooth fit.

```
1 R Code Chunks
2 -----
3
4 With R Markdown, you can insert R code
5 chunks including plots:
6
7 ```{r qplot, fig.width=4, fig.height=3,
8 message=FALSE}
9 # quick summary and plot
10 library(ggplot2)
11 summary(cars)
12 qplot(speed, dist, data=cars) +
13   geom_smooth()
14 ```

R Code Chunks

With R Markdown, you can insert R code chunks including plots:

# quick summary and plot
library(ggplot2)
summary(cars)

##      speed          dist
##  Min.   :4.0   Min.   : 2
##  1st Qu.:12.0  1st Qu.:26
##  Median :15.0  Median :36
##  Mean   :15.4  Mean   :43
##  3rd Qu.:19.0  3rd Qu.:56
##  Max.   :25.0  Max.   :120

qplot(speed, dist, data = cars) + geom_smooth()
```

dist

Inline R Code

- 利用 `r` 在markdown中插入R程式

- 這是DSP推出的第 `r 3+1` 門課程

- 這是DSP推出的第 4 門課程

- 蒼尾花資料集(iris dataset)有 `r levels(iris\$Species)` 等種類,
總共有 `r length(levels(iris\$Species))` 種

- 蒼尾花資料集(iris dataset)有 setosa, versicolor, virginica 等種類,
總共有 3 種

Inline R Equations

- 插入 LaTeX 公式的方法：

- 行內 \$ equation \$
- 段落 \$\$ equation \$\$

熵指標的公式為 $-\sum p_i \log p_i$ ，表示系統的亂度

熵指標的公式為 $-\sum p_i \log p_i$ ，表示系統的亂度

請計算高斯分佈 $f(x; \mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{x-\mu}{\sigma} \right)^2}$

請計算高斯分佈

$$f(x; \mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2} \left(\frac{x-\mu}{\sigma} \right)^2}$$

Rendering Output

- RStudio: "Knit" command:
 - (Win:Ctrl+Shift+K / OSX:Command+Shift+K)
- Command line: rmarkdown::render function

```
rmarkdown::render("input.Rmd")
```

Markdown Basics

Markdown Quick Reference

在RStudio中，在UI界面中點選help (?)可以查閱Markdown語法

The screenshot shows the RStudio interface with the 'Using R Markdown' help page open. The top navigation bar includes 'Environment', 'History', 'Git', 'Files', 'Plots', 'Packages', 'Help', and 'Viewer'. The 'Help' tab is active. The main content area displays the 'Markdown Quick Reference' page, which provides a brief introduction to R Markdown and links to 'Using R Markdown' for more information. Below this, sections for 'Emphasis', 'Headers', 'Lists', and 'Tables' are shown with examples of their syntax.

```
2 title: "IntroRmd.Rmd"
3 author: "John Doe"
4 date: "2015年1月1日"
5 output: html_document
6 ---
7
8 # Markdown part
9 This is an R Markdown document, which is a simple
formatting syntax for authoring HTML, PDF, and MS Word
documents.
10
11 ## R Code Chunk
12 ``{r}
13 summary(cars)
14 plot(cars)
15 ``
```

R version 3.1.1 (2014-07-10) -- "Sock it to Me"
Copyright (C) 2014 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin13.1.0 (64-bit)

R 是免費軟體，不提供任何擔保。
在某些條件下您可以將其自由散布。
用 'license()' 或 'licence()' 來獲得散布的詳細條件。

R 是個合作計劃，有許多人為之做出了貢獻。
用 'contributors()' 來看詳細的情況並且
用 'citation()' 會告訴您如何在出版品中正確地參照 R 或 R 套件。

R Code Chunks

Overview

R code will be evaluated and printed

```
```{r}  
summary(cars$dist)
```
```

```
summary(cars$dist)
```

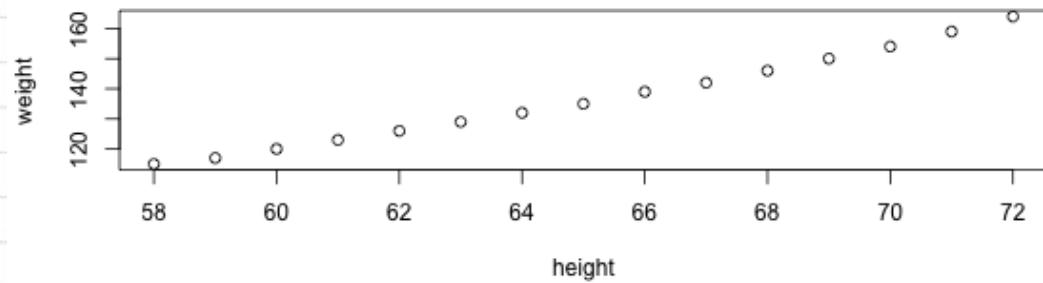
| Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|------|---------|--------|-------|---------|--------|
| 2.00 | 26.00 | 36.00 | 42.98 | 56.00 | 120.00 |

Overview (cont.)

draw graphics

```
```{r}  
plot(women)
```
```

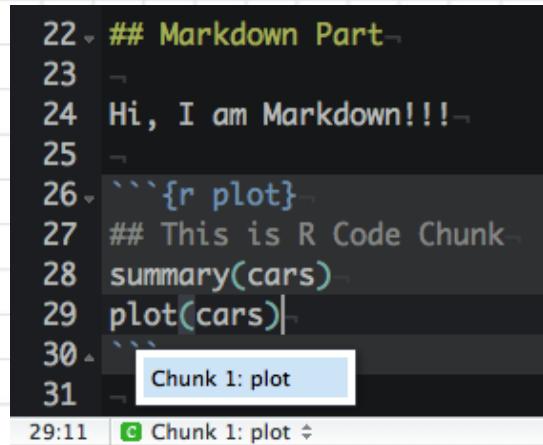
```
plot(women)
```



Named R code chunk.

```
```{r plot}
summary(cars)
plot(cars)
```
```

- Easy Navigation in RStudio



A screenshot of the RStudio interface showing an R script. The code is as follows:

```
22 ## Markdown Part
23
24 Hi, I am Markdown!!!
25
26 ```{r plot}
27 ## This is R Code Chunk
28 summary(cars)
29 plot(cars)
30 ```
31
```

The line `plot(cars)` is highlighted with a blue selection bar. A tooltip window titled "Chunk 1: plot" is displayed over the highlighted line. The status bar at the bottom shows "29:11" and "Chunk 1: plot".

Basic Chunk Options

- `echo`(TRUE): whether to include R source code in the output file
- `eval`(TRUE): whether to evaluate the code chunk
- `message`(TRUE): whether to preserve messages emitted by `message()`
- `results('hide','asis')`: hide output ; asis treats the output of your R code as literal Markdown (when using like `kable` function)
- `include`(TRUE): whether to be written into the output document, but the code is still evaluated and plot files are generated
- `warning`(TRUE): whether to preserve warnings in the output
- `comment`("##"): set to comment notation

Basic Chunk Options (cont.)

Set global chunk options at code chunks header:

```
knitr::opts_chunk$set(echo=FALSE, results='hide')
```

Exercise :

利用R Markdown 製作《一周天氣預報》書面報告。[範例](#)

- [原始出處](#)
- [參考範本](#)
- [範例資料](#)

Exercise: Original :

其他預報地區 臺北市 
 在地天氣報馬仔

【大陸冷氣團及華南雲雨區影響，全區濕冷有短暫雨】。

本週持續在華南雲雨區影響下，各地天氣都不太穩定，今天（12日）水氣較為減少，各區的降雨都明顯緩和下來，由於雲量較多，持續飄著小雨，平地氣溫全天多在15到18度之間變化。

今晚到明天（13日）水氣又會再稍微增加，各區都可能出現局部短暫雨，降雨機率也會提高一些，預估降雨時間不會太長，雨勢也不大，但外出活動建議還是帶個雨具會比較保險；由於最近幾天的天氣變化迅速，提醒大家要多留意最新的氣象資訊。氣溫方面，今天入夜後溫度會再稍下降，到明天清晨平地低溫只有13至14度左右，而白

▷ 今明預報

| 臺北市 | 溫度 (°C) | 天氣狀況 | 舒適度 | 降雨機率 (%) | 發布時間：2016/01/12 23:00 |
|-------------------------------|---------|---|---------|----------|-----------------------|
| 今晚至明晨 01/13 00:00~01/13 06:00 | 14 ~ 15 |  | 寒冷 | 50 % | |
| 明日白天 01/13 06:00~01/13 18:00 | 14 ~ 16 |  | 寒冷至稍有寒意 | 60 % | |
| 明日晚上 01/13 18:00~01/14 06:00 | 14 ~ 15 |  | 寒冷 | 40 % | |

▷ 1週預報

| 臺北市 | 01/13
星期三 | 01/14
星期四 | 01/15
星期五 | 01/16
星期六 | 01/17
星期日 | 01/18
星期一 | 01/19
星期二 | 發布時間：2016/01/12 23:00 |
|-----|---|---|--|---|---|---|---|-----------------------|
| 白天 |  |  |  |  |  |  |  | |
| | 14 ~ 16 | 14 ~ 17 | 14 ~ 17 | 15 ~ 17 | 15 ~ 18 | 15 ~ 17 | 15 ~ 17 | |
| 晚上 |  |  |  |  |  |  |  | |
| | 14 ~ 15 | 14 ~ 16 | 15 ~ 16 | 15 ~ 16 | 15 ~ 16 | 15 ~ 16 | 15 ~ 16 | |

Exercise: After :

在地天氣報馬仔

【東北季風增強天氣轉涼，請適時增添衣物，以免著涼】。

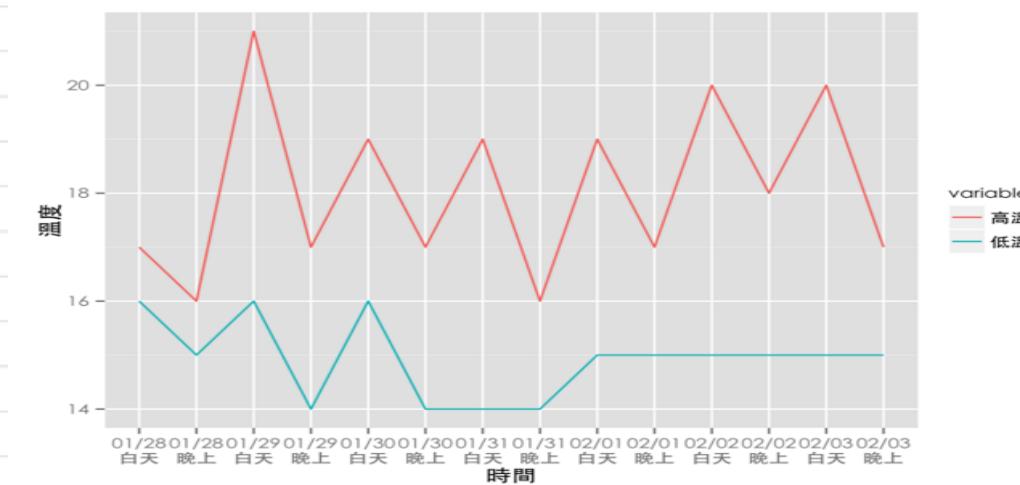
今天（28日）還是受東北季風影響，但是水氣減少，整體而言下雨的現象有機會比昨天少，下雨比較明顯的還是會在北部，目前氣象局已針對基隆北海岸、宜蘭地區及大臺北山區發布大雨特報、建議出門可以攜帶雨具備用；溫度的部分，跟昨天相比，會降1度左右，感受其實跟昨天蠻類似的，預測高溫約17度，低溫約15度，早晚較為偏冷偏涼，請適時增添衣物避免著涼。

另外，也由於東北風增強，沿海空曠地區及外島容易有8到9級的強陣風出現，海邊活動或海上作業船隻請注意安全。

台北市1週預報

| | 01/28 | 01/29 | 01/30 | 01/31 | 02/01 | 02/02 | 02/03 |
|------|-------|-------|-------|-------|-------|-------|-------|
| 白天天氣 | 陰短暫雨 | 多雲短暫雨 | 多雲短暫雨 | 陰短暫雨 | 多雲時陰 | 多雲 | 多雲 |
| 白天溫度 | 17-16 | 21-16 | 19-16 | 19-14 | 19-15 | 20-15 | 20-15 |
| 晚上天氣 | 多雲短暫雨 | 多雲短暫雨 | 陰短暫雨 | 多雲短暫雨 | 多雲 | 多雲 | 多雲 |
| 晚上溫度 | 16-15 | 17-14 | 17-14 | 16-14 | 17-15 | 18-15 | 17-15 |

未來7天預報圖



Exercise Q1

利用R Markdown 製作《一周天氣預報》書面報告。

- 計算01/28日當日的最高溫與最低溫度

```
# Hint:
```

```
# 1. 下載weather-utf8.csv到自己的電腦上  
# 2. 在R chunk中，利用read.csv()讀取檔案進行分析  
  # Windows: read.csv(fileEncoding="UTF-8")  
# 3. 找出01/28當日最高溫 max()  
# 4. 找出01/28當日最低溫 min()  
# 5. use inline R chunk `r max(...)`
```

Exercise A1

利用R Markdown 製作《一周天氣預報》書面報告。

- 計算01/28日當日的最高溫與最低溫度

```
# Hint for Linu& Mac:  
dat <- read.csv("data/weather-utf8.csv")  
max(dat[1:2, 4:5])  
min(dat[1:2, 4:5])  
# 預測高溫約`r max(dat[1:2,4:5])`度, 低溫約`r min(dat[1:2,4:5])`度
```

```
# Hint for Windows:  
dat <- read.csv("data/weather-utf8.csv", fileEncoding="UTF-8")  
max(dat[1:2, 4:5])  
min(dat[1:2, 4:5])  
# 預測高溫約`r max(dat[1:2,4:5])`度, 低溫約`r min(dat[1:2,4:5])`度
```

Table Output

- Print data directly:

```
print(head(women))
```

| | height | weight |
|---|--------|--------|
| 1 | 58 | 115 |
| 2 | 59 | 117 |
| 3 | 60 | 120 |
| 4 | 61 | 123 |
| 5 | 62 | 126 |
| 6 | 63 | 129 |

Table Output (cont.)

- Using `knitr::kable` :
 - Set `results='asis'` to write raw results from R into the output document

```
```{r, results='asis'}
knitr::kable(women)
```
```

| HEIGHT | WEIGHT |
|--------|--------|
| 58 | 115 |
| 59 | 117 |
| 60 | 120 |
| 61 | 123 |
| 62 | 126 |
| 63 | 129 |

Exercise Q2

利用R Markdown 製作《一周天氣預報》書面報告。

- 製作未來七天天氣預報表

```
# Hint:  
# 你可能需要dplyr套件  
# 可以先用filter把白天、晚上分開處理  
# 利用 paste(低溫,高溫,sep="-") 來製作溫度區間, i.e. 16-17  
# 利用colnames, rownames來對整理好的資料表的行與列命名
```

Exercise A2

利用R Markdown 製作《一周天氣預報》書面報告。

- 製作未來七天天氣預報表

```
library(dplyr)
day1 <- filter(dat, 早晚=="白天")
day2 <- mutate(day1, 溫度=paste(高溫,低溫,sep="~"))
day3 <- select(day2, 天氣, 溫度)

night1 <- filter(dat, 早晚=="晚上")
night2 <- mutate(night1, 溫度=paste(高溫,低溫,sep="~"))
night3 <- select(night2, 天氣, 溫度)

out <- data.frame(t(bind_cols(day3, night3)))
colnames(out) <- day1$日期
rownames(out) <- c("白天天氣","白天溫度","晚上天氣","晚上溫度")
```

Exercise A2 (cont.)

利用R Markdown 製作《一周天氣預報》書面報告。

- 製作未來七天天氣預報表

```
```{r results='asis', echo=FALSE}
knitr::kable(out)
```
```

Exercise Q3

利用R Markdown 製作《一周天氣預報》書面報告。

- 製作未來七天天氣預報圖

```
# Hint:  
# 你可能需要ggplot2套件  
# Mac顯示中文需設置字型  
# http://equation85.github.io/blog/graph-font-of-r-in-mac-os-x/  
# par(family='STHeiti')
```

Exercise A3

利用R Markdown 製作《一周天氣預報》書面報告。

- 製作未來七天天氣預報圖

```
library(ggplot2);library(reshape2)
dat1 <- mutate(dat, 時間=paste(日期,早晚,sep="\n"))
dat2 <- select(dat1, 時間, 高溫, 低溫)
colnames(dat2)[1] <- "時間" # for Windows user
dat3 <- melt(dat2)
g <- ggplot(dat3, aes(x=時間, y=value, group=variable, colour=variable)) +
  geom_line() +
  labs(x="時間", y="溫度")
```

```
# 顯示中文字 Mac user only
g + theme_gray(base_family="STHeiti")
```

Exercise

利用R Markdown 製作《一周天氣預報》書面報告。

- [原始出處](#)
- [參考範本](#)
- [範例資料](#)
- [參考解答](#)

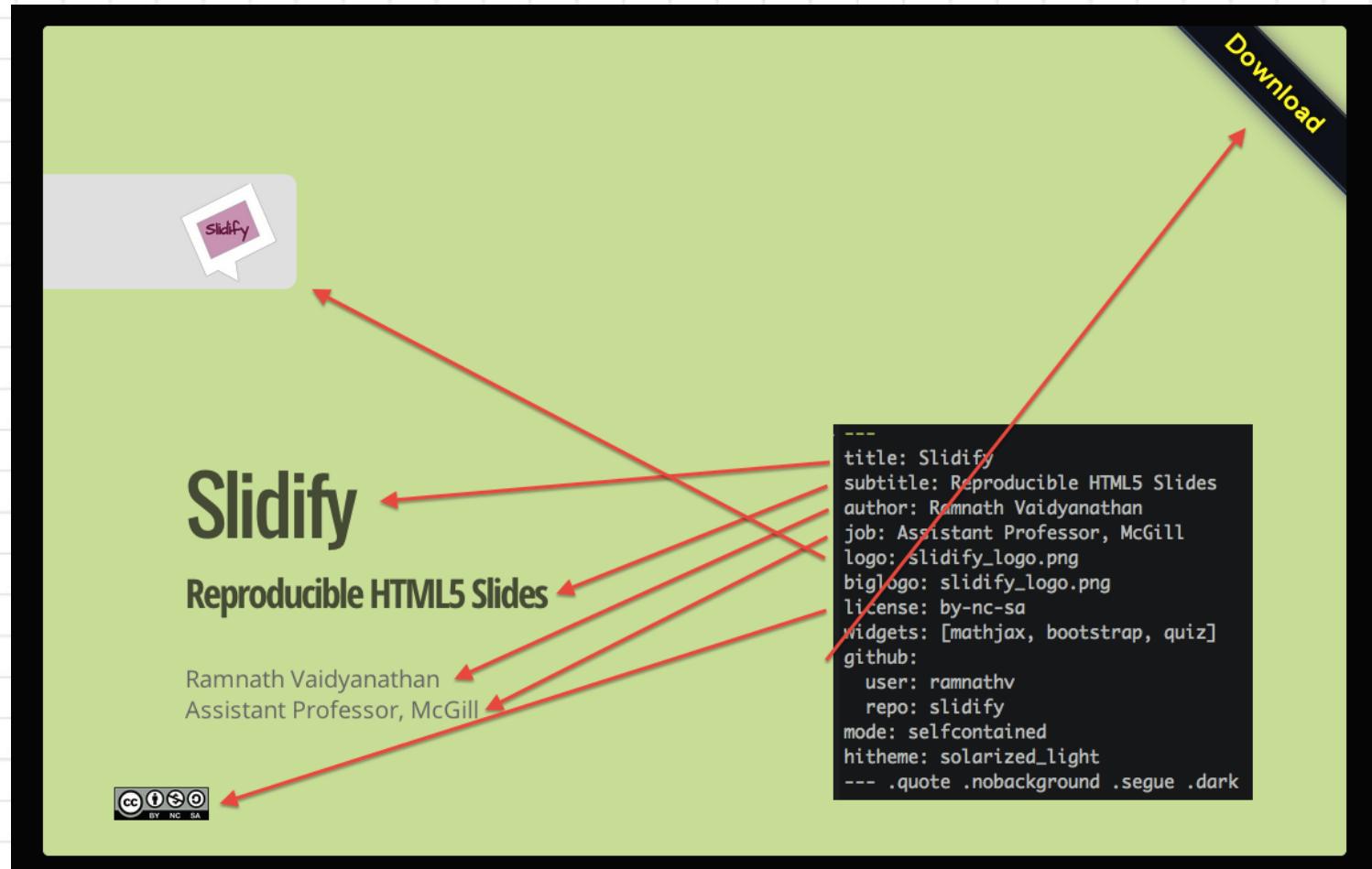
Appendix

About Document Content

You can add R Markdown and HTML in the YAML content.

```
—  
title: "Introduction to R Markdown"  
author: "Wush Wu, Johnson Hsieh, George Chao, Noah Chen"  
date: "2016-01-11"  
output: html_document  
—
```

YAML metadata



Cover by Wush

Some Useful HTML

- iframe: displaying a web page within a web page

```
<iframe src="http://dsp.im/" height=600 width=800></iframe>
```

- img: inserting images into an HTML document. Much easier for adjusting width and height.

```

```



Interactive Documents

It's possible to embed a Shiny application within a document.

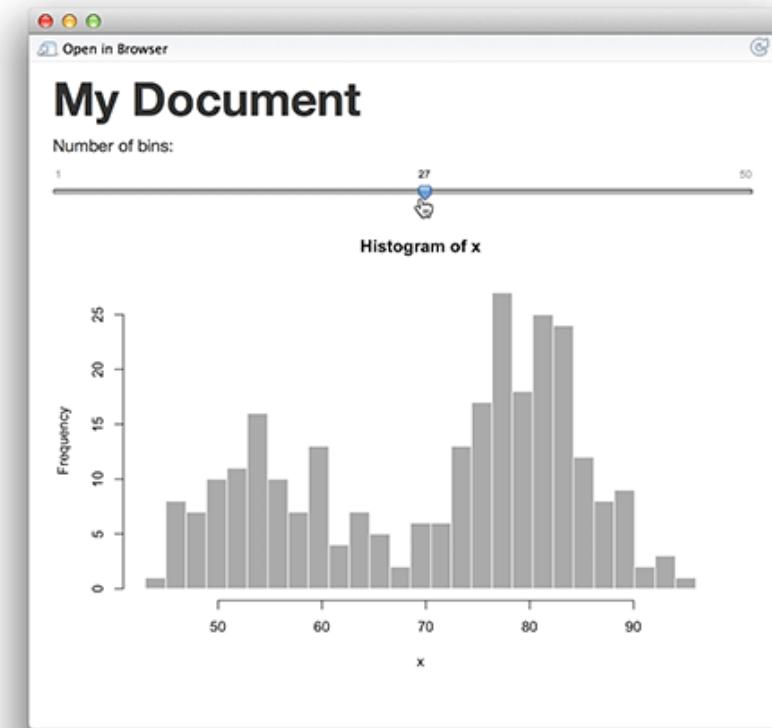
Open in Browser

My Document

How many cars?

	speed	dist
1	4.00	2.00
2	4.00	10.00
3	7.00	4.00
4	7.00	22.00
5	8.00	16.00
6	9.00	10.00
7	10.00	18.00



Publish to the web

Using R packages::slidify to publish your slides to the web

```
library(slidify)
publish_github("repo", username="user_name")
publish_rpubs("title","file_name.html")
publish_dropbox(dir_name)
publish_gist("title",file="file_name.html",publish=TRUE)
```

Publish to the web: Github

1. sign up or login in Github.com at browser
2. find button: New repository to add new one.
3. select a name for repository, then created.
4. the link of your new repository would be like:
[https://github.com/">your_name"/repo_name.git](https://github.com/)
5. find Settings in your profile at top-right corner
6. select SSH Keys and add SSH Key
7. upload your SSH key which created by your own PC/notebook.
8. at RStudio, using Rcommand:
[slidify::publish_github\("repo_name", username="your_name"\)](#)
9. your new page will be ready in 5~10 min and link:
https://>your_name.github.io/>repo_name/index.html

References

- [R Markdown Cheat Sheet](#)
- [R Markdown](#)
- [knitr](#)
- [RStudio Documentation](#)
- [Reproducible Research](#)
- [Shiny Articles](#)
- [Publish to Github Pages/Dropbox/Rpubs](#)

Wush 教學影片

Slidify簡介 by Wush Wu

<https://www.youtube.com/watch?v=P97udK2ktuY>

20121203 MLDM Monday markdown + knitr by Wush Wu

<https://www.youtube.com/watch?v=OHKZLeKIUsM>