可重复性数据分析及其工业实践

第 13 届中国 R 语言会议

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文学编程 [1]

Literate programming is a programming paradigm introduced by Donald Knuth in which a computer program is given an explanation of its logic in a natural language, such as English, interspersed with snippets of macros and traditional source code, from which compilable source code can be generated.

[1] https://en.wikipedia.org/wiki/Literate_programming

Sweave I

下面以 utils 包提供的测试文档为例

```
testfile <- system.file("Sweave", "Sweave-test-1.Rnw",
                        package = "utils")
Sweave(testfile)
tools::texi2pdf("Sweave-test-1.tex")
```

注意

若已安装 LaTeX 发行版 TinyTeX[2]，需要再装三个 LaTeX 宏包 a4wide、ntgclass 和 ae，以供文档编译

```
tinytex::tlmgr_install(c('a4wide', 'ntgclass','ae'))
```

[2] https://github.com/yihui/tinytex

Sweave II

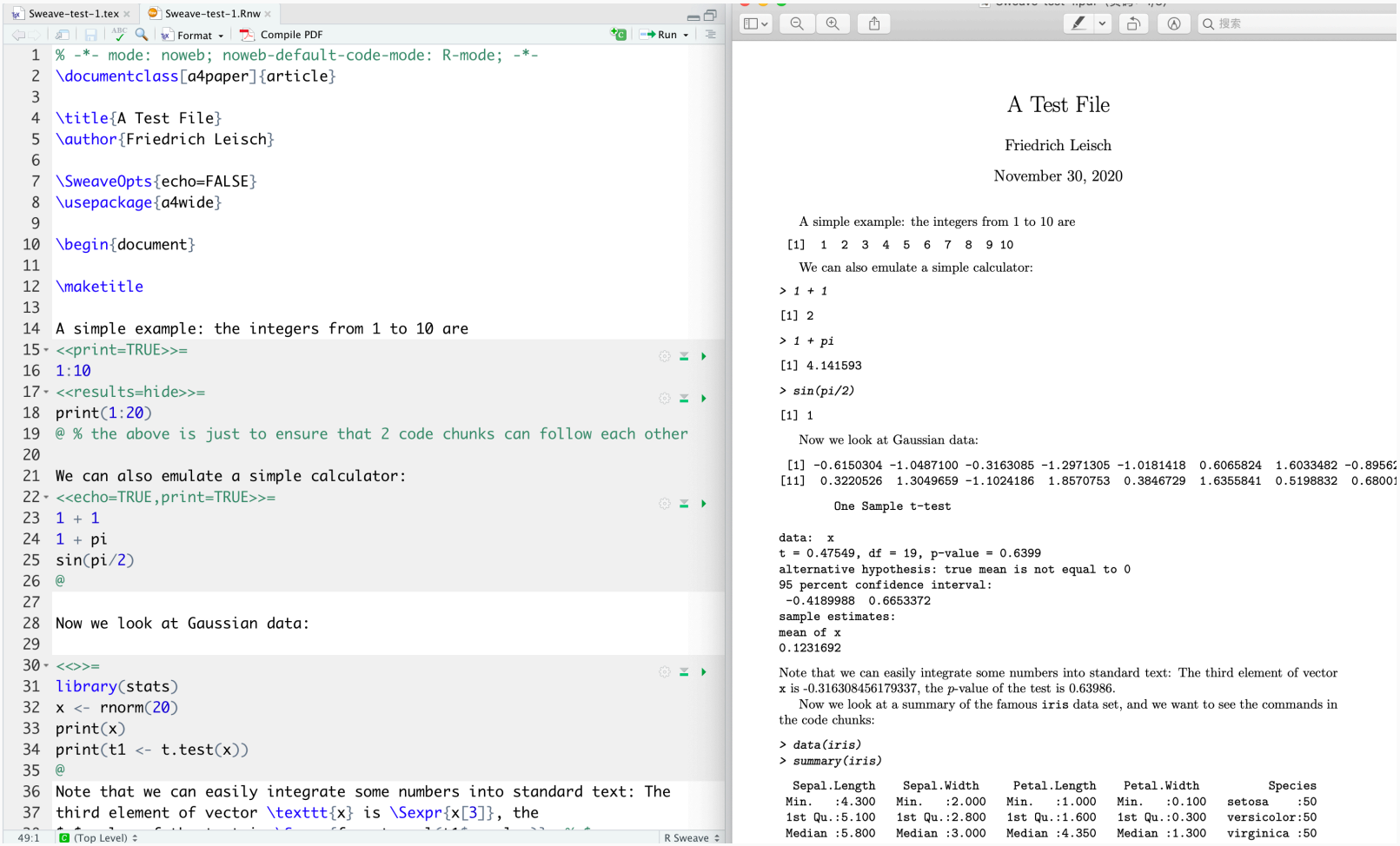


图 1: 形式上是 LaTeX 和 R 代码的混合物

A minimal R Markdown document [3]

```
---
title: "A Simple Regression"  #----
author: "Yihui Xie"           #    |
date: "2019-01-02"            #    |
output:                       #    |--> metadata
  html_document:              #    |
    toc: true                 #----
---

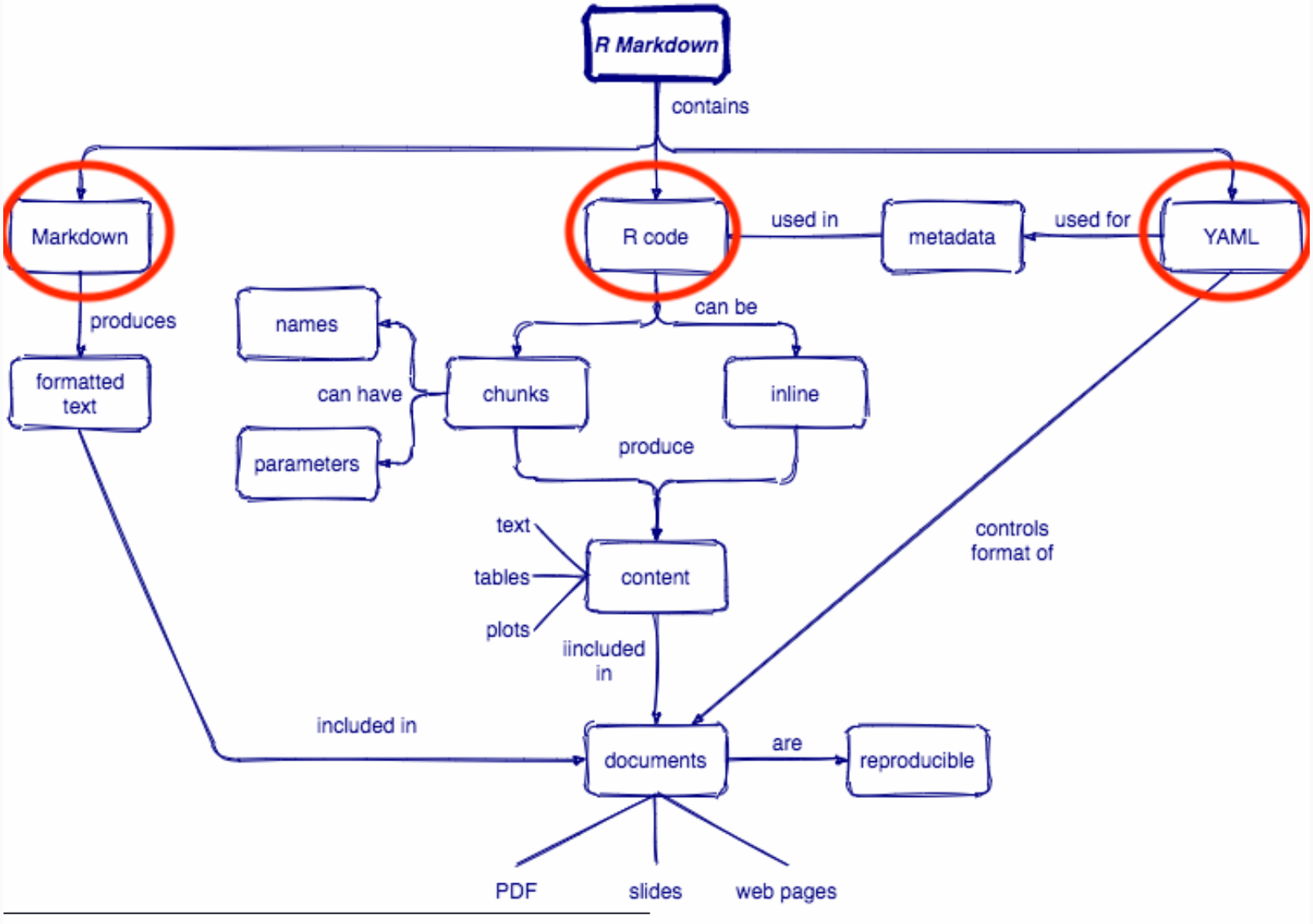
We built a linear regression model.  <!-- narrative -->
```{r}
fit <- lm(dist ~ speed, data = cars)
b   <- coef(fit)
plot(fit)
```

The slope of the regression is `r b[1]`. <!-- narrative w/ code --
```

[3] https://slides.yihui.org/2020-covid-rmarkdown.html#7

Knit R Markdown to Markdown

````
---
title: "A Simple Regression"  #----
author: "Yihui Xie"           #    |
date: "2019-01-02"            #    |
output:                       #    |--> metadata
  html_document:              #    |
    toc: true                 #----
---

We built a linear regression model.  <!-- narrative -->
```r
fit <- lm(dist ~ speed, data = cars)
b   <- coef(fit)
plot(fit)
```

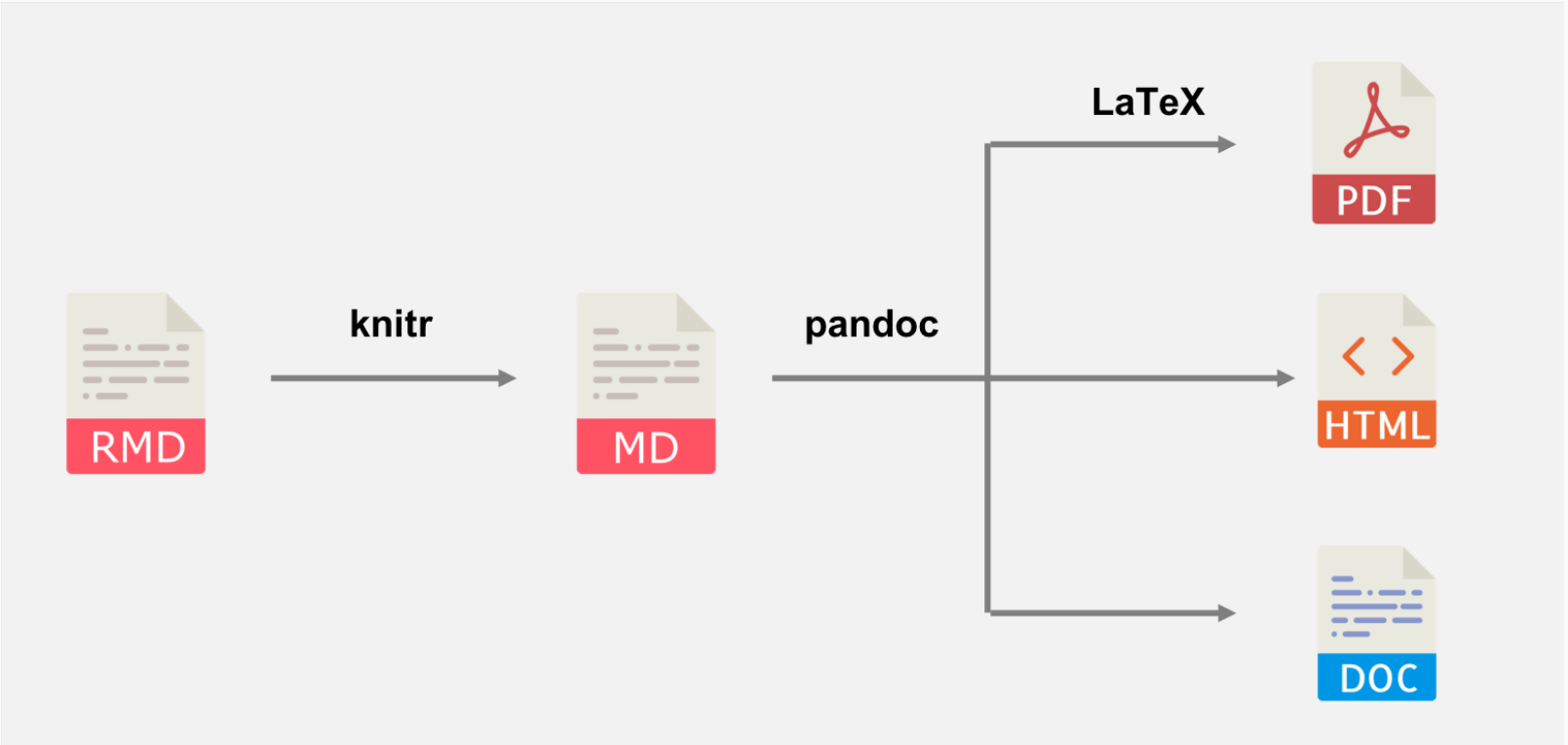
![a plot](input_files/figure-html/unnamed-chunk-1.png)
The slope of the regression is -17.58.  <!-- narrative w/ code -->
````

R Markdown 思维导图[4]



[4] https://github.com/rstudio/concept-maps#r-markdown

编译 R Markdown 文档的过程[5]



R Markdown = knitr (Literate Programming)

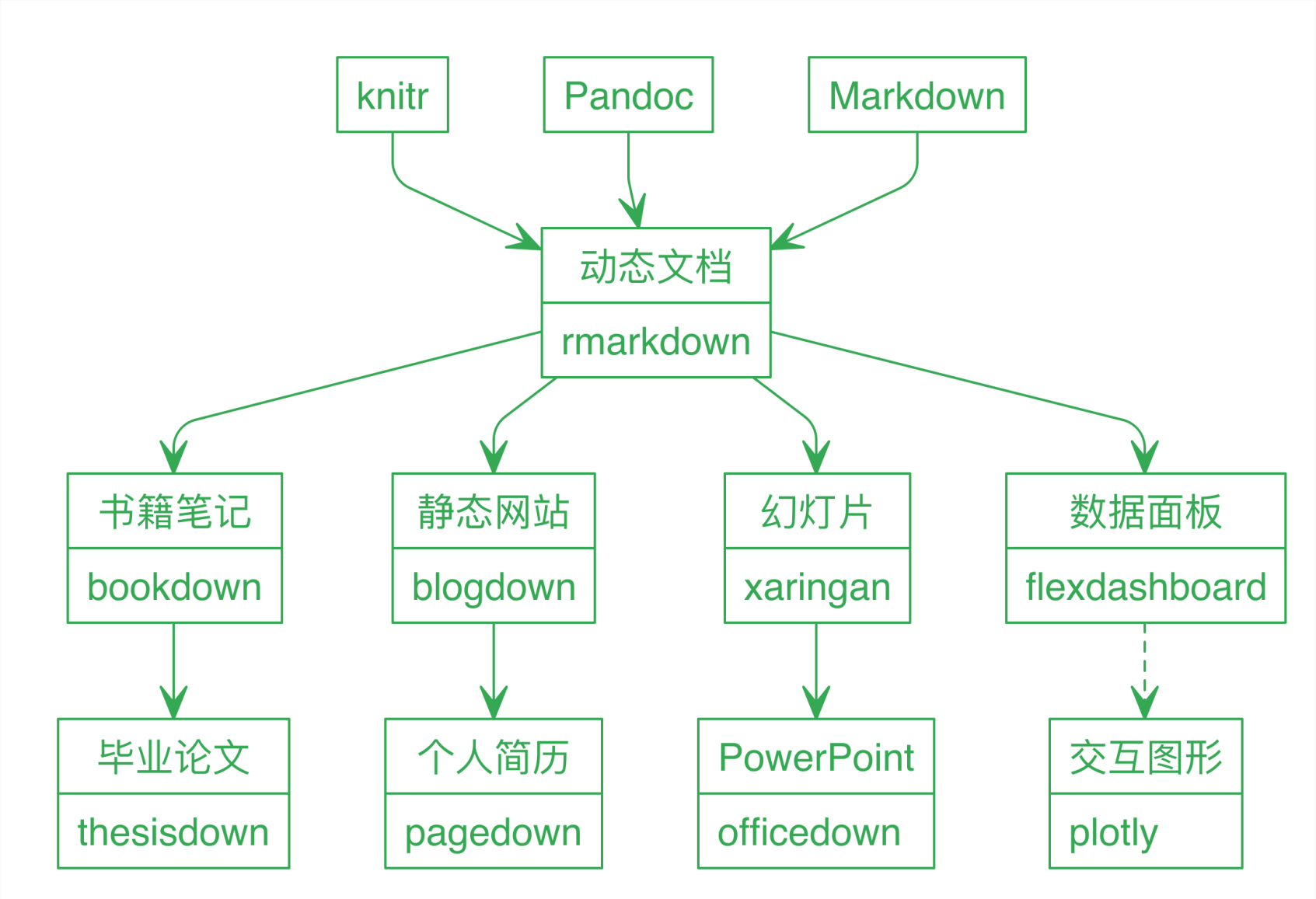
\+ Pandoc

(+ LaTeX for PDF output)

[5] https://slides.yihui.org/2020-covid-rmarkdown.html#7

从 Sweave 到 R Markdown

R Markdown 生态环境

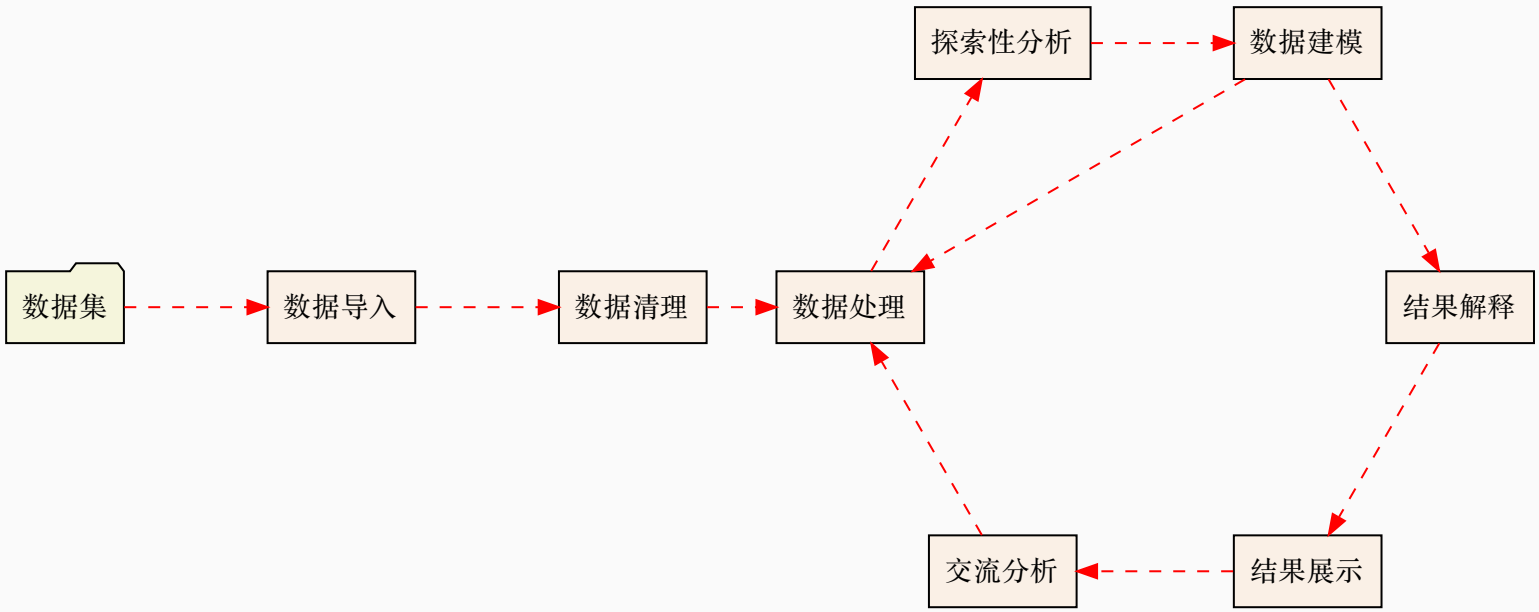


R Markdown 过去 vs 现在

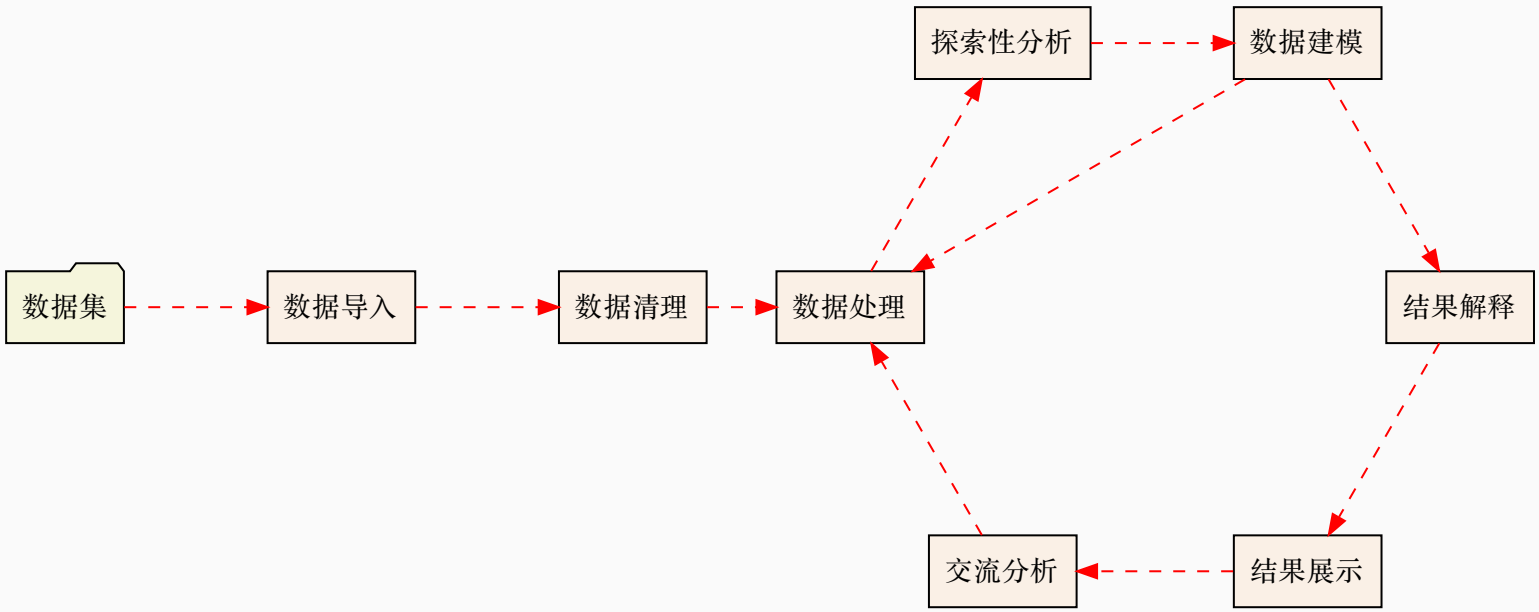
最大的不同在于稳健性和生态圈，基本覆盖 Word / LaTeX 支持的文档处理功能，满足大部分数据分析的场景，比如毕业论文、期刊论文、课程作业、幻灯片、分析报告等。高级的特性依然需要相当的技术实力支撑，包括 Pandoc、Lua、LaTeX、CSS、HTML、JavaScript、Git 和 R，在数据分析师这个行业，它们形成了一簇相当陡峭的学习曲线。

然鹅，有时候真正干活的是搜索引擎和 Ctrl + C/V！

数据分析工作流



数据分析工作流



面对大量的数据时，探索性分析是一件极其困难的事情！

探索性分析

```r
# 连接 Spark
library(sparklyr)
sc <- spark_connect(
  master = "local[2]",
  spark_home = Sys.getenv("SPARK_HOME")
)
# 准备数据
tbl <- copy_to(sc, ggplot2::diamonds, "diamonds")

# 数据查询
library(DBI)
diamonds_db <- dbGetQuery(sc, "
  SELECT count(*) as cnt, cut FROM diamonds GROUP BY cut
")
```

探索性分析 （续）

```
# 关闭连接
spark_disconnect(sc)
# 数据探索
library(ggplot2)
ggplot(diamonds_db, aes(cut, cnt)) +
  geom_col() +
  theme_minimal()

# 数据呈现
library(plotly)
diamonds_db %>%
  plot_ly(x = ~cut, y = ~cnt, type = "bar") %>%
  add_text(
    text = ~ scales::comma(cnt), y = ~cnt,
    textposition = "top middle",
```

探索性分析 （续）

```
    cliponaxis = FALSE, showlegend = FALSE
) %>%
config(displayModeBar = FALSE)
```

然鹅。。。

请从配置环境开始

```
# 安装 openjdk 11
brew install openjdk@11
# 全局设置 JDK 11
sudo ln -sfn /usr/local/opt/openjdk@11/libexec/openjdk.jdk \
  /Library/Java/JavaVirtualMachines/openjdk-11.jdk
# Java 11 JDK 添加到 .zshrc
export CPPFLAGS="-I/usr/local/opt/openjdk@11/include"
export PATH="/usr/local/opt/openjdk@11/bin:$PATH"
# 配置 R 环境
sudo R CMD javareconf
# 安装 rJava 包
Rscript -e 'install.packages(c("rJava", "sparklyr"))'
```

然鹅，请从下载软件开始

手动从官网下载 Spark 软件，配置变量。。。

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警告

Spark 依赖特定版本的 Java、Hadoop，三者之间的版本应该要相融。

然鹅，请从下载软件开始

手动从官网下载 Spark 软件，配置变量。。。

警告

Spark 依赖特定版本的 Java、Hadoop，三者之间的版本应该要相融。

回到开头，重新下载软件，配置环境，再来三遍。

一周过去了，终于可以开始干点活了。。。

数据可视化

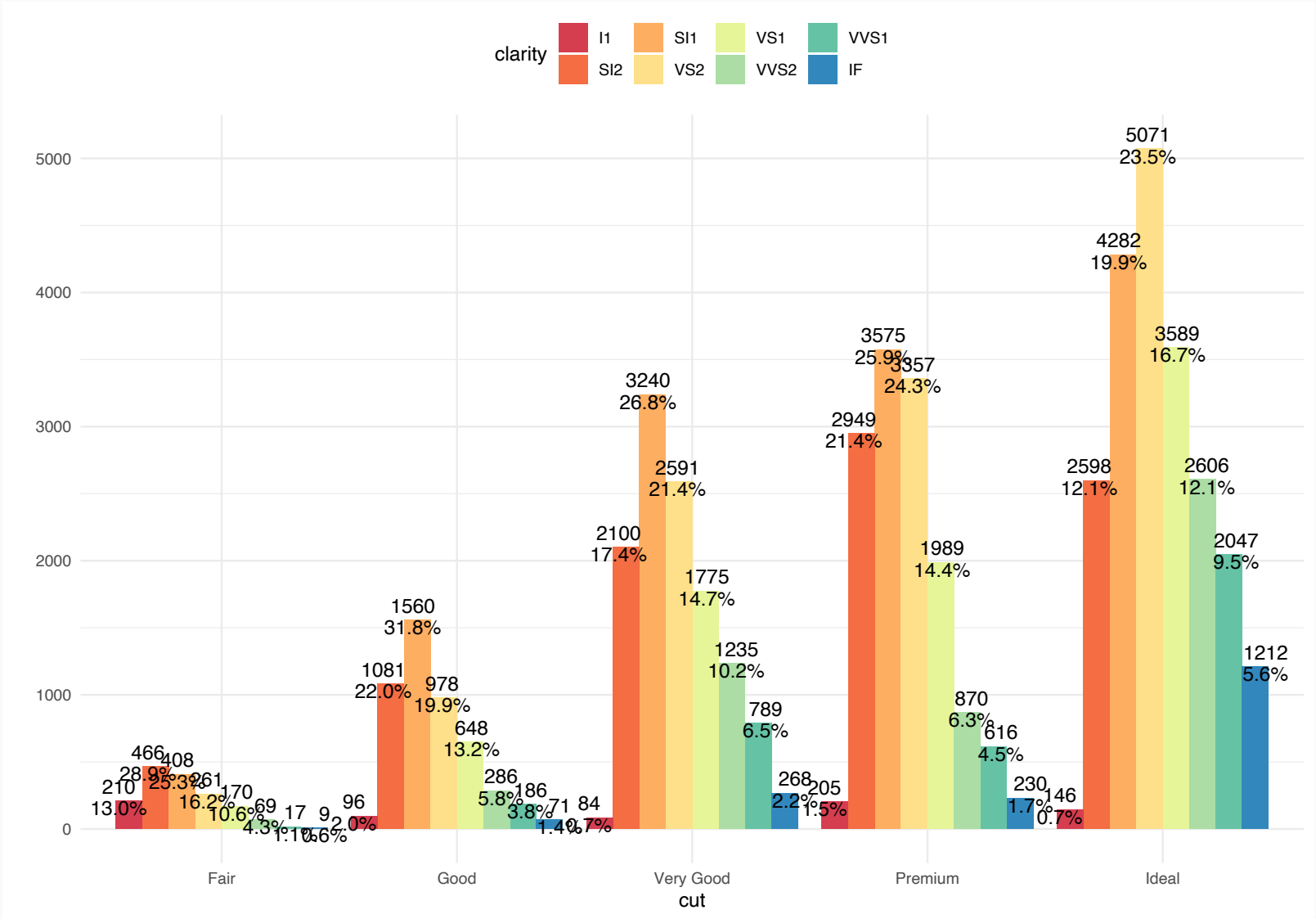

clarity
I1
SI2
SI1
VS2
VS1
VVS2
VVS1
IF
5000
4000
3000
2000
1000
0
Fair
Good
Very Good
Premium
Ideal
cut
210
13.0%
466
28.9%
408
25.3%
261
16.2%
170
10.6%
69
4.3%
17
1.1%
9
0.6%
96
2.0%
1081
22.0%
1560
31.8%
978
19.9%
648
13.2%
286
5.8%
186
3.8%
71
1.4%
84
1.7%
2100
17.4%
3240
26.8%
2591
21.4%
1775
14.7%
1235
10.2%
789
6.5%
268
2.2%
205
1.5%
2949
21.4%
3575
25.9%
3357
24.3%
1989
14.4%
870
6.3%
616
4.5%
230
1.7%
146
0.7%
2598
12.1%
4282
19.9%
5071
23.5%
3589
16.7%
2606
12.1%
2047
9.5%
1212
5.6%

图 2: 柱形图

数据可视化（续）

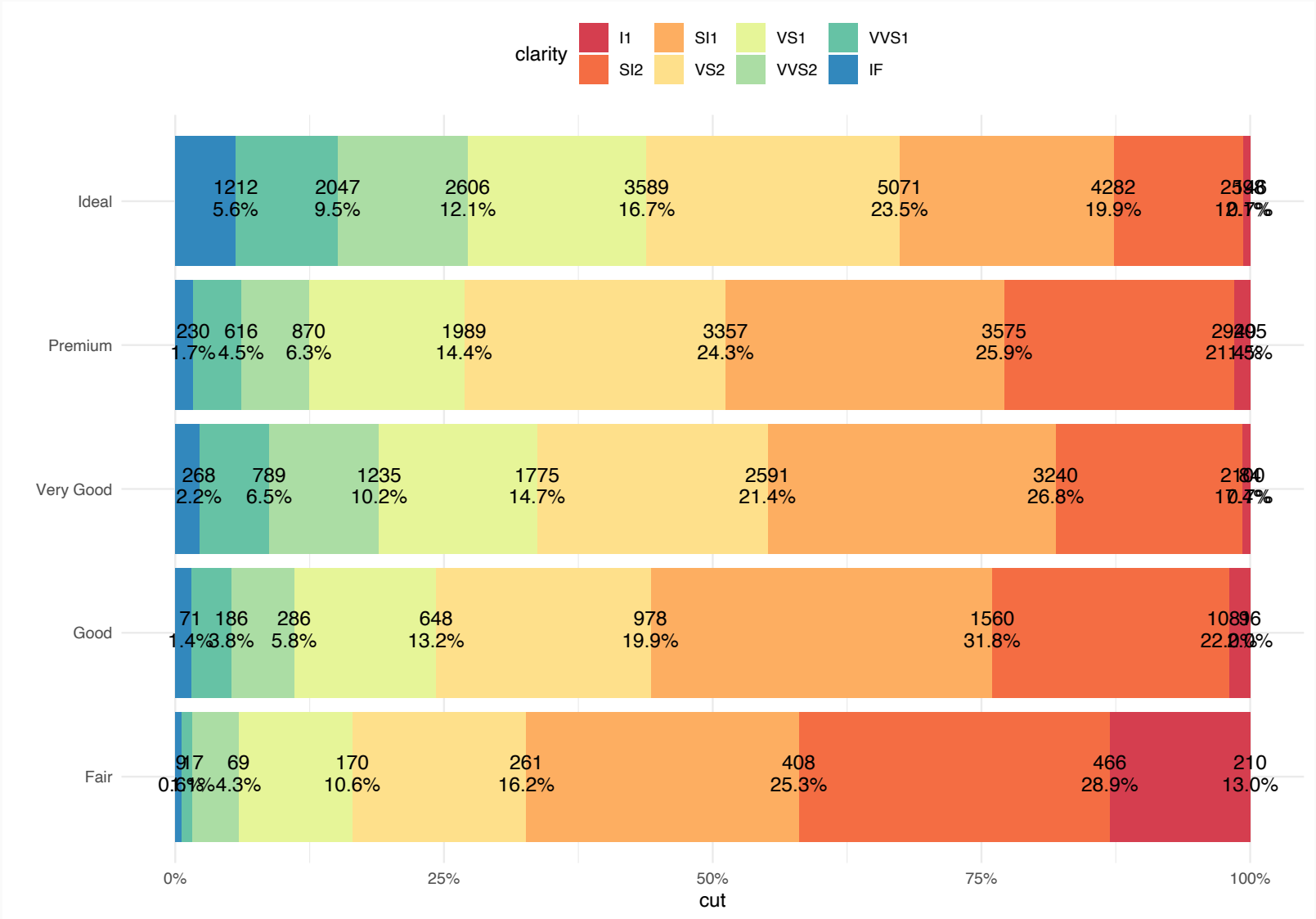


图 3: 条形图

然鹅，要这样。。。

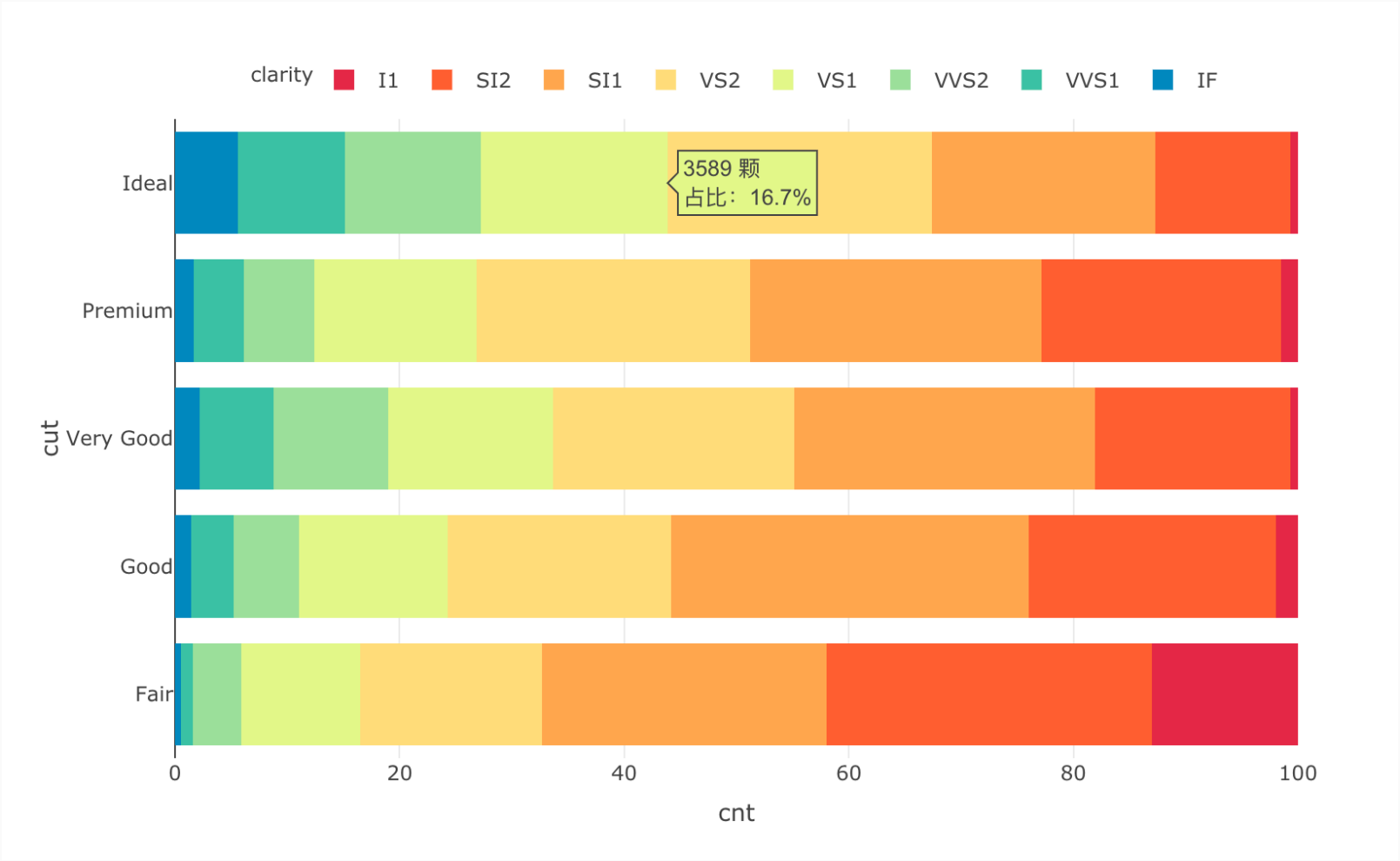
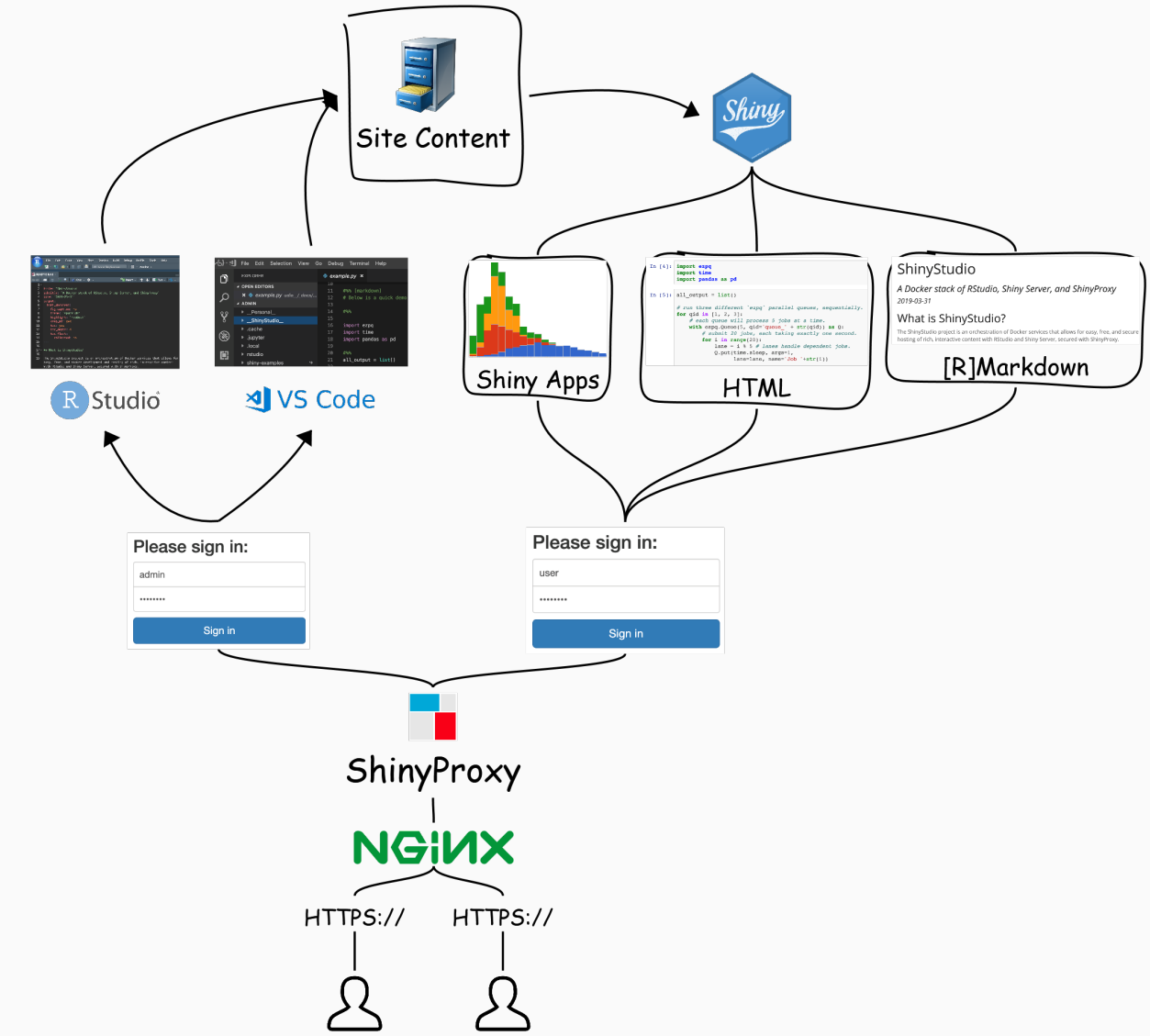


图 4: 交互条形图

工业实践

基础设施 [6]



[6] https://github.com/openanalytics

分层结构

Q & A

谢谢