

Data Technologies

Computational tools for working with data

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Welcome!

This book describes the essential tools and techniques for working with data, especially those ‘behind-the-scenes’ tasks that will take considerable time and effort but don’t receive much attention.

Preface

This book is focused on computational tools for working with data. Data science is a rapidly evolving field, so in many ways, this text is an attempt to capture whatever ‘best practices’ can be codified or generalized.

The topics include coding languages, computational documents, data storage and file formats, version control systems, and general computer science topics.

This text emphasizes using tools that require typing code on a keyboard (rather than using a mouse to point and click).

This book was written in Quarto (learn more about [Quarto books](#)).

Introduction

This is a book created from markdown and executable code. See Knuth (1984) for additional discussion of literate programming.

I've left the boilerplate text above because 1) everyone should know about [Donald Knuth](#) and his contributions to [computational notebooks](#), and 2) I wanted to keep a working example for the `references.qmd` and `references.bib` files when I build the book.

How the sausage is made

I've included the steps for publishing this book *inside* the book because it's serves as an excellent example of the topics contained in this text. This book is [written in quarto](#) which is an 'open-source scientific and technical publishing system.' All of the tools in this text are [open-source](#), which means the source code (i.e. files) to create it are 'made freely available for possible modification and redistribution.'

The code files used to create this book are displayed in the folder tree below:

```
.
+-- _book
+-- _freeze
+-- _quarto.yml
+-- cover.png
+-- data-tech.Rproj
+-- files.qmd
+-- fun-arguments.qmd
+-- fun-environments.qmd
+-- fun-names.qmd
+-- fun-structure.qmd
+-- index.html
+-- index.qmd
+-- intro.html
+-- intro.qmd
+-- intro.rmarkdown
+-- intro_files
```

```
+-- notebooks.qmd
+-- oop-basics.qmd
+-- oop-in-r.qmd
+-- plain-text.qmd
+-- preface.html
+-- preface.qmd
+-- references.bib
+-- references.qmd
+-- renv
+-- renv.lock
\-- site_libs
```

These files are stored in a [GitHub repository](#). GitHub is a platform for hosting open source projects that use [Git](#), the world's most popular distributed version control system.

Using Git

Basic knowledge of Git has become somewhat necessary when you decide to enter the data technology ecosystem (or other open-source projects). I won't be diving into the Git workflow here, but I *will* cover the commands I used to store and publish this book.

1. I created a repository on GitHub.com like this one: [mjfrigaard/data-tech](#)
2. Add (-A) and commit (commit -m) the files in the book folder:

```
$ git add -A
$ git commit -m "first commit"
```

3. push local files to GitHub repo

```
$ git remote add origin git@github.com:mjfrigaard/data-tech.git
$ git branch -M main
$ git push -u origin main
```

4. Create (checkout) an empty gh-pages branch

```
$ git checkout --orphan gh-pages
Switched to a new branch 'gh-pages'
$ git reset --hard
$ git commit --allow-empty -m "Initialising gh-pages branch"
Initialising gh-pages branch
```

5. push the book files to the `gh-pages` branch

```
$ git push origin gh-pages
Enumerating objects: 2, done.
Counting objects: 100% (2/2), done.
Writing objects: 100% (2/2), 176 bytes | 176.00 KiB/s, done.
Total 2 (delta 0), reused 0 (delta 0), pack-reused 0
remote:
remote: Create a pull request for 'gh-pages' on GitHub by visiting:
remote:   https://github.com/mjfrigaard/data-tech/pull/new/gh-pages
remote:
To github.com:mjfrigaard/data-tech.git
 * [new branch]      gh-pages -> gh-pages
```

5. Switch (checkout) back to main branch

```
$ git checkout main
Switched to branch 'main'
Your branch is up to date with 'origin/main'.
```

6. publish to `gh-pages` branch

```
$ quarto publish gh-pages
? Update site at https://mjfrigaard.github.io/data-tech/? (Y/n)

? Update site at https://mjfrigaard.github.io/data-tech/? (Y/n) Yes
```


Part I

Code

Writing code

‘Code’ is the language (grammar and syntax) you’ll use to communicate with a computer.

Machine readable

In order to work, the machine (i.e. computer) must be able to execute the code you’ve written.

Human readable

Code is always read by at least two people: you, and future you.

HTML

Hypertext markup language

Markdown

R

Python

JavaScript

Code files

The command line

The command line is...

Regular expressions

Computational notebooks

Part II

Object-oriented programming

Basics

Object-oriented programming is...

R

R is a ‘functional, object-oriented programming language.’

Python

Part III

Functions

Names

Naming your functions should...

Arguments

Function arguments can be

Structure

Function structure refers to...

Environments

Inside your function...

Knuth, Donald E. 1984. “Literate Programming.” *Comput. J.* 27 (2): 97–111. <https://doi.org/10.1093/comjnl/27.2.97>.