This is us: making CSAFE stronger each week

CSAFE

2019-09-04

Contents

Chapter 1

Prerequisites

This is a *sample* book written in **Markdown**. You can use anything that Pandoc's Markdown supports, e.g., a math equation $a^2 + b^2 = c^2$.

The **bookdown** package can be installed from CRAN or Github:

```
install.packages("bookdown")
# or the development version
# devtools::install_github("rstudio/bookdown")
```

Remember each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading `#`.

To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): https://yihui.name/tinytex/.

Chapter 2

Introduction

This section will become the section for the administrative updates/organization once we have figured out how to use all of the bookdown features for our purposes.

You can label chapter and section titles using `{#label}` after them, e.g., we can reference Chapter 2. If you do not manually label them, there will be automatic labels anyway, e.g., Chapter 5.

Figures and tables with captions will be placed in `figure` and `table` environments, respectively.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

Reference a figure by its code chunk label with the `fig:` prefix, e.g., see Figure 2.1. Similarly, you can reference tables generated from `knitr::kable()`, e.g., see Table 2.1.

```
knitr::kable(
  head(iris, 20), caption = 'Here is a nice table!',
  booktabs = TRUE
)
```

You can write citations, too. For example, we are using the **bookdown** package (Xie, 2019) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015).

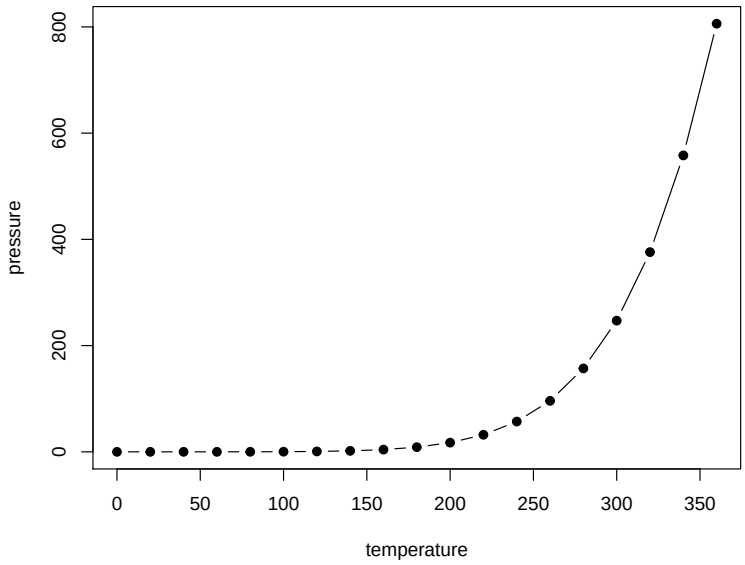

Figure 2.1: Here is a nice figure!

Table 2.1: Here is a nice table!

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa
4.6	3.4	1.4	0.3	setosa
5.0	3.4	1.5	0.2	setosa
4.4	2.9	1.4	0.2	setosa
4.9	3.1	1.5	0.1	setosa
5.4	3.7	1.5	0.2	setosa
4.8	3.4	1.6	0.2	setosa
4.8	3.0	1.4	0.1	setosa
4.3	3.0	1.1	0.1	setosa
5.8	4.0	1.2	0.2	setosa
5.7	4.4	1.5	0.4	setosa
5.4	3.9	1.3	0.4	setosa
5.1	3.5	1.4	0.3	setosa
5.7	3.8	1.7	0.3	setosa
5.1	3.8	1.5	0.3	setosa

Chapter 3

Project CC: Bullets and Cartridge Cases

For both bullets and cartridge cases we are dealing with several inter-related aspects, that we want to address independently.

Those are:

1. data collection
2. computational tools
3. similarity scores
    1. for bullet lands:
        a. crosscut identification
        b. groove location
        c. curvature removal
        d. alignment of signatures
        e. feature extraction
        f. matching with trained Random Forest
    2. for breech faces
4. analysis of results
5. communication of results and methods

3.1 Data Collection

3.1.1 LAPD

All bullets are collected by Srinivasan Rathinam, LAPD.

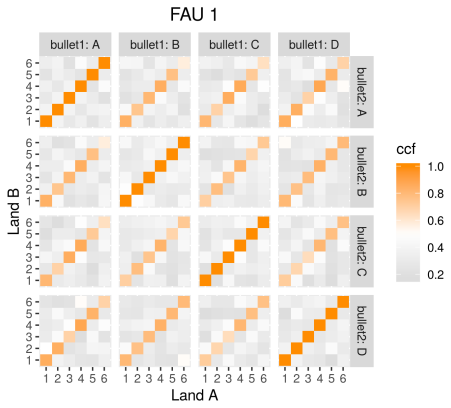

Figure 3.1: Results from assessing scans of barrel FAU 1 similarity.

3.1.1.1 Main study

4 bullets per barrel for 626 Beretta 92 F/FS firearms , ammunition used are 9 mm Luger Winchester 115 grain with a Copper surface.

scans are on Raven

evaluation: Yawei is going to work through all 626 barrels of knowns to assess similarity scores

3.1.1.2 follow-up study

4 bullets per barrel for 96 of the original 626 Beretta firearms using different ammunition

bullets are being scanned

3.1.2 Hamby Sets

Scans for Hamby Sets 10, 36, 44, and 224

Scans for 3 replicates of clones for Hamby 224

3.1.3 Houston Tests

contact: Melissa Nally, Houston FSI

pre-study: 3 kits with 25 bullets each

study: 4 kits with X bullets each

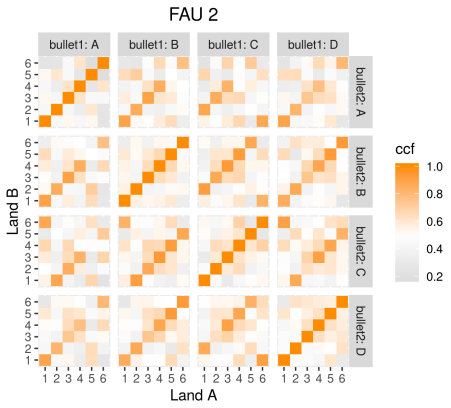

Figure 3.2: Results from assessing scans of barrel FAU 2 similarity.

3.1.4 Houston Persistence

contact: Melissa Nally, Houston FSI

8 barrels with 40 fired bullets each

3.1.5 St Louis persistence

contact: Steve Kramer, St Louis PD

2 barrels with 192 fired bullets each (2 bullets collected every 25 shots)

3.1.6 DFSC Cartridge cases

Breech face data for knowns are scanned and available on a private github repository

evaluation

3.2 Computational Tools

3.2.1 x3ptools

`x3ptools` is an R package for working with files in x3p format. x3p is an ISO standard for describing 3d topographic surface measurements. `x3ptools` is available on CRAN, i.e. can be installed with the command `install.packages("x3ptools")`. The development version is available

from github. Installation instructions and basic usage can be found at https://heike.github.io/x3ptools/

3.2.2 bulletxtrctr

`bulletxtrctr` is a developmental R package available from github (see https://heike.github.io/bulletxtrctr/) that allows an assessment of similarity scores using the data extraction pipeline described in **?**.

3.2.3 grooveFinder

`grooveFinder` is a developmental R package providing different methods for identifying the location of grooves in scans of bullets. Installation instructions and some basic usage can be found at https://heike.github.io/grooveFinder/

3.3 Similarity Scores

3.3.1 Bullet Lands

3.3.1.1 Approaches to identify groove locations

3.3.2 Cartridge Cases

3.4 Analysis of Results

3.5 Communication of Results and Methods

3.6 People involved

3.6.1 Faculty

- Heike Hofmann
- Susan VanderPlas

3.6.2 Graduate Students

- Ganesh Krishnan
- Kiegan Rice
- Nate Garton
- Charlotte Roigers
- Joe Zemmels
- Yawei Ge

3.6.3 Undergraduates

- Talen Fisher (fix3p)

- Andrew Maloney
- Mya Fisher, Allison Mark, Connor Hergenreter, Carley McConnell, Anyesha Ray (scanner)

Chapter 4

Handwriting

We describe our methods for going about the handwriting project here.

Chapter 5

Glass

Chapter 6

Shoes

6.1 Longitudinal Shoe Study

Github repository

6.1.1 Original Study Description

6.1.2 Database Paper

Paper subdirectory of Github repository

6.1.2.1 Methods and Data Description

Methods and data description handed off to Alicia for editing

6.1.2.2 Data Analysis Tools

- Working with the `EBImage` package - very fast processing of images

6.1.2.2.1 Film and Powder Images

Analysis Steps:

1. Create threshold mask
    a. Invert the image
    b. Blur image (circular/gaussian blur, diameter 5)
    c. Threshold image (adaptive threshold, 10 x 10 region, keep anything with an average higher than .90 from the mean)

d. Expand mask
(default parameters rad1 = 5, rad2 = 91, proportion, expand_rad = 50)

1. erode mask image (circle, diameter rad1)
2. dilate mask image (circle, diameter rad2)
3. label disjoint regions of the image
4. prune small image regions (area < proportion parameter)
5. set background color
6. create dataframe of useful (non-background) pixels
7. fill in holes and concave regions in mask, then expand by expand_rad vertically and horizontally (similar to "convex hull", but faster and with additional expansion)

2. Mask image to remove extra variability unrelated to the shoe

3. Threshold masked image?

6.1.2.2.2 Wear Characterization

Ideas: - average intensity of cleaned image - length of border/edges detected

6.2 Passive Shoe Recognition

6.3 Maximum Clique Matching

6.4 Cocoa Powder Citizen Science

Chapter 7

Theoretical foundations

Chapter 8

Outreach activities

Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2019). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.13.