

REPRODUCIBLE RESEARCH IN R

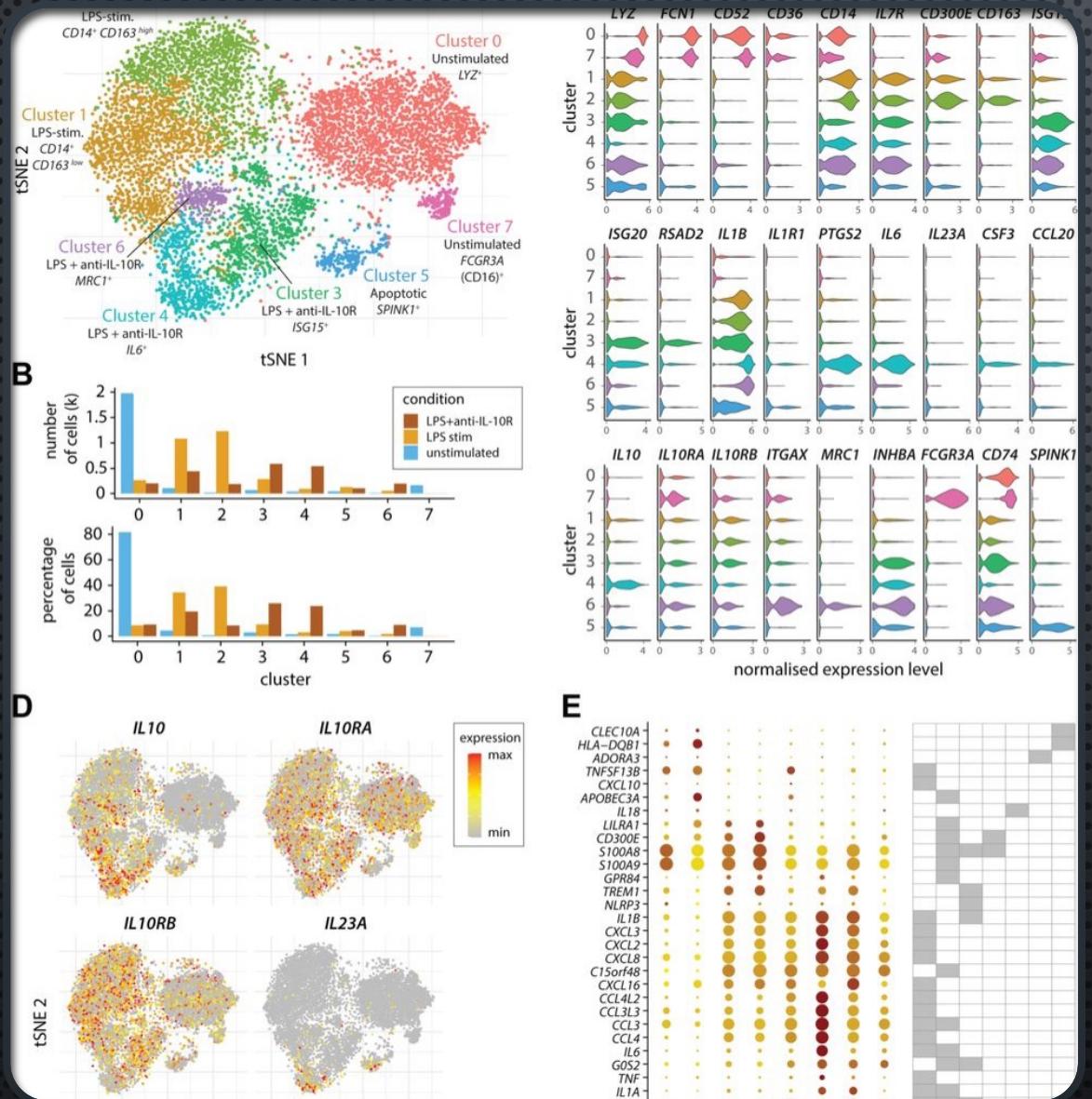
SOUMYA BANERJEE

RATIONALE

- YOUR DATA, YOUR MODEL DECISIONS, PARAMETERS AND YOUR DATA FILTERING DECISIONS WILL KEEP ON CHANGING. HOW DO YOU KNOW 6 MONTHS LATER WHAT HAS CHANGED? DOCUMENT YOUR CODE AND YOUR OUTPUT AND YOUR DESIGN DECISIONS ALL IN ONE PLACE.
- REPRODUCIBLE PIPELINE
- KNOW EXACTLY WHAT CHANGED AND WHEN
- KNOW HOW TO RERUN THE ANALYSIS AND GET THE (SAME) RESULTS
- THIS IS LIKE YOUR RESEARCH NOTEBOOK

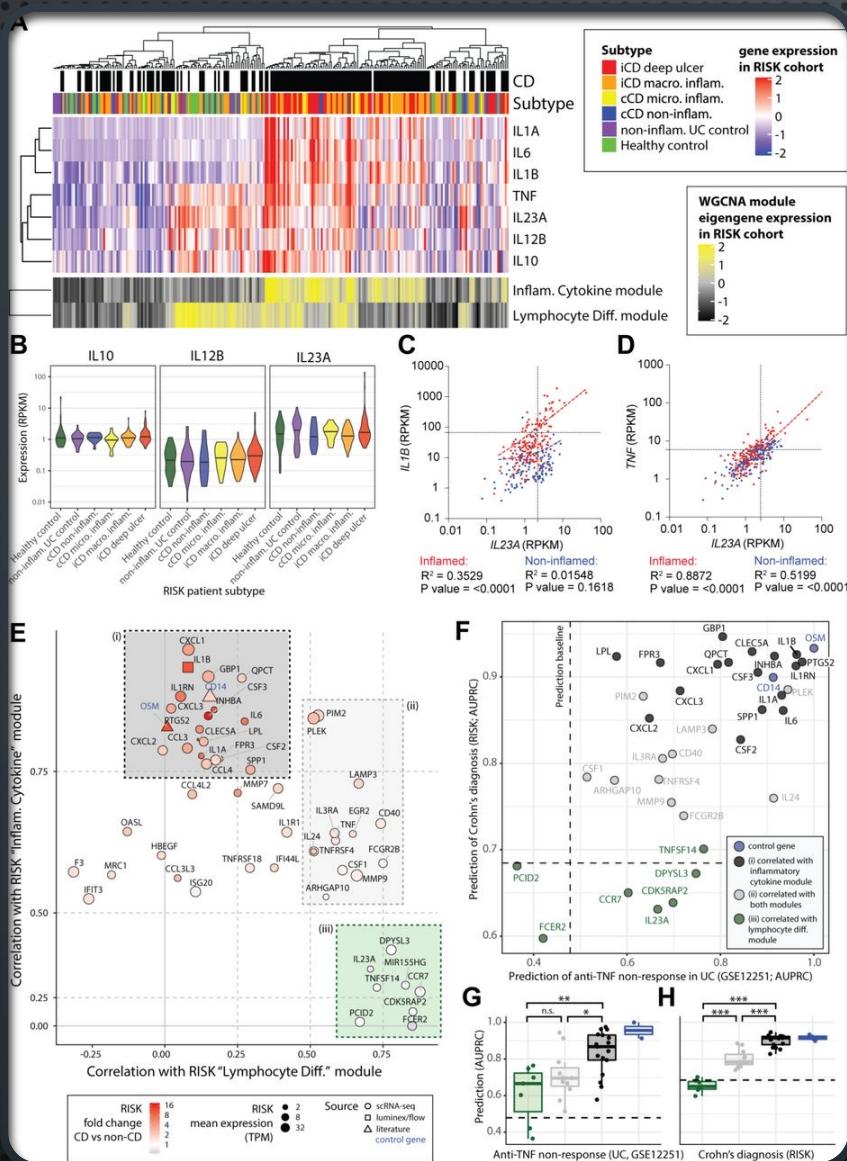
RATIONALE

- EXPERIENCES/CASE STUDIES OF USING RMARKDOWN NOTEBOOKS AND HELPING BIOLOGISTS USE THEM TO ANALYZE THEIR OWN DATA
- WHEN YOU ARE DEEP IN YOUR WORK, IT CAN BE DIFFICULT TO MAKE CODE PRETTY, COMMENT IT AND MAKE IT REPRODUCIBLE.
- BUT YOU WILL REGRET NOT DOING THIS WHEN YOU PARK THE WORK AND 6 MONTHS LATER YOUR COLLOABORATORS/REVIEWERS ASK FOR ADDITIONAL ANALYSIS OR CHANGING SOME ASSUMPTION, ETC.
- YOUR CODE SHOULD THEN BE READY (YOU SHOULD BE ABLE TO CLICK A BUTTON AND REPRODUCE THE FIGURES FOR YOUR PAPER).

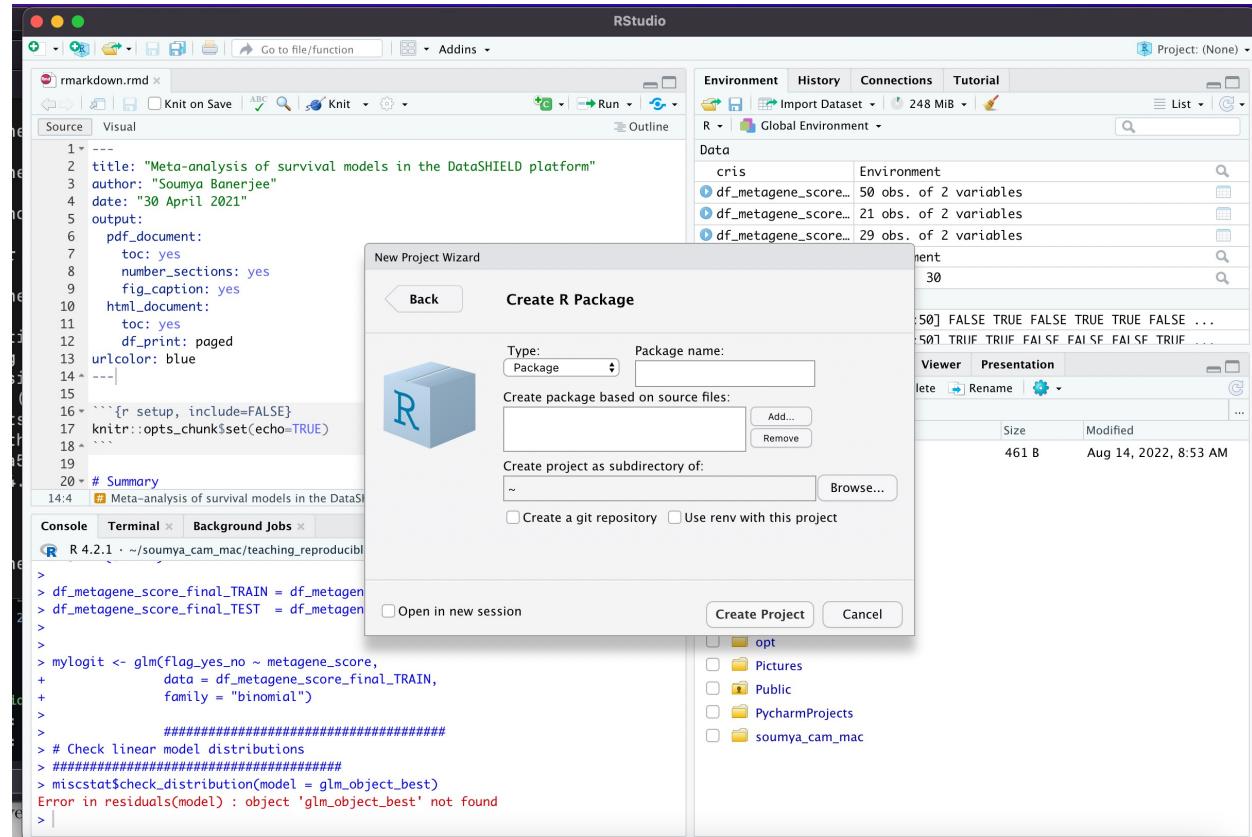


CASE STUDY

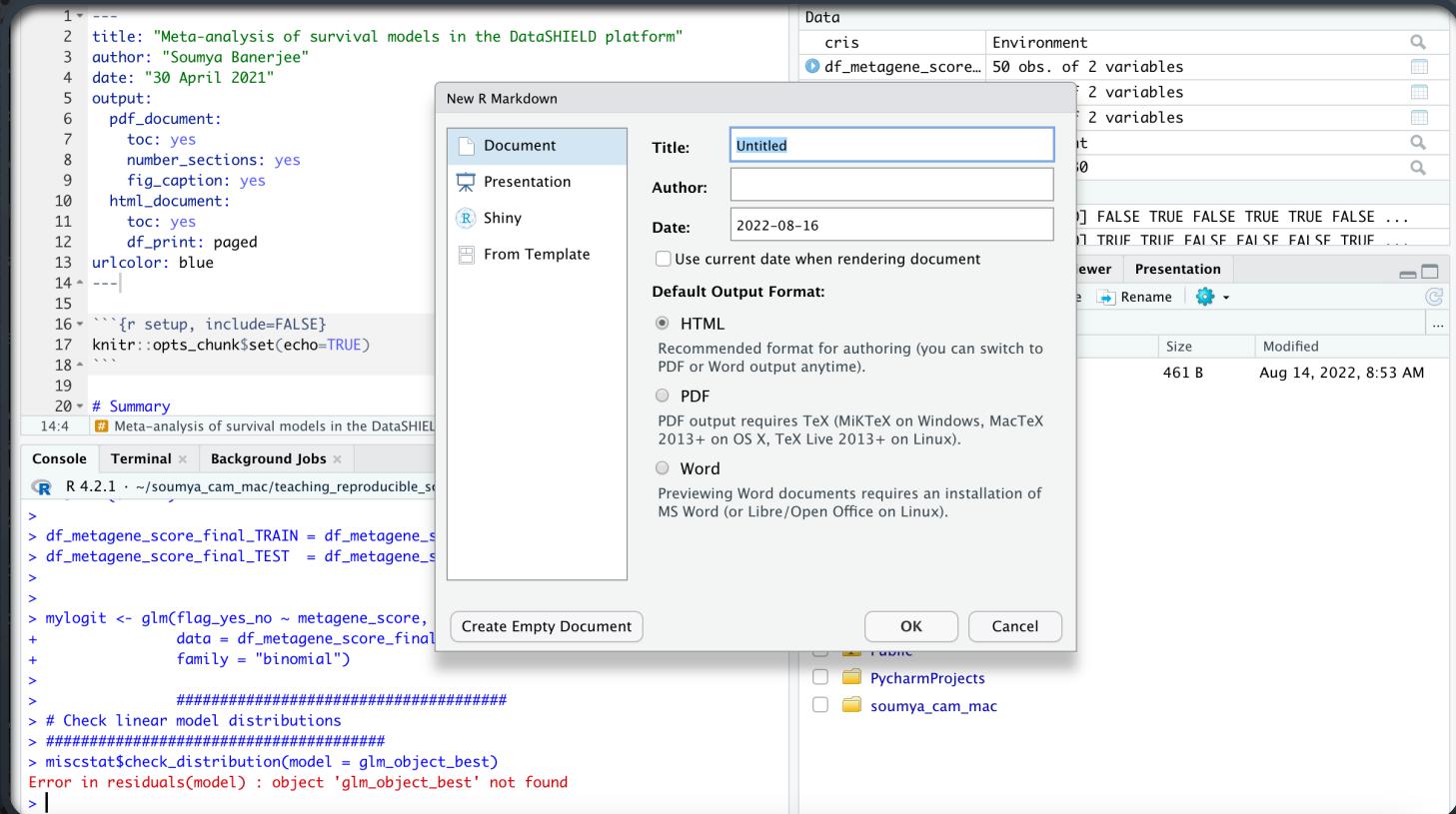
CASE STUDY



CREATING PACKAGES



CREATING R MARKDOWN



RATIONALE

- THE CONCEPTS ARE THE SAME IN ANY PROGRAMMING LANGUAGE (R/PYTHON)
- BOTTOMLINE: WE ARE ALL BUSY AND WE WOULD ALL RATHER PUBLISH PAPERS, BUT IN THE LONG TERM THESE BEST PRACTICES WILL MAKE US MORE PRODUCTIVE
- THIS IS LIKE PROTOCOLS (USED IN EXPERIMENTAL BIOLOGY) FOR COMPUTER SCIENTISTS. ALSO LIKE A LAB NOTEBOOK BUT FOR COMPUTATIONAL PEOPLE.

CONCEPTS ARE LANGUAGE AGNOSTIC

```
# This is a test  
  
Testing pandoc  
  
``` code  
import GPy

``` code  
print("Cat")  
```
```

# CONCEPTS ARE LANGUAGE AGNOSTIC

- [HTTPS://GITHUB.COM/NEELSOUMYA/TEACHING\\_REPRODUCIBLE\\_SCIENCE\\_R/BLOB/MAIN/TST.MD](https://github.com/neelsoumya/teaching_reproducible_science_R/blob/main/tst.md)
- *PANDOC TST.MD -O TEST.IPYNB*

# DEMO

The screenshot shows the RStudio interface with three panes:

- Left Pane (Source):** Displays the code of an R Markdown document named "rmarkdown.rmd". The code includes R Markdown syntax like `#` for sections, `##` for subsections, and code chunks starting with ````{r}`. It also shows a summary of the `cars` dataset.
- Middle Pane (Environment):** Shows the R environment. The message "Environment is empty" is displayed. There are tabs for Environment, History, Connections, and Tutorial.
- Right Pane (Files):** A file browser showing the contents of the "Home" directory. The directory structure is as follows:

| Name            | Size  | Modified              |
|-----------------|-------|-----------------------|
| .Rhistory       | 461 B | Aug 14, 2022, 8:53 AM |
| cam_project     |       |                       |
| Desktop         |       |                       |
| Documents       |       |                       |
| Downloads       |       |                       |
| Library         |       |                       |
| Movies          |       |                       |
| Music           |       |                       |
| opt             |       |                       |
| Pictures        |       |                       |
| Public          |       |                       |
| PycharmProjects |       |                       |
| soumya_cam_mac  |       |                       |

| Syntax                                                                                                                            | Becomes                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:                          | Make a code chunk with three back ticks followed by an r in braces. End the chunk with three back ticks:             |
| <pre>```{r} paste("Hello", "World!") ```</pre>                                                                                    | <pre>paste("Hello", "World!")</pre>                                                                                  |
| Place code inline with a single back ticks. The first back tick must be followed by an R, like this `r paste("Hello", "World!")`. | Place code inline with a single back ticks. The first back tick must be followed by an R, like this Hello World!.    |
| Add chunk options within braces. For example, `echo=FALSE` will prevent source code from being displayed:                         | Add chunk options within braces. For example, <code>echo=FALSE</code> will prevent source code from being displayed: |
| <pre>```{r eval=TRUE, echo=FALSE} paste("Hello", "World!") ```</pre>                                                              | <pre>## [1] "Hello World!"</pre>                                                                                     |

# DEMO

# DEMO

- SEE THE LINK BELOW FOR MORE DETAILS
- [HTTPS://WWW.RSTUDIO.COM/WP-CONTENT/UPLOADS/2015/03/RMarkdown-Reference.pdf](https://www.rstudio.com/wp-content/uploads/2015/03/rmarkdown-reference.pdf)
- NOW HEAD OVER TO THE FILE NAMED RMarkdown.RMD
- [HTTPS://GITHUB.COM/NEELSOUMYA/TEACHING\\_REPRODUCIBLE\\_SCIENCE\\_R/BLOB/MAIN/RMARKDOWN.RMD](https://github.com/NeelSoumya/Teaching_Reproducible_Science_R/blob/main/rmarkdown.Rmd)
- RUNNING THIS WILL CREATE A REPORT LIKE THE FOLLOWING:
- [HTTPS://GITHUB.COM/NEELSOUMYA/TEACHING\\_REPRODUCIBLE\\_SCIENCE\\_R/BLOB/MAIN/RMARKDOWN.PDF](https://github.com/NeelSoumya/Teaching_Reproducible_Science_R/blob/main/rmarkdown.pdf)

DEMO

# EXERCISES WITH SYNTHETIC DATA

# GRAPHICAL USER INTERFACES

- YOU CAN ALSO EASILY CREATE GRAPHICAL USER INTERFACES HERE IS A DEMO:  
[HTTPS://SB2333MEDSCHL.SHINYAPPS.IO/SHINYAPP](https://sb2333medschl.shinyapps.io/shinyapp)
- CODE APP.R:  
[HTTPS://GITHUB.COM/NEELSOUMYA/TEACHING\\_REPRODUCIBLE\\_SCIENCE\\_R/BLOB/MAIN/SHINYAPP/APP.R](https://github.com/neelsoumya/teaching_reproducible_science_r/blob/main/shinyapp/app.r)
- DEMO

# RESOURCES

- [HTTPS://GITHUB.COM/NEELSOUMYA/TEACHING\\_REPRODUCIBLE\\_SCIENCE\\_R/](https://github.com/neelsoumya/teaching_reproducible_science_R/)
- CODE, RESOURCES AND TEMPLATES
- EXERCISES WITH SAMPLE DATA
- INSTALLATION INSTRUCTIONS