Introduction to Data Wrangling & Visualization in R

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Slides & Code available on Github,

SCAN



Background

 Humans are collectively outputting 2.5 quintillion bytes of data every day; by 2020, each person will generate ~ 1.7 MB every second (IBM Marketing Cloud, 2017).

 At this scale, intensive longitudinal data about humans' behavior facilitates new discovery about the patterning of thought and action and potentially better prediction and optimization of health and well-being.

A Digital Biomarker Approach

 Digital biomarkers are defined as objective, quantifiable physiological and behavioral data that are collected and measured by means of digital devices such as portables, wearables, implantables, or digestibles.

 The data collected are typically used to explain, influence, and/or predict health-related outcomes.

A Digital Biomarker Approach: In the News

♦ WSJ NEWS EXCLUSIVE | TECH

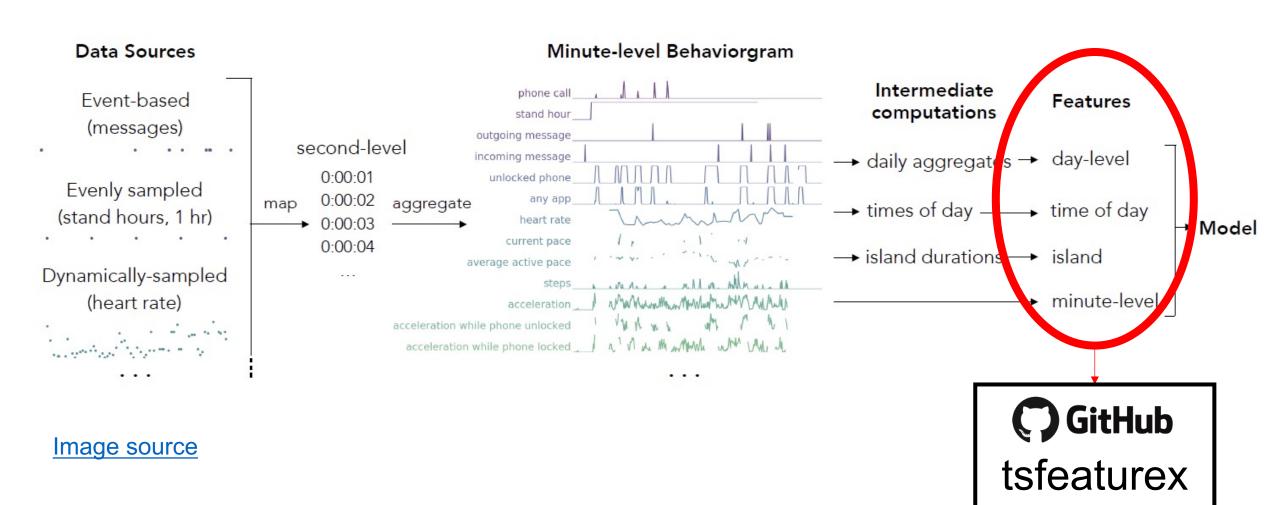
Apple Is Working on iPhone Features to Help Detect Depression, Cognitive Decline

Company is working with UCLA, Biogen to see if sensitive data like facial expressions, typing metrics could signal mental-health concerns

By Rolfe Winkler

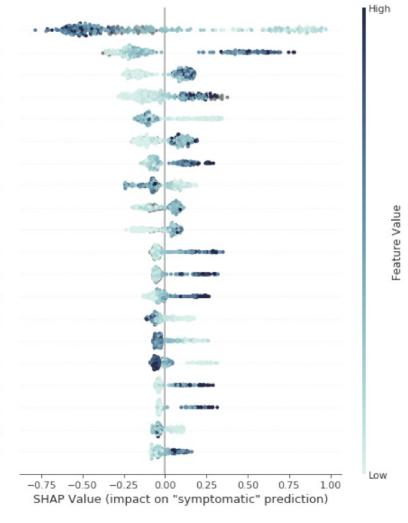
Updated Sept. 21, 2021 1:07 pm ET

A Digital Biomarker Approach: Visualized



Symptomatic participants tended to type slower, exhibit less routine behavior, receive fewer text messages, and spend more time using helper apps than healthy controls.

Typing speed without pauses Median ToD of first active pace (phone) Days with no energy survey response Median ToD of energy survey response Total number of incoming messages IQR of ToD of last acceleration (phone) ToD of first step (phone) Total number of exercise bouts Skew of stride length (watch) IQR of ToD of first acceleration (phone) 95th pctl of Clock app duration IQR of Clock app duration Siri App Suggestion count IQR of daily outgoing message counts 5th pctl of daily 5th pctl of heart rate Median ToD of last acceleration (phone) Total time spent in Clock app IQR of daily total time spent in Clock app Median daily incoming message count Mean words per sentence in typing task

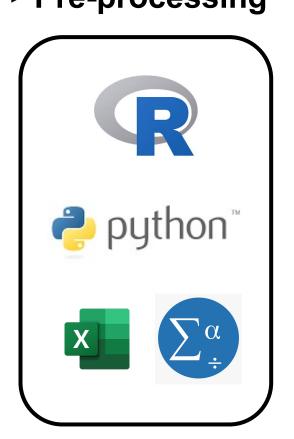


Goals for this Workshop

- Learn about data wrangling principles (e.g., tidy data)
- Import, pre-process & visualize data using R
- Share recommended readings, activities for continued learning

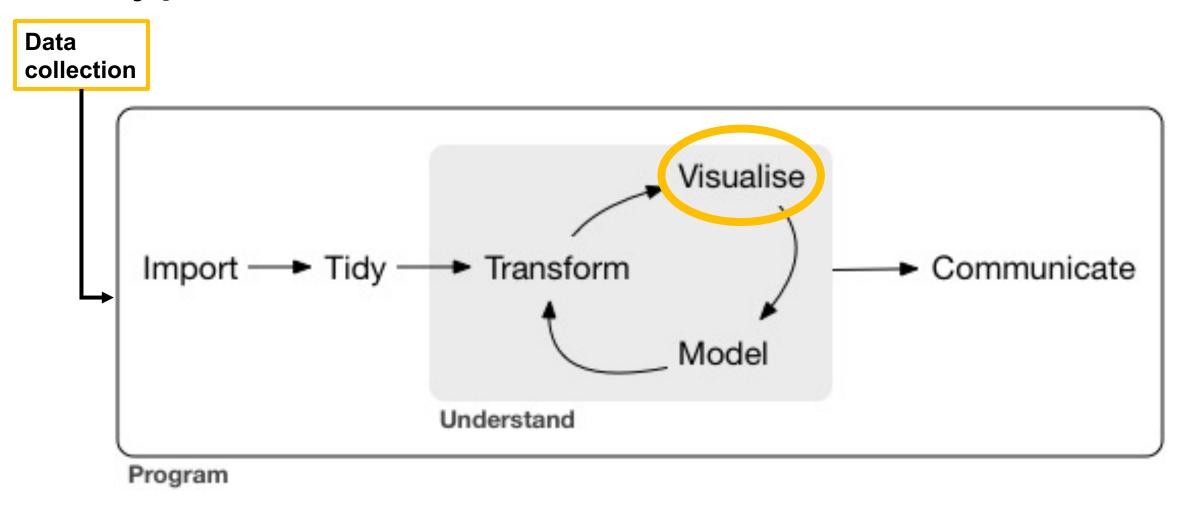
Data Lifecycle







Typical Data Science Workflow



Source: R for Data Science

What is tidy data?

- 1. Every column is a variable.
- 2. Every row is an observation.
- 3. Every cell is a single value.

<u> </u>			
participant	condition	avg_response_time	perc_accuracy
9991	control	506	90
9992	active	516	96
→ 9993	control	526	99

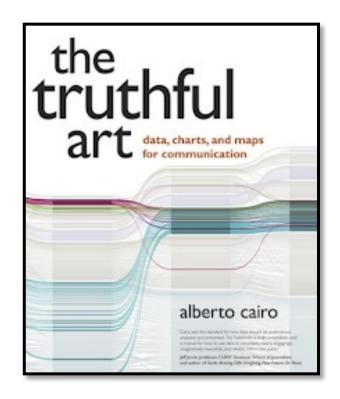
Source: R for Data Science

Uncleaned Data Problems

- In a perfect data-generating system, data are already tidy
- In practice, we must first determine
 - data structure issues, including:
 - Column headers are values, not variable names.
 - Multiple variables are stored in one column.
 - Variables are stored in both rows and columns.
 - Multiple types of observational units are stored in the same table.
 - A single observational unit is stored in multiple tables.
 - Data quality issues
 - Values out of range
 - Improperly/inconsistently coded response options
 - Inconsistent records counts

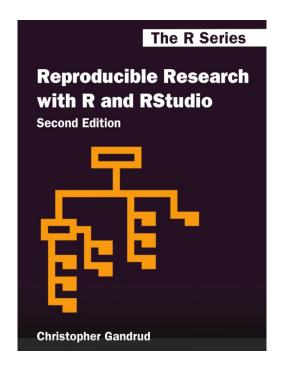
Five Qualities of Great Visualizations

- 1. It is truthful
- 2. It is functional
- 3. It is beautiful
- 4. It is insightful
- 5. It is enlightening



Reproducible Workflows

- Documented, code-based approach to pre-processing and analytics
 - R (RMarkdown), Python (Jupyter notebooks)
- File versioning with clear changelogs
 - Git and Github



https://monashdatafluency.github.io/r-rep-res/

Software Required for Today's Workshop

R - https://cran.r-project.org/

Precompiled binary distributions of the base system and contributed p

• Download R for Linux (Debian, Fedora/Redhat, Ubuntu)

• Download R for macOS

• Download R for Windows

 RStudio - <u>https://www.rstudio.com/prod</u> ucts/rstudio/download/



The Data Source: Google Mobility

Google COVID-19 Community Mobility Reports



See how your community is moving around differently due to COVID-19

Learn more about this data https://www.google.com/covid19/mobility/d ata documentation.html?hl=en

Time for a Demo!

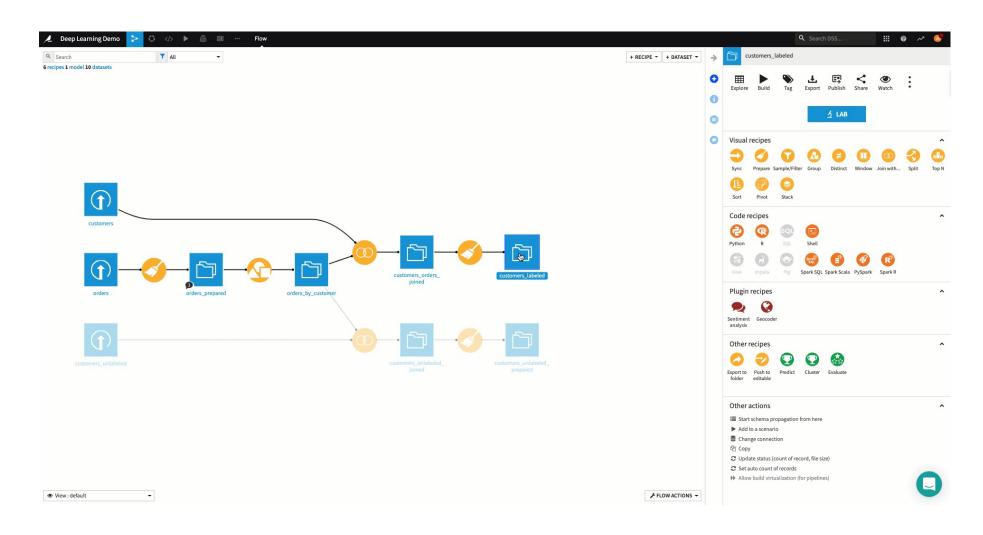
Scan the QR code to view the code we will work with



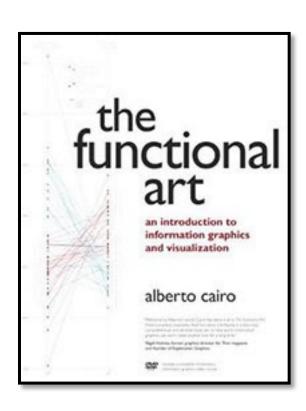
The Future of Data Workflows

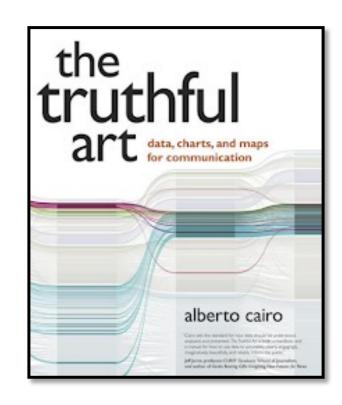
Seamless integration platforms, for example:

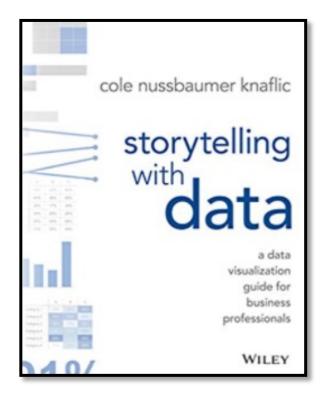




Reading Recommendations







Tutorial Recommendations

Anything by Hadley Wickham

- https://www.r-bloggers.com/
- https://www.r-statistics.com/
- https://blog.revolutionanalytics.com/
- https://r-charts.com/
- http://www.cookbook-r.com/Graphs/
- https://plotly.com/r/



Download Cheatsheets

- Data Import
 - https://github.com/rstudio/cheatsheets/raw/master/data-import.pdf)
- Data Wrangling Cheatsheet
 - https://www.rstudio.com/wp-content/uploads/2015/02/data-wrangling-cheatsheet.pdf)
- Data Transformation with dplyr
 - https://github.com/rstudio/cheatsheets/raw/master/data-visualization.pdf)
- String Manipulation
 - https://github.com/rstudio/cheatsheets/raw/master/strings.pdf)
- Work with dates/times
 - https://github.com/rstudio/cheatsheets/raw/master/lubridate.pdf)
- R Markdown
 - https://github.com/rstudio/cheatsheets/raw/master/rmarkdown.pdf)
- More cheatsheets
 - https://www.rstudio.com/resources/cheatsheets/)

thank

you



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