String Manipulation With glue and stringr

Outline

Intro to glue and stringr

String “injection” with glue

- Basics of glue: glue() and friends
- glue in the wild! (At least how I use it…)

String manipulation with stringr

- Detecting, Lengthening, Joining/Splitting, Subsetting, Mutating, Sorting/Ordering
- Regex’s
- Data cleaning example

glue and stringr

glue and stringr are tidyverse packages for string injection and manipulation

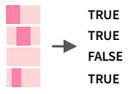
String manipulation is essential for data science

We will pay special attention to *regular expressions*: strings that signify special patterns of characters in other strings

Work with strings with stringr : : **CHEAT SHEET**

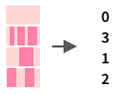
The **stringr** package provides a set of internally consistent tools for working with character strings, i.e. sequences of characters surrounded by quotation marks.

Detect Matches



str_detect(string, **pattern**) Detect the presence of a pattern match in a string. *str_detect(fruit, "a")*

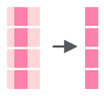
str_which(string, **pattern**) Find the indexes of strings that contain a pattern match. *str_which(fruit, "a")*



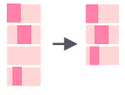
str_count(string, **pattern**) Count the number of matches in a string. *str_count(fruit, "a")*

str_locate(string, **pattern**) Locate the positions of pattern matches in a string. Also **str_locate_all**. *str_locate(fruit, "a")*

Subset Strings

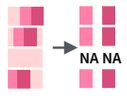


str_sub(string, start = 1L, end = -1L) Extract substrings from a character vector. *str_sub(fruit, 1, 3); str_sub(fruit, -2)*



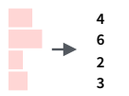
str_subset(string, **pattern**) Return only the strings that contain a pattern match. *str_subset(fruit, "b")*

str_extract(string, **pattern**) Return the first pattern match found in each string, as a vector. Also **str_extract_all** to return every pattern match. *str_extract(fruit, "[aeiou]")*

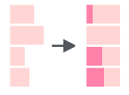


str_match(string, **pattern**) Return the first pattern match found in each string, as a matrix with a column for each ( ) group in pattern. Also **str_match_all**. *str_match(sentences, "(a|the) ([^]+)")*

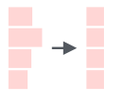
Manage Lengths



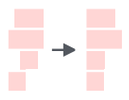
str_length(string) The width of strings (i.e. number of code points, which generally equals the number of characters). *str_length(fruit)*



str_pad(string, width, side = c("left", "right", "both"), pad = " ") Pad strings to constant width. *str_pad(fruit, 17)*



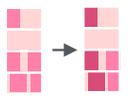
str_trunc(string, width, side = c("right", "left", "center"), ellipsis = "...") Truncate the width of strings, replacing content with ellipsis. *str_trunc(fruit, 3)*



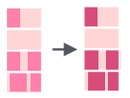
str_trim(string, side = c("both", "left", "right")) Trim whitespace from the start and/or end of a string. *str_trim(fruit)*

Mutate Strings

str_sub() **<-** value. Replace substrings by identifying the substrings with str_sub() and assigning into the results. *str_sub(fruit, 1, 3) <- "str"*



str_replace(string, **pattern**, replacement) Replace the first matched pattern in each string. *str_replace(fruit, "a", "-")*



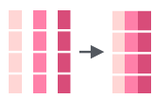
str_replace_all(string, **pattern**, replacement) Replace all matched patterns in each string. *str_replace_all(fruit, "a", "-")*

str_to_lower(string, locale = "en")[1] Convert strings to lower case. *str_to_lower(sentences)*

str_to_upper(string, locale = "en")[1] Convert strings to upper case. *str_to_upper(sentences)*

str_to_title(string, locale = "en")[1] Convert strings to title case. *str_to_title(sentences)*

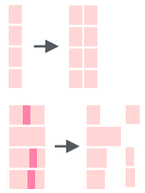
Join and Split



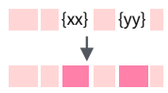
str_c(..., sep = "", collapse = NULL) Join multiple strings into a single string. *str_c(letters, LETTERS)*

str_c(..., sep = "", **collapse = NULL**) Collapse a vector of strings into a single string. *str_c(letters, collapse = "")*

str_dup(string, times) Repeat strings times times. *str_dup(fruit, times = 2)*



str_split_fixed(string, **pattern**, n) Split a vector of strings into a matrix of substrings (splitting at occurrences of a pattern match). Also **str_split** to return a list of substrings. *str_split_fixed(fruit, " ", n=2)*



glue::**glue**(..., .sep = "", .envir = parent.frame(), .open = "{", .close = "}") Create a string from strings and {expressions} to evaluate. *glue::glue("Pi is {pi}")*

glue::**glue_data**(.x, ..., .sep = "", .envir = parent.frame(), .open = "{", .close = "}") Use a data frame, list, or environment to create a string from strings and {expressions} to evaluate. *glue::glue_data(mtcars, "{rownames(mtcars)} has {hp} hp")*

Order Strings

str_order(x, decreasing = FALSE, na_last = TRUE, locale = "en", numeric = FALSE, ...)[1] Return the vector of indexes that sorts a character vector. *x[str_order(x)]*

str_sort(x, decreasing = FALSE, na_last = TRUE, locale = "en", numeric = FALSE, ...)[1] Sort a character vector. *str_sort(x)*

Helpers

str_conv(string, encoding) Override the encoding of a string. *str_conv(fruit,"ISO-8859-1")*

str_view(string, **pattern**, match = NA) View HTML rendering of first regex match in each string. *str_view(fruit, "[aeiou]")*

str_view_all(string, **pattern**, match = NA) View HTML rendering of all regex matches. *str_view_all(fruit, "[aeiou]")*

str_wrap(string, width = 80, indent = 0, exdent = 0) Wrap strings into nicely formatted paragraphs. *str_wrap(sentences, 20)*

[1] See bit.ly/ISO639-1 for a complete list of locales.

glue

glue's main function is glue() which creates strings and can inject R objects into strings

glue() has two arguments we are interested in:

1. String(s) with …
2. How to separate the elements with sep

```
glue("Hello, my name is Grant Innerst")
```

```
Hello, my name is Grant Innerst
```

You "inject" R code into the string with { }

```
first_name <- "Grant"; last_name <- "Innerst"
glue("Hello, my name is {first_name} {last_name}")
```

```
Hello, my name is Grant Innerst
```

glue

```
name <- "Grant"
age <- 30
anniversary <- as.Date("2018-07-14")

glue('My name is {name},',
  ' my age next year is {age + 1},',
  ' my anniversary is {format(anniversary, "%A, %B %d, %Y")}.')
```

```
My name is Grant, my age next year is 31, my anniversary is Saturday,
July 14, 2018.
```

glue

glue has other functions that perform more specific tasks

glue_data() works well with pipes and exposes LHS names

glue_collapse() collapses a character vector into one string

glue_col() colors console output of strings

etc…

glue in the wild!

Downloading files from a remote server

stringr

stringr is much more extensive package for string manipulation

stringr functions will almost always start with str_

stringr functions are wrappers of a very fast C++ library called stringi. stringi is powerful but complicated

stringr functions can be grouped into six categories

- Detecting
- Lengthening
- Joining/Splitting
- Subsetting
- Mutating
- Sorting/Ordering

Detecting

The fruit vector:

```
glimpse(fruit)
```

```
chr [1:80] "apple" "apricot" "avocado" "banana" "bell pepper"
"bilberry" ...
```

```
str_detect(fruit, "apple")
```

```
 [1]  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[10] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[19] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[28] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[37] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[46] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[55] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  TRUE FALSE
[64] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
[73] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
```

Detecting

```
 fruit %>% str_which("berry")
```

```
[1]  6  7 10 11 19 21 29 32 33 38 50 70 73 76
```

```
 fruit %>% str_count("a")
```

```
 [1] 1 1 2 3 0 0 1 2 1 0 0 1 2 2 1 0 0 0 0 0 1 0 1 1 1 1 1 1
[29] 0 1 0 0 0 1 1 2 0 0 1 1 0 0 1 0 0 1 0 2 1 0 1 0 0 1 1 3
[57] 1 1 1 0 1 1 0 2 0 1 0 1 2 1 1 0 2 2 1 1 2 1 0 1
```

Subsetting

```
fruit %>% str_sub(2, 4)
```

```
 [1] "ppl" "pri" "voc" "ana" "ell" "ilb" "lac" "lac" "loo" "lue" "oys" "rea" "ana" "ant" "her"
[16] "her" "hil" "lem" "lou" "oco" "ran" "ucu" "urr" "ams" "ate" "rag" "uri" "ggp" "lde" "eij"
[31] "ig"  "oji" "oos" "rap" "rap" "uav" "one" "uck" "ack" "amb" "uju" "iwi" "umq" "emo" "ime"
[46] "oqu" "ych" "and" "ang" "ulb" "ect" "ut"  "liv" "ran" "ame" "apa" "ass" "eac" "ear" "ers"
[61] "hys" "ine" "lum" "ome" "ome" "urp" "uin" "ais" "amb" "asp" "edc" "ock" "ala" "ats" "tar"
[76] "tra" "ama" "ang" "gli" "ate"
```

```
fruit %>% str_sub(-2)
```

```
[1] "le" "ot" "do" "na" "er" "ry" "ry" "nt" "ge" "ry" "ry" "it" "on" "pe" "ya"
[16] "ry" "er" "ne" "ry" "ut" "ry" "er" "nt" "on" "te" "it" "an" "nt" "ry" "oa"
[31] "ig" "ry" "ry" "pe" "it" "va" "ew" "ry" "it" "ul" "be" "it" "at" "on" "me"
[46] "at" "ee" "ne" "go" "ry" "ne" "ut" "ve" "ge" "lo" "ya" "it" "ch" "ar" "on"
[61] "is" "le" "um" "te" "lo" "en" "ce" "in" "an" "ry" "nt" "on" "ry" "ma" "it"
[76] "ry" "lo" "ne" "it" "on"
```

Subsetting

```
fruit %>% str_subset("apple")
```

```
[1] "apple"     "pineapple"
```

```
fruit %>% str_extract("app")
```

```
 [1] "app" NA    NA    NA    NA    NA    NA    NA    NA    NA    NA
[12] NA    NA    NA    NA    NA    NA    NA    NA    NA    NA    NA
[23] NA    NA    NA    NA    NA    NA    NA    NA    NA    NA    NA
[34] NA    NA    NA    NA    NA    NA    NA    NA    NA    NA    NA
[45] NA    NA    NA    NA    NA    NA    NA    NA    NA    NA    NA
[56] NA    NA    NA    NA    NA    NA    "app" NA    NA    NA    NA
[67] NA    NA    NA    NA    NA    NA    NA    NA    NA    NA    NA
[78] NA    NA    NA
```

Lengthening

```
fruit[1:5]
```

```
[1] "apple"  "apricot"  "avocado"  "banana"  "bell pepper"
```

```
fruit[1:5] %>% str_length()
```

```
 [1]  5  7  7  6 11
```

```
fruit[1:5] %>% str_pad(11L)
```

```
[1] "      apple" "    apricot" "    avocado" "     banana"
[5] "bell pepper"
```

You can pad from the left or right and with whatever symbol you want

Lengthening

```
fruit[1:5] %>% str_trunc(6L)
```

```
[1] "apple"  "apr..." "avo..." "banana" "bel..."
```

```
fruit[1:5] %>% str_pad(11L) %>% str_trim()
```

```
[1] "apple"  "apricot"  "avocado"  "banana"  "bell pepper"
```

Mutating

```
fruit[1:5] %>% str_replace("p", "_")
```

```
[1] "a_ple"    "a_ricot"   "avocado"  "banana"    "bell _epper"
```

```
fruit[1:5] %>% str_replace_all("p", "_")
```

```
[1] "a__le"    "a_ricot"  "avocado"  "banana"    "bell _e__er"
```

```
fruit[1:5] %>% str_to_upper()
```

```
[1] "APPLE"    "APRICOT"  "AVOCADO"  "BANANA"    "BELL PEPPER"
```

```
fruit[1:5] %>% str_to_title()
```

```
[1] "Apple"    "Apricot"  "Avocado"  "Banana"    "Bell Pepper"
```

Joining and Splitting

```
fruit[1:5] %>% str_c(collapse = " ")
```

```
[1] "apple apricot avocado banana bell pepper"
```

```
fruit[1:5] %>% str_c(rep("x_", 5), .)
```

```
[1] "x_apple" "x_apricot" "x_avocado" "x_banana" "x_bell pepper"
```

```
fruit[1:5] %>% str_c(collapse = " ") %>% str_split(" ")
```

```
[[1]]
[1] "apple"   "apricot" "avocado" "banana"  "bell"
[6] "pepper"
```

Sorting and Ordering

```
fruit[1:5] %>% str_sort(decreasing = TRUE)
```

```
[1] "bell pepper" "banana"   "avocado"  "apricot"  "apple"
```

```
fruit[1:5] %>% str_order()
```

```
[1] 1 2 3 4 5
```