Socio-Informatics 348

Data Transformation
Regex I

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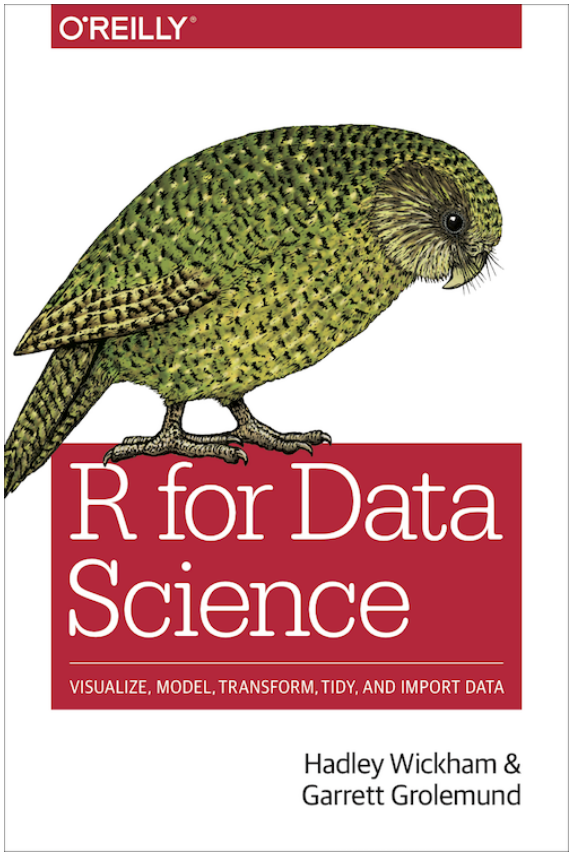
Today's Reading



R for Data Science, Chapter 15

Why Regular Expressions?

- Regular expressions (regex/regexp): concise, powerful language for string patterns.
- Use cases: extract, detect, count, replace text.

Pattern Basics

Use `str_view()` to do basic pattern matching.

- **Literal characters:** match themselves exactly (e.g., `berry`).

```
str_view(fruit, "berry")
#>  [6] │ bil<berry>
#>  [7] │ black<berry>
#> [10] │ blue<berry>
#> [11] │ boysen<berry>
#> [19] │ cloud<berry>
#> [21] │ cran<berry>
#> ... and 8 more
```

- **Metacharacters:** Punctuation and special meanings
- **Quantifiers:** How many times can a pattern match?

Pattern Basics

- **Literal characters:** match themselves exactly (e.g., `berry`).
- **Metacharacters:** Punctuation and special characters
  `.  + * [ ] ?` etc.
- **Dot (`.`):** any single character.

```
str_view(c("a", "ab", "ae", "bd", "ea", "eab"), "a.")
#> [2] │ <ab>
#> [3] │ <ae>
#> [6] │ e<ab>
```

- **Quantifiers:** How many times can a pattern match?

Pattern Basics

- **Literal characters:** match themselves exactly (e.g., `berry`).
- **Metacharacters:** Punctuation and special characters
  `.  + * [ ] ?` etc.
- **Dot (`.`):** any single character.

```
str_view(fruit, "a...e")
#>  [1] | <apple>
#>  [7] | bl<ackbe>rry
#> [48] | mand<arine>
#> [51] | nect<arine>
#> [62] | pine<apple>
#> [64] | pomegr<anate>
#> ... and 2 more
```

- **Quantifiers:** How many times can a pattern match?

Pattern Basics

- **Quantifiers:** How many times can a pattern match?
  ? optional, + one or more, * zero or more.

```
# ab? matches an "a", optionally followed by a "b".
str_view(c("a", "ab", "abb"), "ab?")
#> [1] │ <a>
#> [2] │ <ab>
#> [3] │ <ab>b

# ab+ matches an "a", followed by at least one "b".
str_view(c("a", "ab", "abb"), "ab+")
#> [2] │ <ab>
#> [3] │ <abb>

# ab* matches an "a", followed by any number of "b"s.
str_view(c("a", "ab", "abb"), "ab*")
#> [1] │ <a>
#> [2] │ <ab>
#> [3] │ <abb>
```

Character Sets and Alternation

- Character classes are defined by square brackets: `[abcd]`.
- Find the words containing an "x" surrounded by vowels, or a "y" surrounded by consonants:

```
str_view(words, "[aeiou]x[aeiou]")
#> [284] | <exa>ct
#> [285] | <exa>mple
#> [288] | <exe>rcise
#> [289] | <exi>st
str_view(words, "[^aeiou]y[^aeiou]")
#> [836] | <sys>tem
#> [901] | <typ>e
```

- Note: invert the match with `^` inside brackets: `[^aeiou]`.

Character Sets and Alternation

- Alternation is defined by vertical bar: `a|b|c`.
- Look for fruits containing "apple", "melon", or "nut", or a repeated vowel:

```
str_view(fruit, "apple|melon|nut")
#>  [1] │ <apple>
#> [13] │ canary <melon>
#> [20] │ coco<nut>
#> [52] │ <nut>
#> [62] │ pine<apple>
#> [72] │ rock <melon>
#> ... and 1 more
str_view(fruit, "aa|ee|ii|oo|uu")
#>  [9] │ bl<oo>d orange
#> [33] │ g<oo>seberry
#> [47] │ lych<ee>
#> [66] │ purple mangost<ee>n
```

Key Regex Functions

- `str_detect()` – logical vector.
- `str_subset()` – return matches.
- `str_which()` – positions.
- `str_count()` – number of matches.
- `str_replace()`, `str_replace_all()`.
- `separate_wider_regex()` – extract to columns.

str_detect()

- `str_detect(string, pattern)` returns TRUE/FALSE if pattern is found in string.

```
str_detect(c("a", "b", "c"), "[aeiou]")
#> [1]  TRUE FALSE FALSE
```

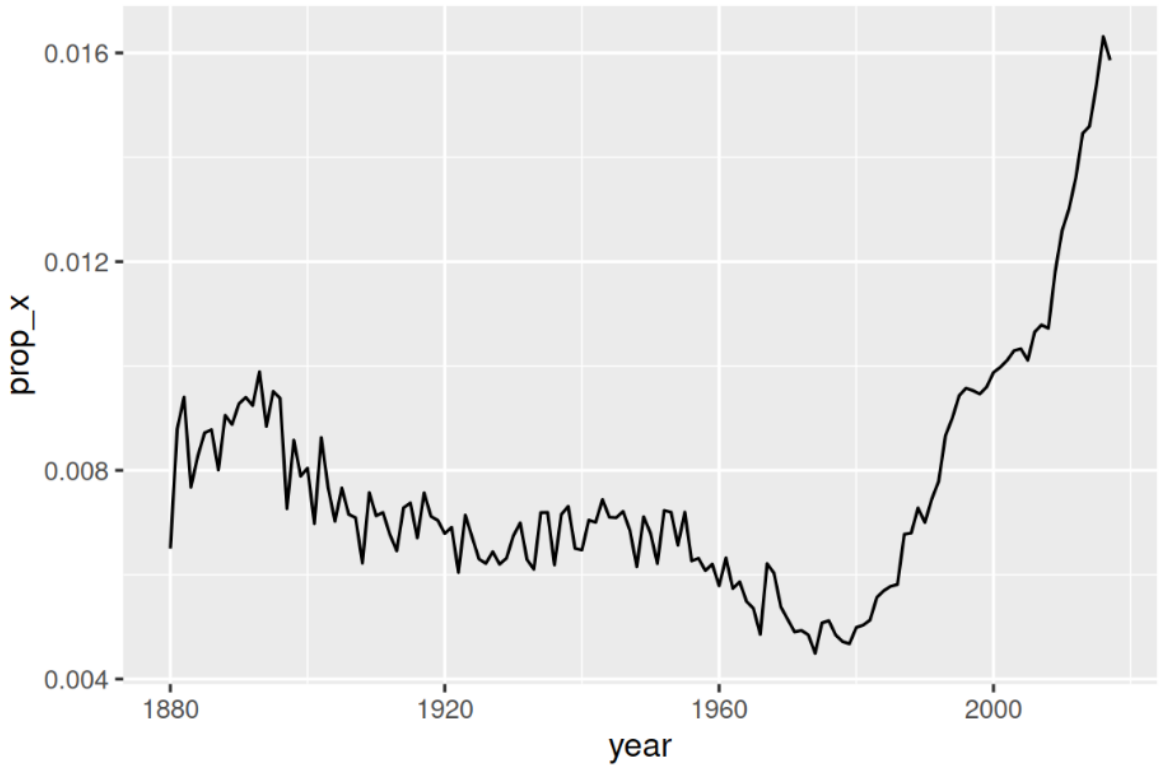
- Useful for filtering with `filter()`.

```
babynames |>
  filter(str_detect(name, "x")) |>
  count(name, wt = n, sort = TRUE)
```

str_detect()

- useful with `sum()` and `mean()`.

```
babynames |>
  group_by(year) |>
  summarize(prop_x = mean(str_detect(name, "x"))) |>
  ggplot(aes(x = year, y = prop_x)) +
  geom_line()
```



str_count()

- `str_count(string, pattern)` counts occurrences of pattern in string.

```
x <- c("apple", "banana", "pear")
str_count(x, "p")
#> [1] 2 0 1
```

- Note that patterns cannot overlap.

```
str_count("abababa", "aba")
#> [1] 2
str_view("abababa", "aba")
#> [1] | <aba>b<aba>
```

str_count()

- Use with `mutate()` to create new variables.

```
babynames |>
  count(name) |>
  mutate(
    vowels = str_count(name, "[aeiou]"),
    consonants = str_count(name, "[^aeiou]")
  )
#> # A tibble: 97,310 × 4
#>   name           n vowels consonants
#>   <chr>      <int>  <int>      <int>
#> 1 Aaban         10      2          3
#> 2 Aabha          5      2          3
#> 3 Aabid          2      2          3
#> 4 Aabir          1      2          3
#> 5 Aabriella      5      4          5
#> 6 Aada           1      2          2
#> # ℹ 97,304 more rows
```

- What do you notice about the number of vowels?

`str_count()`

Solve the issue:

- Include uppercase vowels to character class
  `str_count(name, "[aeiouAEIOU]")`.
- Tell the function to ignore case
  `str_count(name, regex("[aeiou]", ignore_case = TRUE))`.
- Convert names to lower case before counting
  `str_count(str_to_lower(name), "[aeiou]")`.

str_replace() and str_remove()

- Replace first match:
  `str_replace(string, pattern, replacement)`
- Replace all matches:
  `str_replace_all(string, pattern, replacement)`

```
x <- c("apple", "pear", "banana")
str_replace_all(x, "[aeiou]", "-")
#> [1] "-ppl-"  "p--r"   "b-n-n-"
```

- Remove matches: set replacement to empty string `""` OR use `str_remove()` and `str_remove_all()`.

```
x <- c("apple", "pear", "banana")
str_remove_all(x, "[aeiou]")
#> [1] "ppl" "pr"  "bnn"
```

- Very useful for data cleaning with `mutate()`.

Extract variables with `separate_wider_regex()`

- Similar to `separate_wider_position` and `separate_wider_delim`.

```
df <- tribble(
  ~str,
  "<Sheryl>-F_34",
  "<Kisha>-F_45",
  "<Brandon>-N_33",
  "<Sharon>-F_38",
  "<Penny>-F_58",
  "<Justin>-M_41",
  "<Patricia>-F_84",
)
```

Extract variables with `separate_wider_regex()`

- Similar to `separate_wider_position` and `separate_wider_delim`.

```
df |>
  separate_wider_regex(
    str,
    patterns = c(
      "<",
      name = "[A-Za-z]+",
      ">-",
      gender = ".",
      "_",
      age = "[0-9]+"
    )
  )
#> # A tibble: 7 × 3
#>   name    gender age
#>   <chr>   <chr>  <chr>
#> 1 Sheryl  F      34
#> 2 Kisha   F      45
#> 3 Brandon N      33
#> 4 Sharon  F      38
#> 5 Penny   F      58
```

Escaping

- Escape metacharacters with backslash – can get tricky!

```
x <- "a\\b"
str_view(x)
#> [1] | a\b
str_view(x, "\\\\")
#> [1] | a<\>b
```

- Alternative approaches – raw strings and character classes.

```
str_view(x, r"{\\}")
#> [1] | a<\>b
```

```
str_view(c("abc", "a.c", "a*c", "a c"), "a[.]c")
#> [2] | <a.c>
str_view(c("abc", "a.c", "a*c", "a c"), ".[*]c")
#> [3] | <a*c>
```

Anchors and Word Boundaries

- Anchors: `^` (start), `$` (end).

```
str_view(fruit, "^a")
#> [1] │ <a>pple
#> [2] │ <a>pricot
#> [3] │ <a>vocado
str_view(fruit, "a$")
#>  [4] │ banan<a>
#> [15] │ cherimoy<a>
#> [30] │ feijo<a>
#> [36] │ guav<a>
#> [56] │ papay<a>
#> [74] │ satsum<a>
```

- Full-string match: `^pattern$`.

Anchors and Word Boundaries

- Word boundary:

```
x <- c("summary(x)", "summarize(df)", "rowsum(x)", "sum(x)")
str_view(x, "sum")
#> [1] │ <sum>mary(x)
#> [2] │ <sum>marize(df)
#> [3] │ row<sum>(x)
#> [4] │ <sum>(x)
str_view(x, "\\bsum\\b")
#> [4] │ <sum>(x)
```