

Column-wise and row-wise operations in dplyr

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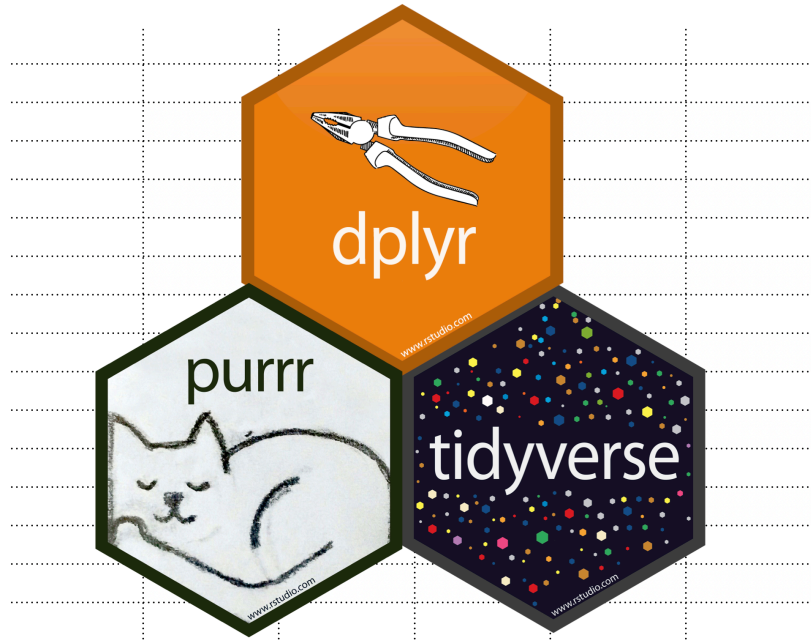


Figure 1: row-wise and column-wise operations

With the development of **dplyr** or its umbrella package **tidyverse**, it becomes quite easy to perform operations over columns or rows in R. These column- or row-wise methods can also be directly integrated with other dplyr verbs like `select`, `mutate`, `filter` and `summarise`, making them more comparable with other functions in `apply` or `map` families. In this blog, I will briefly cover some useful column- or row-wise operations.

1 Column-wise operation

Example 1: select those string columns with less than 5 levels in the dataset of **starwars**.

```
starwars %>%  
  select_if(~ any(is.character(.x) & length(unique(.x)) <= 5)) %>%  
  head()
```

```
# A tibble: 6 x 2  
  sex    gender  
  <chr> <chr>  
1 male  masculine  
2 none  masculine
```

```
3 none    masculine
4 male    masculine
5 female  feminine
6 male    masculine
```

We can combine `select_if` and `any` to identify certain columns by certain criterion. **Note:** we are using tilde (`~`) to define an anonymous function, and thus we should use `.x` to refer to the selected columns. See this [link](#) for detailed illustration of tilde (`~`), dot (`.`), and dot x (`.x`) in `dplyr`.

If you want to calculate the levels of those selected columns, you can try `across` function and `summarise` the number of levels by column.

```
starwars %>%
  summarise(across(where(is.character), ~ length(unique(.x))))
```

```
# A tibble: 1 x 8
  name hair_color skin_color eye_color sex gender homeworld species
<int>   <int>      <int>    <int> <int> <int>    <int>   <int>
1    87        12        31      15    5     3      49     38
```

Alternatively, you can make use of the `map` or `map_dbl` function in **purrr** by the following command. Note that when a `map` function is applied to a `data.frame`, it will operate over columns by default.

```
# map_dbl returns a double vector, while map returns a list
starwars %>%
  select_if(~ is.character(.x)) %>%
  map_dbl(~length(unique(.x))) %>%
  head()
```

```
name hair_color skin_color eye_color sex gender
87      12      31      15    5     3
```

Example 2: select those numeric columns and calculate the means and sds across columns in the dataset of `starwars`.

```
starwars %>%
  summarise(across(where(~ is.numeric(.x)),
    list(Mean = ~ mean(.x, na.rm = TRUE),
         Sd = ~ sd(.x, na.rm = TRUE))))
```

```
# A tibble: 1 x 6
  height_Mean height_Sd mass_Mean mass_Sd birth_year_Mean birth_year_Sd
    <dbl>      <dbl>    <dbl>   <dbl>         <dbl>         <dbl>
1      175.      34.8     97.3    169.         87.6         155.
```

This example provides us a good illustration of the use of `.x` in **dplyr** style syntax, since we have some missing values (NAs) in certain columns. Thus, we need to specify the parameter with `na.rm = TRUE` inside the functions.

There is indeed a more convenient and elegant way of solving this by using the function `summarise_if`. It allows us to select certain columns and operate by columns like this:

```
starwars %>%
  summarise_if(is.numeric,
               list(Sum = sum, Mean = mean, Sd = sd),
               na.rm = TRUE)
```

```
# A tibble: 1 x 9
  height_Sum mass_Sum birth_year_Sum height_Mean mass_Mean birth_year_Mean height_Sd mass_Sd
    <int>    <dbl>         <dbl>      <dbl>    <dbl>         <dbl>    <dbl>    <dbl>
1   14143   5741.         3765.      175.     97.3         87.6    34.8    169.
```

2 Row-wise operation

Example 3: calculate the **sums**, **means** and **sds** for each row for the dataset of **iris**.

```
iris %>%
  rowwise() %>%
  mutate(
    Rowsum = sum(c_across(Sepal.Length:Petal.Width)),
    Rowsd = sd(c_across(Sepal.Length:Petal.Width)),
    Rowmean = mean(c_across(Sepal.Length:Petal.Width))
  ) %>%
  ungroup() %>%
  head()
```

```
# A tibble: 6 x 8
  Sepal.Length Sepal.Width Petal.Length Petal.Width Species Rowsum Rowsd Rowmean
    <dbl>      <dbl>         <dbl>      <dbl> <fct>    <dbl> <dbl>    <dbl>
1      5.1      3.5         1.4        0.2 setosa    10.2  2.18    2.55
```

2	4.9	3	1.4	0.2	setosa	9.5	2.04	2.38
3	4.7	3.2	1.3	0.2	setosa	9.4	2.00	2.35
4	4.6	3.1	1.5	0.2	setosa	9.4	1.91	2.35
5	5	3.6	1.4	0.2	setosa	10.2	2.16	2.55
6	5.4	3.9	1.7	0.4	setosa	11.4	2.23	2.85

Here the function `c_across` is specifically designed to work with `rowwise` operations. **Note:** `rowwise` groups your data by row (class: `rowwise_df`), and it is best to `ungroup` immediately. Of course, if you are more comfortable with the `apply` function, you can also use the following command:

```
iris %>%
  select(Sepal.Length:Petal.Width) %>%
  apply(., 1, function(x) c(sum(x), sd(x), mean(x))) %>%
  as_tibble() %>%
  t() %>%
  head()
```

	[,1]	[,2]	[,3]
V1	10.2	2.179449	2.550
V2	9.5	2.036950	2.375
V3	9.4	1.997498	2.350
V4	9.4	1.912241	2.350
V5	10.2	2.156386	2.550
V6	11.4	2.230844	2.850

```
iris %>%
  rowwise() %>%
  dplyr::mutate(
    Rowsum = sum(c_across(Sepal.Length:Petal.Width)),
    Rowmean = mean(c_across(Sepal.Length:Petal.Width)),
    Rowsd = sd(c_across(Sepal.Length:Petal.Width)),
    .before = "Species"
  ) %>%
  ungroup() %>%
  head()
```

```
# A tibble: 6 x 8
  Sepal.Length Sepal.Width Petal.Length Petal.Width Rowsum Rowmean Rowsd Species
    <dbl>         <dbl>         <dbl>         <dbl>   <dbl>   <dbl> <dbl> <fct>
1 10.2         2.179449         2.550         9.5     2.04    2.38  setosa
2  9.5         2.036950         2.375         9.4     2.00    2.35  setosa
3  9.4         1.997498         2.350         9.4     1.91    2.35  setosa
4  9.4         1.912241         2.350         9.4     1.91    2.35  setosa
5 10.2         2.156386         2.550        10.2     2.16    2.55  setosa
6 11.4         2.230844         2.850        11.4     2.23    2.85  setosa
```

1	5.1	3.5	1.4	0.2	10.2	2.55	2.18	setosa
2	4.9	3	1.4	0.2	9.5	2.38	2.04	setosa
3	4.7	3.2	1.3	0.2	9.4	2.35	2.00	setosa
4	4.6	3.1	1.5	0.2	9.4	2.35	1.91	setosa
5	5	3.6	1.4	0.2	10.2	2.55	2.16	setosa
6	5.4	3.9	1.7	0.4	11.4	2.85	2.23	setosa

```
iris %>%
  as_tibble() %>%
  dplyr::mutate(
    row = pmap(across(1:4), ~ {
      list(rsum = sum, rmean = mean) %>%
        map_dfc(function(f) f(c(...)))
    }),
    .before = "Sepal.Length"
  ) %>%
  unnest(row) %>%
  head()
```

A tibble: 6 x 7

	rsum	rmean	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<fct>
1	10.2	2.55	5.1	3.5	1.4	0.2	setosa
2	9.5	2.38	4.9	3	1.4	0.2	setosa
3	9.4	2.35	4.7	3.2	1.3	0.2	setosa
4	9.4	2.35	4.6	3.1	1.5	0.2	setosa
5	10.2	2.55	5	3.6	1.4	0.2	setosa
6	11.4	2.85	5.4	3.9	1.7	0.4	setosa

```
iris %>%
  as_tibble() %>%
  dplyr::mutate(
    row = pmap(
      across(Sepal.Length:Petal.Width),
      ~ bind_cols(
        rsum = sum(c(...)),
        rmean = mean(c(...)),
        rsd = sd(c(...))
      )
    ),
    .before = "Sepal.Length"
```

```
) %>%
unnest(row) %>%
head()
```

```
# A tibble: 6 x 8
  rsum rmean  rsd Sepal.Length Sepal.Width Petal.Length Petal.Width Species
<dbl> <dbl> <dbl>      <dbl>      <dbl>      <dbl>      <dbl> <fct>
1  10.2  2.55  2.18        5.1        3.5        1.4        0.2 setosa
2   9.5  2.38  2.04        4.9         3        1.4        0.2 setosa
3   9.4  2.35  2.00        4.7        3.2        1.3        0.2 setosa
4   9.4  2.35  1.91        4.6        3.1        1.5        0.2 setosa
5  10.2  2.55  2.16         5         3.6        1.4        0.2 setosa
6  11.4  2.85  2.23        5.4        3.9        1.7        0.4 setosa
```

3 Related links:

- <https://dplyr.tidyverse.org/articles/rowwise.html>
- <https://purrr.tidyverse.org/reference/map.html>