Concise indicator variable recoding with ind2cat

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Abstract Indicator variables are often used in data analyses given the ease which with they are created, stored and interpreted. They concisely encode information about the presence or not of a condition for observational units. The variable name encapsulates the information about the true condition, the variable's values (TRUE and FALSE, 1 or 0, "Yes" or "No"), indicate if the condition is true for the observational unit. When using indicator variables to use in summary products, analysts often make a choice between using an indicator variable as-is or crafting categorical variables where values can be directly interpreted. Using the indicator variable as-is may be motivated by time savings, but yeilds poor results in summary products. {{ind2cat}} can help analysts concisely translate indicator variables to categorical variables for reporting products, yielding more polished outputs. By default, ind2cat creates the categorical variable from the indicator variable name, resulting in a light weight syntax.

1 Introduction

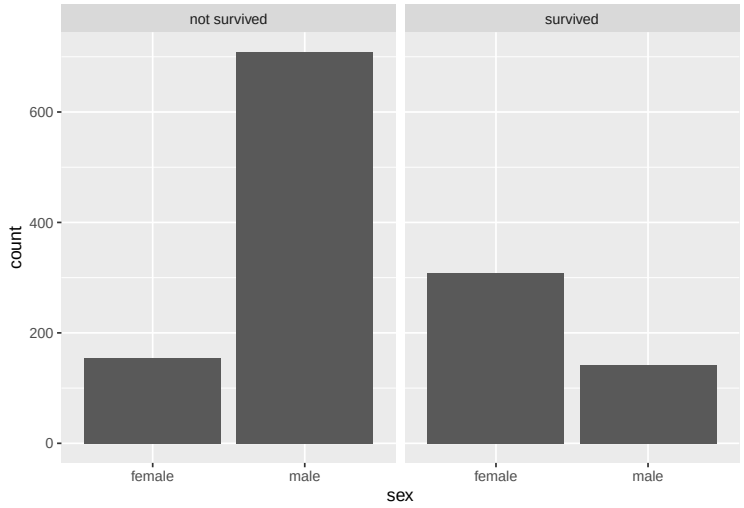
Using current analytic tools analysts make a choice between directly using indicators or verbose recode. Current proceedures for recoding indicator variables to a categorial variable is repetitive, but forgoing a recode and using indicator variables directly yeilds hard-to-interpret summary products.

Below is demonstrated how an analyst might current recode and indicator variable; this method is repetitive:

```
library(tidyverse)
tidytitanic::passengers %>%
  tibble() %>%
  mutate(cat_survived = ifelse(survived, "survived", "not survived"),
         .before = 1)
```

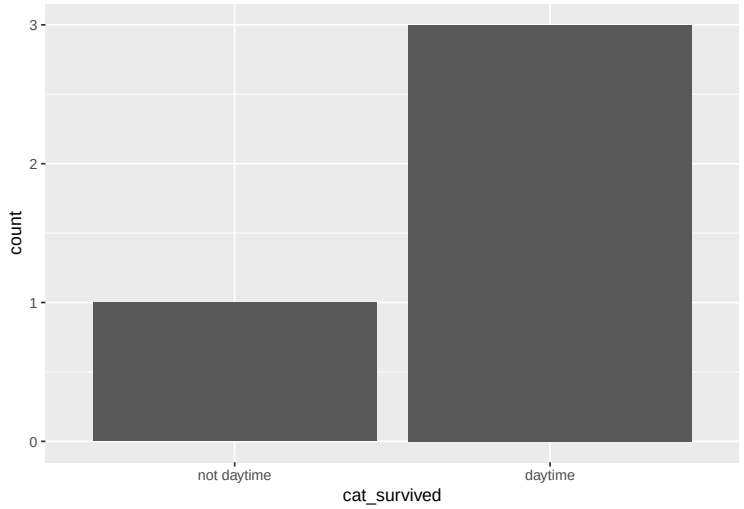
```
    # A tibble: 1,313 x 6
       cat_survived name                                  class   age sex   survi~1
       <chr>        <chr>                                 <chr> <dbl> <chr>   <int>
     1 survived     Allen, Miss Elisabeth Walton          1st   29    fema~       1
     2 not survived Allison, Miss Helen Loraine           1st    2    fema~       0
     3 not survived Allison, Mr Hudson Joshua Creighton   1st   30    male        0
     4 not survived Allison, Mrs Hudson JC (Bessie Waldo ~ 1st   25    fema~       0
     5 survived     Allison, Master Hudson Trevor         1st    0.92 male        1
     6 survived     Anderson, Mr Harry                    1st   47    male        1
     7 survived     Andrews, Miss Kornelia Theodosia      1st   63    fema~       1
     8 not survived Andrews, Mr Thomas, jr                1st   39    male        0
     9 survived     Appleton, Mrs Edward Dale (Charlotte ~ 1st   58    fema~       1
    10 not survived Artagaveytia, Mr Ramon                1st   71    male        0
    # ... with 1,303 more rows, and abbreviated variable name 1: survived
```

```
tidytitanic::passengers %>%
ggplot() +
  aes(x = sex) +
  geom_bar() +
  facet_grid(~ ifelse(survived, "survived", "not survived"))
```



This solution above also does not address category display ordering; ordering in products will be alphabetical and not reflect the F/T order of the source variable. An additional step to reflect the source variable, using a function like forcats::fct_rev, may be required for consistency in reporting.

```
data.frame(ind_daytime = c(T, F, T, T)) %>%
    mutate(cat_survived = ifelse(ind_daytime, "daytime", "not daytime")) %>%
  mutate(cat_survived = fct_rev(cat_survived)) %>%
  ggplot() +
  aes(x = cat_survived) +
  geom_bar()
```



Given how verbose recoding can be, analyst may choose to forego a recoding the variable, especially in exploratory analysis.

However, when indicator variables are used directly in data summary products like tables and visuals, information is often awkwardly displayed and is sometimes lost.

Below, the column header comes from the indicator variable name allowing savvy readers to interpret the output, but interpretation is awkward:

```
tidytitanic::passengers %>%
  count(survived)
```

```
  survived   n
1        0 863
2        1 450
```

In the following two-way table, information is completely lost due to using the indicator variable directly:

```
tidytitanic::passengers %>%
  janitor::tabyl(sex, survived) %>%
  knitr::kable(caption = "C. ", format = kabel_format)
```

Table 1: C.

sex	0	1
female	154	308
male	709	142

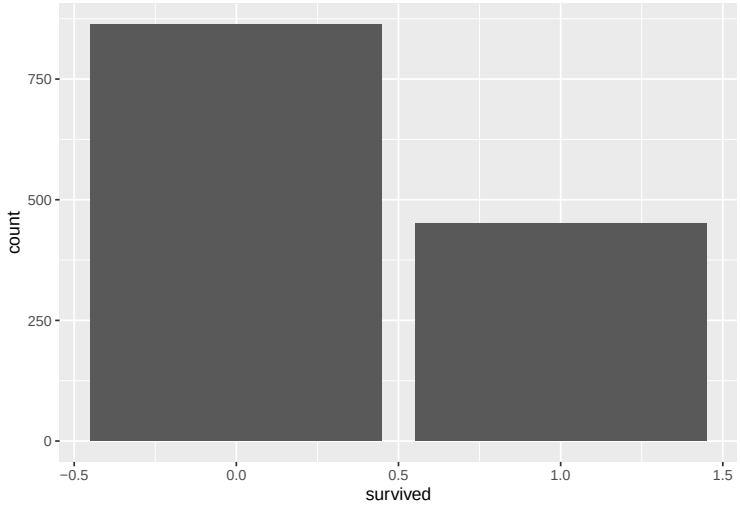


Figure 1: A. Bar labels + axis label preserves information but is awkward

In the following visual summary of the data, where the indicator variable is directly used, interpretation is awkward.

```
library(tidyverse)

tidytitanic::passengers %>%
  ggplot() +
  aes(x = survived) +
  geom_bar()
```

If used as a faceting variable with the ggplot2 library, information is lost and the graph is not directly interpable.

```
tidytitanic::passengers %>%
ggplot() +
  aes(x = age) +
  geom_histogram() +
  facet_grid(~ survived)
```

2 Introducing ind2cat::ind_recode

The ind2cat::ind_recode() function uses variable name to automatically derive human-readable, and appropriately ordered categories.

To clearly compare the new method, we reiterate the status quo with a toy example:

```
library(tidyverse)

data.frame(ind_graduated = c(T,T,F)) |>
  mutate(cat_graduated  = ifelse(ind_graduated,
                                 "graduated",
                                 "not graduated")) |>
  mutate(cat_graduated = fct_rev(cat_graduated))
```

```
      ind_graduated cat_graduated
    1          TRUE     graduated
    2          TRUE     graduated
    3         FALSE not graduated
```

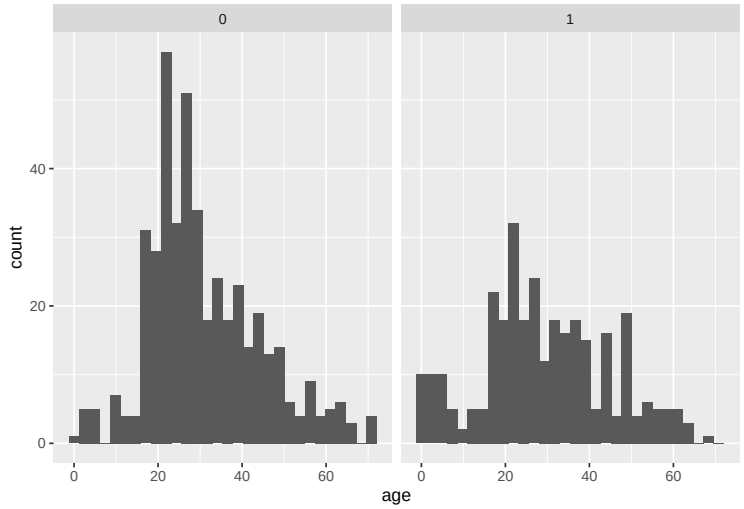


Figure 2: D. Facetting directly on an indicator variable with popular ggplot2 results in information loss

Below we contrast this with the use of ind2cat's ind_recode function which avoids repetition by creating categories based on the indicator variable name. Using the the function ind_recode(), we can accomplish the same task shown above more succinctly:

```
library(ind2cat)

data.frame(ind_graduated = c(T,T,F)) |>
  mutate(cat_graduated  = ind_recode(ind_graduated))
```

```
  ind_graduated cat_graduated
1          TRUE     graduated
2          TRUE     graduated
3         FALSE not graduated
```

The indicator variable can be populated with TRUE/FALSE values as well as 1/0 or "Yes"/"No" (and variants 'y/n' for example).

Furthermore, while ind_recode default functionality allows analysts to move from its first-cut human-readable recode, it also allows fully customized categories via adjustment of the functions parameters.

- cat_true a character string string to be used place of T/1/"Yes" for the categorical variable output, if NULL the category is automatically generated from the variable name
- negator a character string used to create cat_false when cat_false is NULL, default is 'not'
- cat_false a character string string to be used place of F/0/"No" for the categorical variable output, if NULL the category is automatically generated from cat_true and the negator
- rev logical indicating if the order should be reversed from the F/T ordering of the indicator source variable, default is FALSE
- var_prefix a character string that will be ignored when creating the categorical variable

```
data.frame(ind_graduated = c(T,T,F)) %>%
  mutate(cat_graduated  = ind_recode(ind_graduated,
                                     cat_false = "current"))
```

```
  ind_graduated cat_graduated
1          TRUE     graduated
2          TRUE     graduated
3         FALSE       current
```

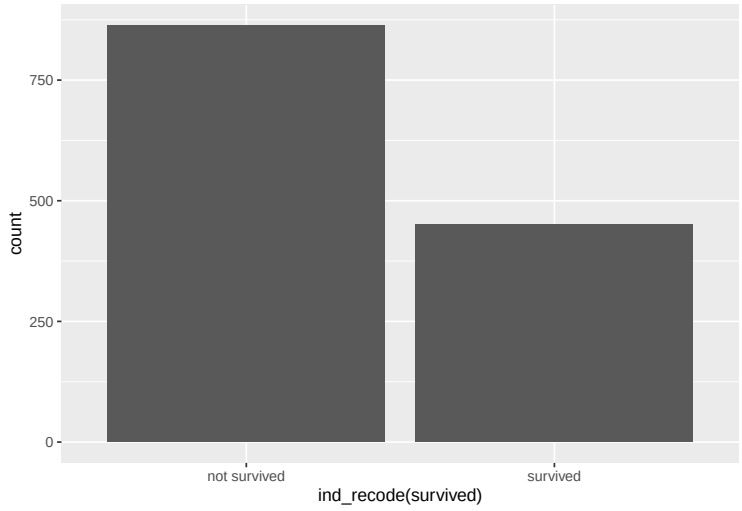
```
tibble(ind_grad = c("y", "n")) %>%
  mutate(cat_grad  = ind_recode(ind_grad,
                                cat_true = "graduated"))
```

```
    # A tibble: 2 x 2
      ind_grad cat_grad
      <chr>    <fct>
    1 y        graduated
    2 n        not graduated

tibble(ind_grad = c(T,T,F)) %>%
  mutate(cat_grad  = ind_recode(ind_grad, negator = "didn't"))

    # A tibble: 3 x 2
      ind_grad cat_grad
      <lgl>    <fct>
    1 TRUE     grad
    2 TRUE     grad
    3 FALSE    didn't grad

tibble(ind_grad = c("Y", "N")) %>%
  mutate(cat_grad  = ind_recode(ind_grad, cat_false = "enrolled"))

    # A tibble: 2 x 2
      ind_grad cat_grad
      <chr>    <fct>
    1 Y        grad
    2 N        enrolled

tibble(ind_grad = c("yes", "no")) %>%
  mutate(cat_grad  = ind_recode(ind_grad, rev = TRUE)) %>%
  mutate(cat_grad_num = as.numeric(cat_grad))

    # A tibble: 2 x 3
      ind_grad cat_grad cat_grad_num
      <chr>    <fct>           <dbl>
    1 yes      grad                1
    2 no       not grad            2

tibble(dummy_grad = c(0,0,1,1,1 ,0 ,0)) %>%
  mutate(cat_grad  = ind_recode(dummy_grad, var_prefix = "dummy_"))

    # A tibble: 7 x 2
      dummy_grad cat_grad
           <dbl> <fct>
    1          0 not grad
    2          0 not grad
    3          1 grad
    4          1 grad
    5          1 grad
    6          0 not grad
    7          0 not grad
```

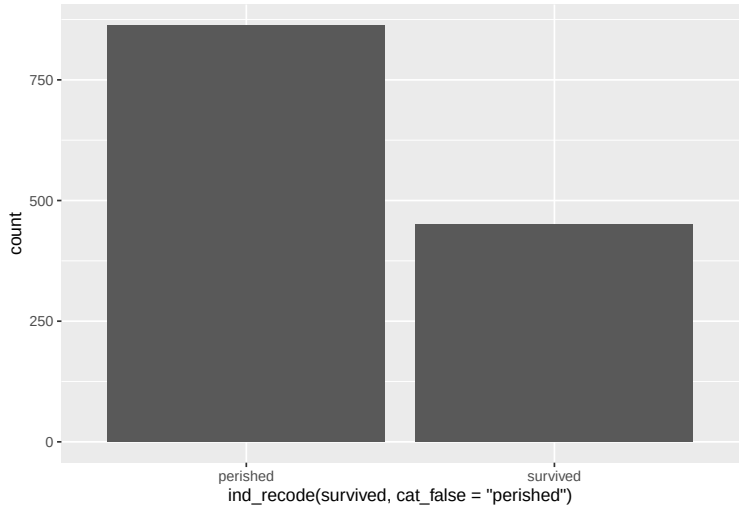
Use in data products like figures and tables

In what follows, we show ind2cat's use in summary products, which is a main motivation for ind2cat.

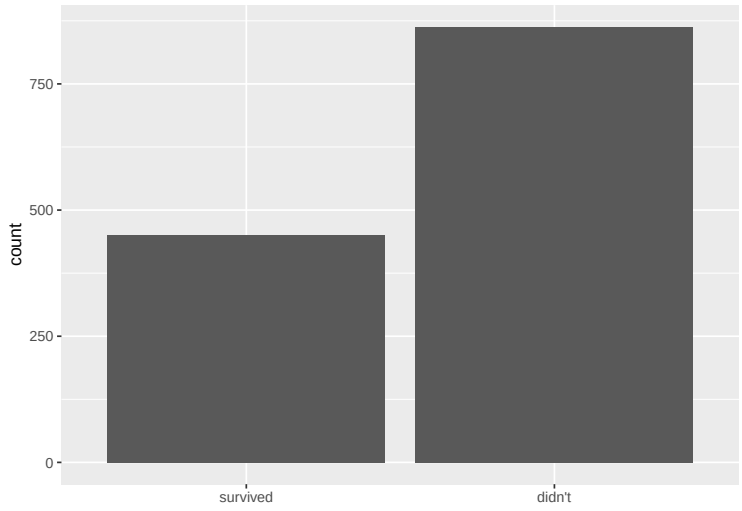
```
tidytitanic::passengers %>%
ggplot() +
  aes(x = ind_recode(survived)) +
  geom_bar()
```




```
# or
last_plot() +
  aes(x = ind_recode(survived, cat_false = "perished"))
```

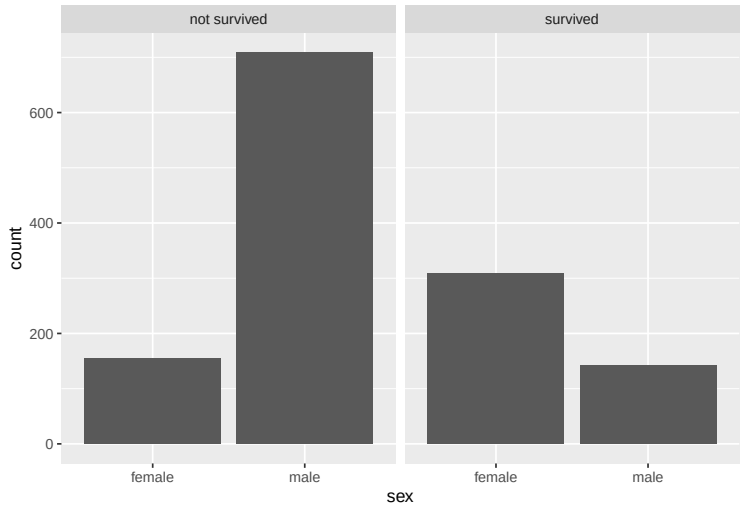



```
# or
last_plot() +
  aes(x = ind_recode(survived, cat_false = "didn't", rev = T)) +
  labs(x = NULL)
```




```
tidytitanic::passengers %>%
ggplot() +
```

```
  aes(x = sex) +
  geom_bar() +
  facet_grid(~ ind_recode(survived))
```




```
tidytitanic::passengers %>%
  mutate(cat_survived = ind_recode(survived)) %>%
  janitor::tabyl(sex, cat_survived) %>%
  janitor::adorn_percentages() %>%
  janitor::adorn_pct_formatting() %>%
  janitor::adorn_ns(position = "rear")
```

```
        sex not survived    survived
     female  33.3% (154) 66.7% (308)
       male  83.3% (709) 16.7% (142)
```

3 Implementation details

```
readLines("R/ind_recode.R") -> implementation

#' ind_recode
#'
#' @param var the name of an indicator variable
#' @param var_prefix a character string that will be ignored when creating the categorical variable
#' @param negator a character string used to create cat_false when cat_false is NULL, default is 'not'
#' @param cat_true a character string string to be used place of  T/1/"Yes" for the categorical variable outp
#' @param cat_false a character string string to be used place of  F/0/"No" for the categorical variable outp
#' @param rev logical indicating if the order should be reversed from the F/T ordering of the indicator sourc
#'
#' @return
#' @export
#'
#' @examples
#' library(tibble)
#' library(dplyr)
#' tibble(ind_grad = c(0,0,1,1,1 ,0 ,0)) %>%
#'   mutate(cat_grad  = ind_recode(ind_grad))
#'
#' tibble(ind_grad = c(TRUE,TRUE,FALSE)) %>%
#'   mutate(cat_grad  = ind_recode(ind_grad))
#'
#' tibble(ind_grad = c("Y", "N")) %>%
#'   mutate(cat_grad  = ind_recode(ind_grad))
#'
#' tibble(ind_grad = c("y", "n")) %>%
#'   mutate(cat_grad  = ind_recode(ind_grad))
#'
```

```
#' tibble(ind_grad = c("yes", "no")) %>%
#'   mutate(cat_grad  = ind_recode(ind_grad))
ind_recode <- function(var, var_prefix = "ind_", negator = "not",
                       cat_true = NULL, cat_false = NULL, rev = FALSE){

  if(is.null(cat_true)){
    cat_true = deparse(substitute(var)) %>%   # use r lang in rewrite
      stringr::str_remove(paste0("^", var_prefix)) %>%
      stringr::str_replace_all("_", " ")
  }

  if(is.null(cat_false)){
    cat_false = paste(negator, cat_true)
  }

  # for yes/no case
  if(is.character({{var}})){

    my_var <- {{var}} %>% as.factor() %>% as.numeric() - 1

  }else{

    my_var <- {{var}}
  }

  if(rev){
    ifelse(my_var, cat_true, cat_false) %>%
      factor(levels = c(cat_true, cat_false))
  }else{
    ifelse(my_var, cat_true, cat_false) %>%
      factor(levels = c(cat_false, cat_true))
  }


}
```

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