14.- Feature Data Transform_04_19_vacunacion_completo_v_01

June 8, 2023

#

CU04_Optimización de vacunas

Citizenlab Data Science Methodology > III - Feature Engineering Domain *** > # 14.- Feature Data Transform

Feature Data Transform is the process that allows change (if is required) the type and/or distribution of data features (e.g. scaling, normalizing o standardizing data features).

0.1 Tasks

Perform Basic Data Transforms

Perform Categorical Variable Transformation
- Encode Transformation
- One-hot encoding
- Ordinal encoding
- Dummy encoding
- Evaluate a Logistic Regression model
- Consider Embedding if text mining context

Perform Numeric Variable Transformation
- Scale Transformation
- Normalization
- Standardization
- IQR Robust Scaler Transform
- Evaluate a KNN model
- Distribution Transformation
- Discretization
- Uniform
- Clustered(k-Means)
- Quantile
- Normal Quantile
- Uniform Quantile
- Evaluate a KNN model
- Evaluate a KNN model
- Power transforms (Make Distributions More Gaussian)
- Box-Cox Transform
- Yeo-Johnson Transform
- Evaluate a KNN model

0.2 Consideraciones casos CitizenLab programados en R

- Algunas de las tareas de este proceso se han realizado en los notebooks del proceso 05 Data Collection porque eran necesarias para las tareas ETL. En esos casos, en este notebook se referencia al notebook del proceso 05 correspondiente
- Otras tareas típicas de este proceso se realizan en los notebooks del dominio IV al ser más eficiente realizarlas en el propio pipeline de modelización.
- Por tanto en los notebooks de este proceso de manera general se incluyen las comprobaciones necesarias, y comentarios si procede
- Las tareas del proceso se van a aplicar solo a los archivos que forman parte del despliegue, ya que hay muchos archivos intermedios que no procede pasar por este proceso
- El nombre de archivo del notebook hace referencia al nombre de archivo del proceso 05 al que se aplica este proceso, por eso pueden no ser correlativa la numeración
- Las comprobaciones se van a realizar teniendo en cuenta que el lenguaje utilizado en el despliegue de este caso es R

0.3 File

- Input File: CU_04_08_20_vacunacion_gripe_train_and_test.csv
- Output File: No aplica

0.3.1 Encoding

Con la siguiente expresión se evitan problemas con el encoding al ejecutar el notebook. Es posible que deba ser eliminada o adaptada a la máquina en la que se ejecute el código.

[7]:
```
Sys.setlocale(category = "LC_ALL", locale = "es_ES.UTF-8")
```

```
Warning message in Sys.setlocale(category = "LC_ALL", locale = "es_ES.UTF-8"):
"OS reports request to set locale to "es_ES.UTF-8" cannot be honored"
```

”

0.4 Settings

0.4.1 Libraries to use

[8]:
```
library(readr)
library(dplyr)
library(tidyr)
library(forcats)
library(lubridate)
```

0.4.2 Paths

[9]:
```
iPath <- "Data/Input/"
oPath <- "Data/Output/"
```

0.5 Data Load

OPCION A: Seleccionar fichero en ventana para mayor comodidad

Data load using the {tcltk} package. Ucomment the line if using this option

[10]:
```
# file_data <- tcltk::tk_choose.files(multi = FALSE)
```

OPCION B: Especificar el nombre de archivo

[11]:
```
iFile <- "CU_04_08_20_vacunacion_gripe_train_and_test.csv"
file_data <- paste0(iPath, iFile)

if(file.exists(file_data)){
    cat("Se leerán datos del archivo: ", file_data)
} else{
    warning("Cuidado: el archivo no existe.")
}
```

```
Se leerán datos del archivo:
Data/Input/CU_04_08_20_vacunacion_gripe_train_and_test.csv
```

Data file to dataframe Usar la función adecuada según el formato de entrada (xlsx, csv, json, ...)

[12]:
```
data <- read_csv(file_data)
```

```
Rows: 21736 Columns: 49
  Column specification



Delimiter: ","
chr  (3): GEOCODIGO, DESBDT, nombre_zona
dbl (45): ano, semana, n_vacunas, n_citas, tmed, prec, velmedia,
presMax, be…
lgl  (1): is_train

 Use `spec()` to retrieve the full column specification for this
data.
 Specify the column types or set `show_col_types = FALSE` to quiet
this message.
```

Estructura de los datos:

[13]:
```
data |> glimpse()
```

```
Rows: 21,736
Columns: 49
$ GEOCODIGO         <chr> "259", "260", "041", "025", "046",
```

```
"159", "065", "09…
$ DESBDT            <chr> "V Centenario", "Valdeacederas",
"Canillejas", "Bara…
$ ano               <dbl> 2022, 2022, 2022, 2022, 2022, 2022,
2022, 2021, 2023…
$ semana            <dbl> 34, 8, 9, 49, 24, 3, 8, 47, 1, 2,
52, 39, 16, 50, 34…
$ n_vacunas         <dbl> 0, 0, 0, 292, 0, 524, 0, 248, 204,
205, NA, 0, 0, 51…
$ n_citas           <dbl> 0, 0, 0, 280, 0, 498, 0, 228, 198,
187, NA, 0, 0, 51…
$ tmed              <dbl> 27.278748, 9.577289, 8.536554,
9.065363, 29.905728, …
$ prec              <dbl> 0.169955881, 1.264910043,
3.122881160, 7.313886680, …
$ velmedia          <dbl> 2.297067, 1.890425, 2.418071,
1.562328, 2.564749, 1.…
$ presMax           <dbl> 940.0420, 944.1770, 949.7179,
941.8342, 940.5669, 95…
$ benzene           <dbl> 0.1764413, 0.4591543, 0.4099159,
0.4224172, 0.195865…
$ co                <dbl> 0.4987735, 0.3960647, 0.3951587,
NA, 0.2891224, 0.50…
$ no                <dbl> NA, 6.611337, 9.331224, 14.007722,
4.063517, 24.4756…
$ no2               <dbl> 14.21113, 34.67671, 30.29999,
32.54832, 26.06913, 44…
$ nox               <dbl> 18.00109, 48.94660, 45.22346,
56.75574, 30.35311, 74…
$ o3                <dbl> 80.90659, 42.06663, 48.88088,
26.68276, 64.55205, 31…
$ pm10              <dbl> 20.117087, 15.042152, 14.002432,
18.032354, 55.79346…
$ pm2.5             <dbl> 10.628064, 5.539590, 7.124192,
6.793868, 19.520373, …
$ so2               <dbl> 2.794934, 3.507164, 2.692125,
2.351139, 3.397640, 2.…
$ campana           <dbl> NA, NA, NA, 2022, NA, 2021, NA,
2021, 2022, 2021, 20…
$ scampana          <dbl> NA, NA, NA, 14, NA, 20, NA, 12, 18,
19, 17, 4, NA, 1…
$ capacidad_zona    <dbl> 7957, 6537, 7167, 5633, 3864,
12583, 8544, 5077, 494…
$ prop_riesgo       <dbl> 0.11393237, 0.15763986, 0.25500690,
0.14452370, 0.26…
$ tasa_riesgo       <dbl> 0.013477754, 0.015731142,
0.009177382, 0.013099129, …
$ tasa_mayores      <dbl> 0.023033610, 0.032817374,
```

```
0.028147027, 0.020829657, …
$ poblacion_mayores <dbl> 0.10330662, 0.14362062, 0.23161874,
0.13058449, 0.24…
$ nombre_zona       <chr> "V Centenario", "Valdeacederas",
"Canillejas", "Bara…
$ nsec              <dbl> 17, 18, 22, 13, 14, 42, 32, 13, 17,
11, NA, 15, 15, …
$ t3_1              <dbl> 36.73039, 41.41412, 45.44882,
39.78001, 46.13171, 46…
$ t1_1              <dbl> 31778, 26202, 28658, 22492, 15450,
50478, 34148, 202…
$ t2_1              <dbl> 0.5084658, 0.5329728, 0.5316594,
0.5189021, 0.551191…
$ t2_2              <dbl> 0.4915342, 0.4670272, 0.4683406,
0.4810979, 0.448809…
$ t4_1              <dbl> 0.22551283, 0.12790298, 0.12603707,
0.18104432, 0.11…
$ t4_2              <dbl> 0.6711962, 0.7284970, 0.6423306,
0.6883785, 0.641173…
$ t4_3              <dbl> 0.10330662, 0.14362062, 0.23161874,
0.13058449, 0.24…
$ t5_1              <dbl> 0.1063332, 0.2295250, 0.1655070,
0.1266086, 0.165893…
$ t6_1              <dbl> 0.1706875, 0.3477631, 0.2511757,
0.1998911, 0.261480…
$ t7_1              <dbl> 0.05131106, 0.04606911, 0.04379644,
0.05585777, 0.06…
$ t8_1              <dbl> 0.03892836, 0.03586418, 0.03207779,
0.04434976, 0.05…
$ t9_1              <dbl> 0.5151383, 0.3863876, 0.3129631,
0.4611972, 0.701812…
$ t10_1             <dbl> 0.09258503, 0.13151901, 0.13926119,
0.10460043, 0.06…
$ t11_1             <dbl> 0.6406787, 0.5451465, 0.4600730,
0.5920292, 0.471769…
$ t12_1             <dbl> 0.7028586, 0.6277335, 0.5346482,
0.6590530, 0.502531…
$ area              <dbl> 2100118.9, 1164622.0, 1597474.5,
3816572.0, 870986.8…
$ densidad_hab_km   <dbl> 15131.52443, 22498.28643,
17939.56640, 5893.24662, 1…
$ tuits_gripe       <dbl> 60, 56, 72, 196, 46, 382, 56, 280,
24, 508, NA, 126,…
$ interes_gripe     <dbl> 24, 15, 24, 77, 21, 42, 15, 64, 64,
69, NA, 42, 40, …
$ Target            <dbl> 24, 15, 24, 77, 21, 42, 15, 64, 64,
69, NA, 42, 40, …
$ is_train          <lgl> TRUE, TRUE, TRUE, TRUE, TRUE, TRUE,
```

TRUE, TRUE, TRUE…

Muestra de los primeros datos:

[14]:
```
data |> slice_head(n = 5)
```

A spec_tbl_df: 5 × 49

GEOCODIGO <chr>	DESBDT <chr>	ano <dbl>	semana <dbl>	n_vacunas <dbl>	n_citas <dbl>	tmed <dbl>	p
259	V Centenario	2022	34	0	0	27.278748	0
260	Valdeacederas	2022	8	0	0	9.577289	1
041	Canillejas	2022	9	0	0	8.536554	3
025	Barajas	2022	49	292	280	9.065363	7
046	Castelló	2022	24	0	0	29.905728	0

0.6 Basic Data Transforms

0.6.1 Data Selecting

[68]:
```
data |> select(1)
```

GEOCODIGO
<chr>
259
260
041
025
046
159
065
092
221
038
041
174
126
139
188
040
084
261
132
172
266
022
233
195
286
209
128
137
124
210
121
123
125
141
143
145
154
155
163
166
175
178
180
183
186
190
196
197
211
215

A tibble: 21736 × 1

0.6.2 Data Filtering

[69]:
```
data |> filter(ano = 2021)
```

```
Error in `filter()`:
! We detected a named input.
  This usually means that you've used `=` instead of `==`.
  Did you mean `ano == 2021`?
Traceback:

1. filter(data, ano = 2021)
2. filter.data.frame(data, ano = 2021)
3. check_filter(dots)
4. abort(bullets, call = error_call)
5. signal_abort(cnd, .file)
```

0.6.3 Insert New Column

[70]:
```
data |>
    mutate(x = TRUE)
```

GEOCODIGO	DESBDT	ano	semana	n_vacunas	n_citas	tmed
<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
259	V Centenario	2022	34	0	0	27.278
260	Valdeacederas	2022	8	0	0	9.5772
041	Canillejas	2022	9	0	0	8.5365
025	Barajas	2022	49	292	280	9.0653
046	Castelló	2022	24	0	0	29.905
159	Mar Báltico	2022	3	524	498	4.7172
065	Daroca	2022	8	0	0	10.233
092	Felipe II	2021	47	248	228	6.0786
221	Ramón y Cajal	2023	1	204	198	8.1459
038	Campo Real	2022	2	205	187	4.2450
041	NA	2023	52	NA	NA	10.700
174	Monforte de Lemos	2022	39	0	0	16.474
126	La Plata	2022	16	0	0	10.784
139	Las Rozas	2022	50	515	510	8.8428
188	Opañel	2022	34	0	0	28.005
040	Canal de Panamá	2021	37	0	0	19.878
084	Embajadores	2022	11	0	0	10.896
261	Valdebernardo	2021	42	185	183	15.813
132	Las Américas	2022	5	409	397	9.6411
172	Miraflores	2022	50	291	265	10.074
266	Valdezarza	2022	33	0	0	24.314
022	Arganda - Felicidad	2022	43	418	393	18.313
233	San Blas	2022	50	333	326	10.574
195	Paracuellos del Jarama	2022	32	0	0	28.061
286	Zofío	2022	42	368	357	18.393
209	Portazgo	2021	45	215	213	10.457
128	La Ribota	2022	18	0	0	16.293
137	Las Matas	2021	36	0	0	21.968
124	La Marazuela	2022	52	151	149	8.4116
210	Potosí	2022	12	0	0	10.009
121	NA	2023	52	NA	NA	7.3067
123	NA	2023	52	NA	NA	10.211
125	NA	2023	52	NA	NA	10.545
141	NA	2023	52	NA	NA	11.357
143	NA	2023	52	NA	NA	11.203
145	NA	2023	52	NA	NA	10.166
154	NA	2023	52	NA	NA	10.225
155	NA	2023	52	NA	NA	11.044
163	NA	2023	52	NA	NA	11.014
166	NA	2023	52	NA	NA	10.142
175	NA	2023	52	NA	NA	11.012
178	NA	2023	52	NA	NA	11.259
180	NA	2023	52	NA	NA	10.654
183	NA	2023	52	NA	NA	11.527
186	NA	2023	52	NA	NA	11.146
190	NA	2023	52	NA	NA	11.068
196	NA	2023	52	NA	NA	11.219
197	NA	2023	52	NA	NA	10.361
211	NA	2023	52	NA	NA	10.965
215	NA	2023	52	NA	NA	11.205

A tibble: 21736 × 50

0.6.4 Delete Column

[71]:
```
data |> select(-x)
```

```
Error in `select()`:
! Can't subset columns that don't exist.
  Column `x` doesn't exist.
Traceback:

1. select(data, -x)
2. select.data.frame(data, -x)
3. tidyselect::eval_select(expr(c(…)), data = .data, error_call = error_call)
4. eval_select_impl(data, names(data), as_quosure(expr, env), include = include
 .     exclude = exclude, strict = strict, name_spec = name_spec,
 .     allow_rename = allow_rename, allow_empty = allow_empty, allow_predicates
 ↪= allow_predicates,
 .     error_call = error_call, )
5. with_subscript_errors(out <- vars_select_eval(vars, expr, strict = strict,
 .     data = x, name_spec = name_spec, uniquely_named = uniquely_named,
 .     allow_rename = allow_rename, allow_empty = allow_empty, allow_predicates
 ↪= allow_predicates,
 .     type = type, error_call = error_call), type = type)
6. try_fetch(expr, vctrs_error_subscript = function(cnd) {
 .     cnd$subscript_action <- subscript_action(type)
 .     cnd$subscript_elt <- "column"
 .     cnd_signal(cnd)
 . })
7. withCallingHandlers(expr, condition = function(cnd) {
 .     {
 .         .__handler_frame__. <- TRUE
 .         .__setup_frame__. <- frame
 .         if (inherits(cnd, "message")) {
 .             except <- c("warning", "error")
 .         }
 .         else if (inherits(cnd, "warning")) {
 .             except <- "error"
 .         }
 .         else {
 .             except <- ""
 .         }
 .     }
 .     while (!is_null(cnd)) {
 .         if (inherits(cnd, "vctrs_error_subscript")) {
 .             out <- handlers[[1L]](cnd)
 .             if (!inherits(out, "rlang_zap"))
 .                 throw(out)
 .         }
 .         inherit <- .subset2(.subset2(cnd, "rlang"), "inherit")
```

```
 .         if (is_false(inherit)) {
 .             return()
 .         }
 .         cnd <- .subset2(cnd, "parent")
 .     }
 . })
8. vars_select_eval(vars, expr, strict = strict, data = x, name_spec = name_spe ,
 .     uniquely_named = uniquely_named, allow_rename = allow_rename,
 .     allow_empty = allow_empty, allow_predicates = allow_predicates,
 .     type = type, error_call = error_call)
9. walk_data_tree(expr, data_mask, context_mask)
10. eval_c(expr, data_mask, context_mask)
11. reduce_sels(node, data_mask, context_mask, init = init)
12. walk_data_tree(new, data_mask, context_mask)
13. as_indices_sel_impl(out, vars = vars, strict = strict, data = data,
  .     allow_predicates = allow_predicates, call = error_call, arg =␣
 ↪as_label(expr))
14. as_indices_impl(x, vars, call = call, arg = arg, strict = strict)
15. chr_as_locations(x, vars, call = call, arg = arg)
16. vctrs::vec_as_location(x, n = length(vars), names = vars, call = call,
  .     arg = arg)
17. (function ()
  . stop_subscript_oob(i = i, subscript_type = subscript_type, names = names,
  .     subscript_action = subscript_action, subscript_arg = subscript_arg,
  .     call = call))()
18. stop_subscript_oob(i = i, subscript_type = subscript_type, names = names,
  .     subscript_action = subscript_action, subscript_arg = subscript_arg,
  .     call = call)
19. stop_subscript(class = "vctrs_error_subscript_oob", i = i, subscript_type =
 ↪subscript_type,
  .     …, call = call)
20. abort(class = c(class, "vctrs_error_subscript"), i = i, …,
  .     call = call)
21. signal_abort(cnd, .file)
22. signalCondition(cnd)
23. (function (cnd)
  . {
  .     {
  .         .__handler_frame__. <- TRUE
  .         .__setup_frame__. <- frame
  .         if (inherits(cnd, "message")) {
  .             except <- c("warning", "error")
  .         }
  .         else if (inherits(cnd, "warning")) {
  .             except <- "error"
  .         }
  .         else {
  .             except <- ""
```

```
.         }
.     }
.     while (!is_null(cnd)) {
.         if (inherits(cnd, "vctrs_error_subscript")) {
.             out <- handlers[[1L]](cnd)
.             if (!inherits(out, "rlang_zap"))
.                 throw(out)
.         }
.         inherit <- .subset2(.subset2(cnd, "rlang"), "inherit")
.         if (is_false(inherit)) {
.             return()
.         }
.         cnd <- .subset2(cnd, "parent")
.     }
. })(structure(list(message = "", trace = structure(list(call = list(
.     IRkernel::main(), kernel$run(), handle_shell(), executor$execute(msg),
.     tryCatch(evaluate(request$content$code, envir = .GlobalEnv,
.         output_handler = oh, stop_on_error = 1L), interrupt = function(cond␣
↪{
.         log_debug("Interrupt during execution")
.         interrupted <<- TRUE
.     }, error = .self$handle_error), tryCatchList(expr, classes,
.         parentenv, handlers), tryCatchOne(tryCatchList(expr,
.         names[-nh], parentenv, handlers[-nh]), names[nh], parentenv,
.         handlers[[nh]]), doTryCatch(return(expr), name, parentenv,
.         handler), tryCatchList(expr, names[-nh], parentenv, handlers[-nh]),
.     tryCatchOne(expr, names, parentenv, handlers[[1L]]),␣
↪doTryCatch(return(expr),
.         name, parentenv, handler), evaluate(request$content$code,
.         envir = .GlobalEnv, output_handler = oh, stop_on_error = 1L),
.     evaluate_call(expr, parsed$src[[i]], envir = envir, enclos = enclos,
.         debug = debug, last = i == length(out), use_try = stop_on_error !=
.             2L, keep_warning = keep_warning, keep_message = keep_message,
.         log_echo = log_echo, log_warning = log_warning, output_handler =␣
↪output_handler,
.         include_timing = include_timing), timing_fn(handle(ev <-␣
↪withCallingHandlers(withVisible(eval_with_user_handlers(expr,
.         envir, enclos, user_handlers)), warning = wHandler, error = eHandle
.         message = mHandler))), handle(ev <-␣
↪withCallingHandlers(withVisible(eval_with_user_handlers(expr,
.         envir, enclos, user_handlers)), warning = wHandler, error = eHandle
.         message = mHandler)), try(f, silent = TRUE), tryCatch(expr,
.         error = function(e) {
.             call <- conditionCall(e)
.             if (!is.null(call)) {
.                 if (identical(call[[1L]], quote(doTryCatch)))
.                   call <- sys.call(-4L)
.                 dcall <- deparse(call, nlines = 1L)
```

```
.                 prefix <- paste("Error in", dcall, ": ")
.                 LONG <- 75L
.                 sm <- strsplit(conditionMessage(e), "\n")[[1L]]
.                 w <- 14L + nchar(dcall, type = "w") + nchar(sm[1L],
.                   type = "w")
.                 if (is.na(w))
.                   w <- 14L + nchar(dcall, type = "b") + nchar(sm[1L],
.                     type = "b")
.                 if (w > LONG)
.                   prefix <- paste0(prefix, "\n  ")
.             }
.             else prefix <- "Error : "
.             msg <- paste0(prefix, conditionMessage(e), "\n")
.             .Internal(seterrmessage(msg[1L]))
.             if (!silent && isTRUE(getOption("show.error.messages"))) {
.                 cat(msg, file = outFile)
.                 .Internal(printDeferredWarnings())
.             }
.             invisible(structure(msg, class = "try-error", condition = e))
.         }), tryCatchList(expr, classes, parentenv, handlers),
.     tryCatchOne(expr, names, parentenv, handlers[[1L]]),␣
↪doTryCatch(return(expr),
.         name, parentenv, handler),␣
↪withCallingHandlers(withVisible(eval_with_user_handlers(expr,
.         envir, enclos, user_handlers)), warning = wHandler, error = eHandle
.         message = mHandler), withVisible(eval_with_user_handlers(expr,
.         envir, enclos, user_handlers)), eval_with_user_handlers(expr,
.         envir, enclos, user_handlers), eval(expr, envir, enclos),
.     eval(expr, envir, enclos), select(data, -x), select.data.frame(data,
.         -x), tidyselect::eval_select(expr(c(…)), data = .data,
.         error_call = error_call), eval_select_impl(data, names(data),
.         as_quosure(expr, env), include = include, exclude = exclude,
.         strict = strict, name_spec = name_spec, allow_rename = allow_rename
.         allow_empty = allow_empty, allow_predicates = allow_predicates,
.         error_call = error_call, ), with_subscript_errors(out <-␣
↪vars_select_eval(vars,
.         expr, strict = strict, data = x, name_spec = name_spec,
.         uniquely_named = uniquely_named, allow_rename = allow_rename,
.         allow_empty = allow_empty, allow_predicates = allow_predicates,
.         type = type, error_call = error_call), type = type),
.     try_fetch(expr, vctrs_error_subscript = function(cnd) {
.         cnd$subscript_action <- subscript_action(type)
.         cnd$subscript_elt <- "column"
.         cnd_signal(cnd)
.     }), withCallingHandlers(expr, condition = function(cnd) {
.         {
.             .__handler_frame__. <- TRUE
.             .__setup_frame__. <- frame
```

```
.             if (inherits(cnd, "message")) {
.                 except <- c("warning", "error")
.             }
.             else if (inherits(cnd, "warning")) {
.                 except <- "error"
.             }
.             else {
.                 except <- ""
.             }
.         }
.         while (!is_null(cnd)) {
.             if (inherits(cnd, "vctrs_error_subscript")) {
.                 out <- handlers[[1L]](cnd)
.                 if (!inherits(out, "rlang_zap"))
.                   throw(out)
.             }
.             inherit <- .subset2(.subset2(cnd, "rlang"), "inherit")
.             if (is_false(inherit)) {
.                 return()
.             }
.             cnd <- .subset2(cnd, "parent")
.         }
.     }), vars_select_eval(vars, expr, strict = strict, data = x,
.         name_spec = name_spec, uniquely_named = uniquely_named,
.         allow_rename = allow_rename, allow_empty = allow_empty,
.         allow_predicates = allow_predicates, type = type, error_call =␣
↪error_call),
.     walk_data_tree(expr, data_mask, context_mask), eval_c(expr,
.         data_mask, context_mask), reduce_sels(node, data_mask,
.         context_mask, init = init), walk_data_tree(new, data_mask,
.         context_mask), as_indices_sel_impl(out, vars = vars,
.         strict = strict, data = data, allow_predicates = allow_predicates,
.         call = error_call, arg = as_label(expr)), as_indices_impl(x,
.         vars, call = call, arg = arg, strict = strict), chr_as_locations(x,
.         vars, call = call, arg = arg), vctrs::vec_as_location(x,
.         n = length(vars), names = vars, call = call, arg = arg),
.     `<fn>`(), stop_subscript_oob(i = i, subscript_type = subscript_type,
.         names = names, subscript_action = subscript_action, subscript_arg =␣
↪subscript_arg,
.         call = call), stop_subscript(class = "vctrs_error_subscript_oob",
.         i = i, subscript_type = subscript_type, …, call = call),
.     abort(class = c(class, "vctrs_error_subscript"), i = i, …,
.         call = call)), parent = c(0L, 1L, 2L, 3L, 4L, 5L, 6L,
. 7L, 6L, 9L, 10L, 4L, 12L, 13L, 13L, 15L, 16L, 17L, 18L, 19L,
. 13L, 13L, 13L, 23L, 24L, 0L, 0L, 27L, 28L, 29L, 30L, 31L, 29L,
. 33L, 34L, 35L, 36L, 37L, 38L, 39L, 40L, 0L, 42L, 43L, 44L), visible = c(TRU ,
. TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE,
. TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE,
```

```
  . TRUE, TRUE, TRUE, TRUE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE), namespace = c("IRkernel", NA, "IRkernel",
  . NA, "base", "base", "base", "base", "base", "base", "base", "evaluate",
  . "evaluate", "evaluate", "evaluate", "base", "base", "base", "base",
  . "base", "base", "base", "evaluate", "base", "base", "dplyr",
  . "dplyr", "tidyselect", "tidyselect", "tidyselect", "rlang", "base",
  . "tidyselect", "tidyselect", "tidyselect", "tidyselect", "tidyselect",
  . "tidyselect", "tidyselect", "tidyselect", "vctrs", "vctrs", "vctrs",
  . "vctrs", "rlang"), scope = c("::", NA, "local", NA, "::", "local",
  . "local", "local", "local", "local", "local", "::", ":::", "local",
  . "local", "::", "::", "local", "local", "local", "::", "::", ":::",
  . "::", "::", "::", ":::", "::", ":::", ":::", "::", "::", ":::",
  . ":::", ":::", ":::", ":::", ":::", ":::", ":::", "::", "local",
  . ":::", ":::", "::"), error_frame = c(FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE, FALSE, TRUE, FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE,
  . FALSE, FALSE, FALSE, FALSE, FALSE)), row.names = c(NA, -45L), version = 2L,
↪class = c("rlang_trace",
  . "rlib_trace", "tbl", "data.frame")), parent = NULL, i = "x",
  .     subscript_type = "character", names = c("GEOCODIGO", "DESBDT",
  .     "ano", "semana", "n_vacunas", "n_citas", "tmed", "prec",
  .     "velmedia", "presMax", "benzene", "co", "no", "no2", "nox",
  .     "o3", "pm10", "pm2.5", "so2", "campana", "scampana", "capacidad_zona",
  .     "prop_riesgo", "tasa_riesgo", "tasa_mayores", "poblacion_mayores",
  .     "nombre_zona", "nsec", "t3_1", "t1_1", "t2_1", "t2_2", "t4_1",
  .     "t4_2", "t4_3", "t5_1", "t6_1", "t7_1", "t8_1", "t9_1", "t10_1",
  .     "t11_1", "t12_1", "area", "densidad_hab_km", "tuits_gripe",
  .     "interes_gripe", "Target", "is_train"), subscript_action = NULL,
  .     subscript_arg = "x", rlang = list(inherit = TRUE), call = select(data,
  .         -x)), class = c("vctrs_error_subscript_oob", "vctrs_error_subscript ,
  . "rlang_error", "error", "condition")))
24. handlers[[1L]](cnd)
25. cnd_signal(cnd)
26. signal_abort(cnd)
```

0.6.5 Rank Data

Operation

[76]:
```
data |> mutate(rank = order(Target))
```

GEOCODIGO <chr>	DESBDT <chr>	ano <dbl>	semana <dbl>	n_vacunas <dbl>	n_citas <dbl>	tmed <dbl>
259	V Centenario	2022	34	0	0	27.278
260	Valdeacederas	2022	8	0	0	9.5772
041	Canillejas	2022	9	0	0	8.5365
025	Barajas	2022	49	292	280	9.0653
046	Castelló	2022	24	0	0	29.905
159	Mar Báltico	2022	3	524	498	4.7172
065	Daroca	2022	8	0	0	10.233
092	Felipe II	2021	47	248	228	6.0786
221	Ramón y Cajal	2023	1	204	198	8.1459
038	Campo Real	2022	2	205	187	4.2450
041	NA	2023	52	NA	NA	10.700
174	Monforte de Lemos	2022	39	0	0	16.474
126	La Plata	2022	16	0	0	10.784
139	Las Rozas	2022	50	515	510	8.8428
188	Opañel	2022	34	0	0	28.005
040	Canal de Panamá	2021	37	0	0	19.878
084	Embajadores	2022	11	0	0	10.896
261	Valdebernardo	2021	42	185	183	15.813
132	Las Américas	2022	5	409	397	9.6411
172	Miraflores	2022	50	291	265	10.074
266	Valdezarza	2022	33	0	0	24.314
022	Arganda - Felicidad	2022	43	418	393	18.313
233	San Blas	2022	50	333	326	10.574
195	Paracuellos del Jarama	2022	32	0	0	28.061
286	Zofío	2022	42	368	357	18.393
209	Portazgo	2021	45	215	213	10.457
128	La Ribota	2022	18	0	0	16.293
137	Las Matas	2021	36	0	0	21.968
124	La Marazuela	2022	52	151	149	8.4116
210	Potosí	2022	12	0	0	10.009
121	NA	2023	52	NA	NA	7.3067
123	NA	2023	52	NA	NA	10.211
125	NA	2023	52	NA	NA	10.545
141	NA	2023	52	NA	NA	11.357
143	NA	2023	52	NA	NA	11.203
145	NA	2023	52	NA	NA	10.166
154	NA	2023	52	NA	NA	10.225
155	NA	2023	52	NA	NA	11.044
163	NA	2023	52	NA	NA	11.014
166	NA	2023	52	NA	NA	10.142
175	NA	2023	52	NA	NA	11.012
178	NA	2023	52	NA	NA	11.259
180	NA	2023	52	NA	NA	10.654
183	NA	2023	52	NA	NA	11.527
186	NA	2023	52	NA	NA	11.146
190	NA	2023	52	NA	NA	11.068
196	NA	2023	52	NA	NA	11.219
197	NA	2023	52	NA	NA	10.361
211	NA	2023	52	NA	NA	10.965
215	NA	2023	52	NA	NA	11.205

A tibble: 21736 × 50

0.7 Numeric Variable Transformation: Scale

0.7.1 Normalization Transform

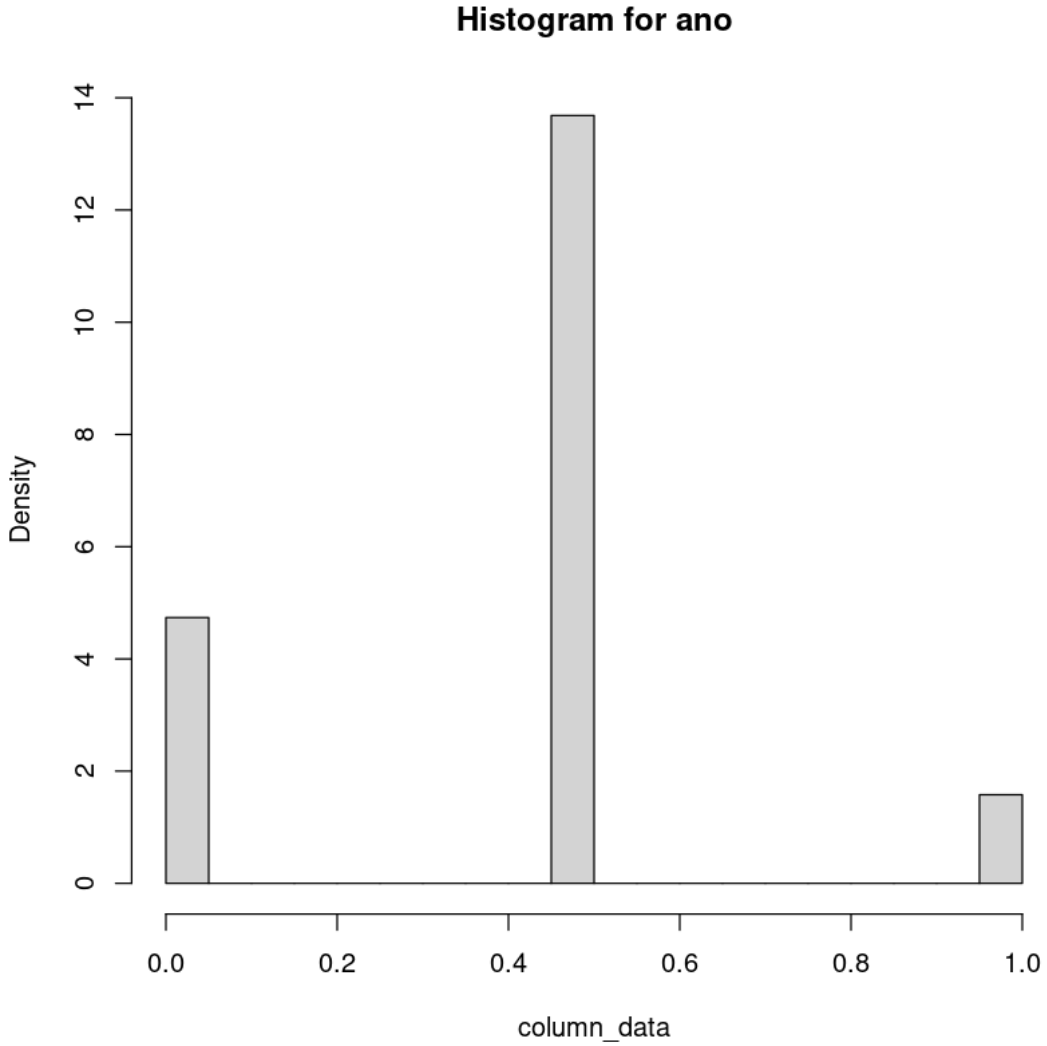
Select columns

[21]:
```
cols <- sapply(data, is.numeric)
```

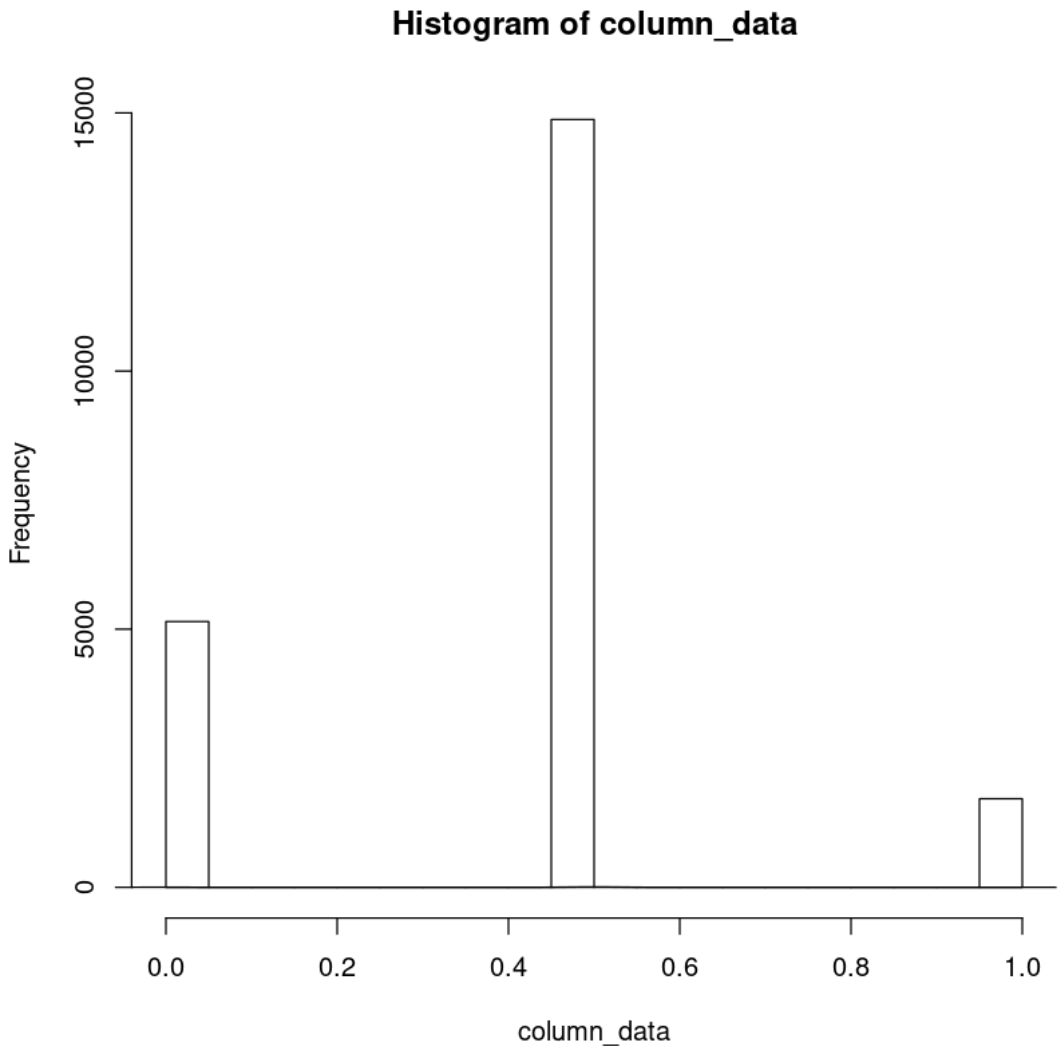
Operation

[25]:
```
data_normalized <- data
for (col_name in names(numeric_cols)[numeric_cols]) {
  data_normalized[[col_name]] <- (data[[col_name]] - min(data[[col_name]])) /
                                 (max(data[[col_name]]) - min(data[[col_name]]))
}

for (col_name in names(cols)[cols]) {
    cat("Processing column:", col_name, "\n")
    column_data <- data_normalized[[col_name]]
    hist_plot <- hist(column_data, freq = FALSE, main = paste("Histogram for",␣
 ↪col_name))
    print(plot(hist_plot))
    lines(density(column_data))
}
```

```
Processing column: ano
```

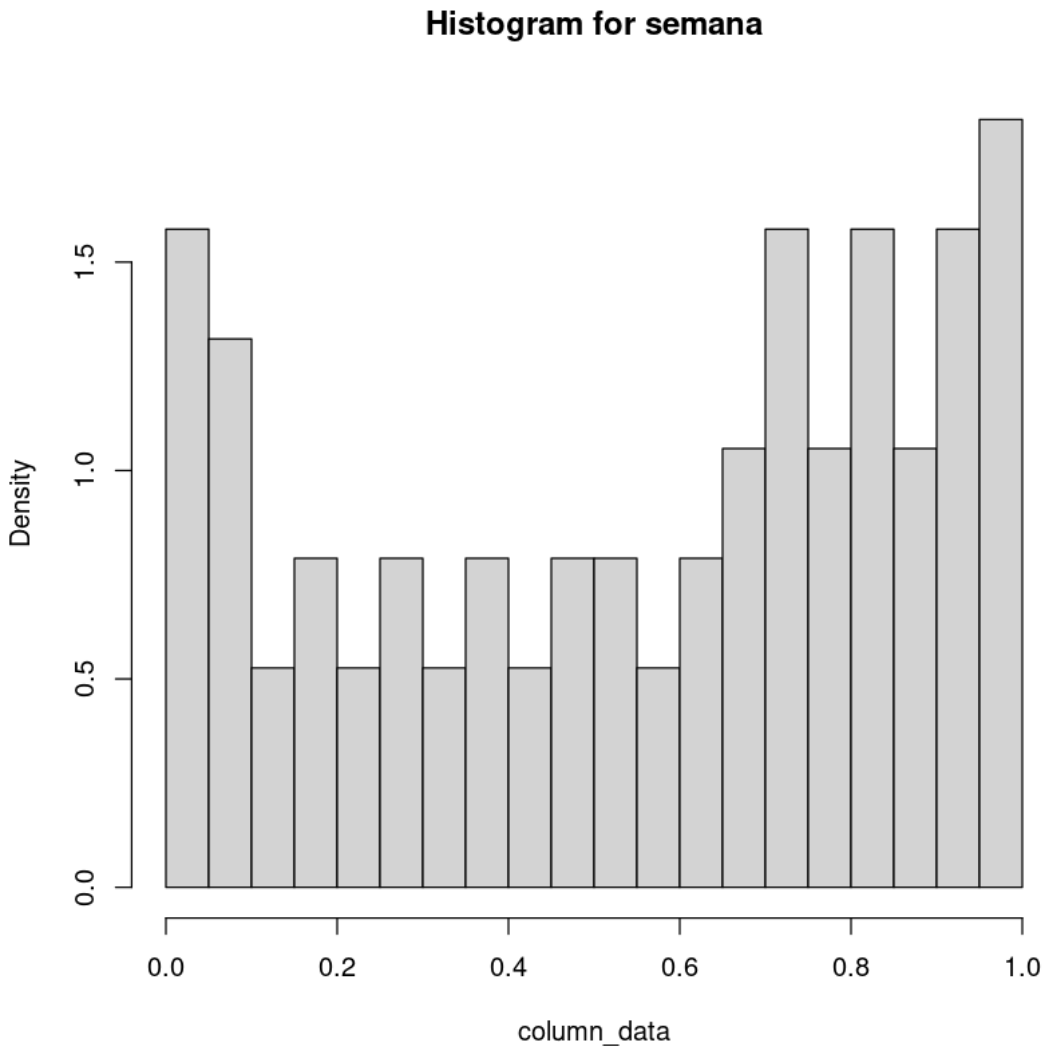


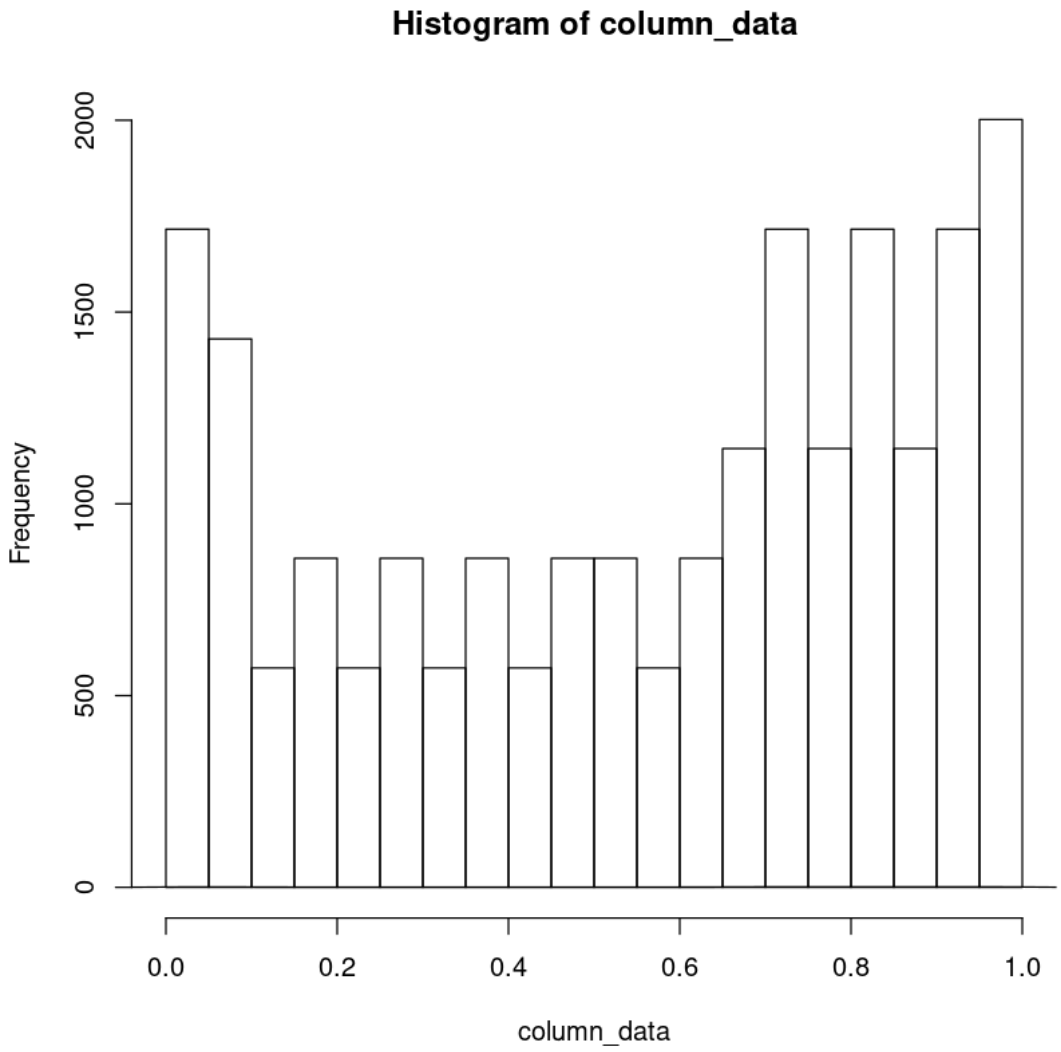

```
NULL
Processing column: semana
```




```
NULL
Processing column: n_vacunas
```

```
Error in hist.default(column_data, freq = FALSE, main = paste("Histogram for",
 ↪invalid number of 'breaks'
Traceback:

1. hist(column_data, freq = FALSE, main = paste("Histogram for",
 .     col_name))
2. hist.default(column_data, freq = FALSE, main = paste("Histogram for",
 .     col_name))
3. stop("invalid number of 'breaks'")
```


Histogram for semana
Density
0.0
0.5
1.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
column_data



[ ]:

0.7.2 Standarization Transform

Select columns

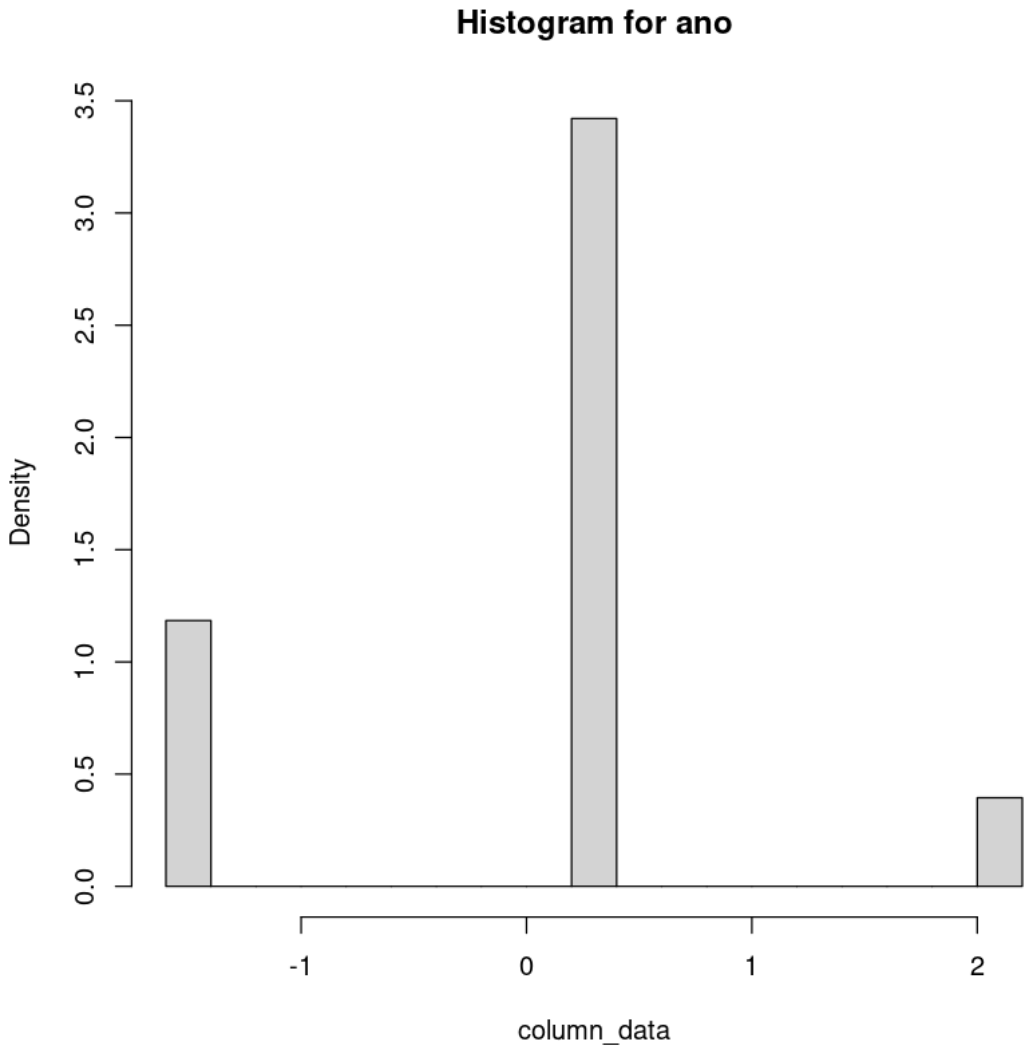
[27]:
```
cols <- sapply(data, is.numeric)
```

Operation

[26]:
```
data_standardized <- data

for (col_name in names(numeric_cols)[numeric_cols]) {
  data_standardized[[col_name]] <- scale(data[[col_name]])
```

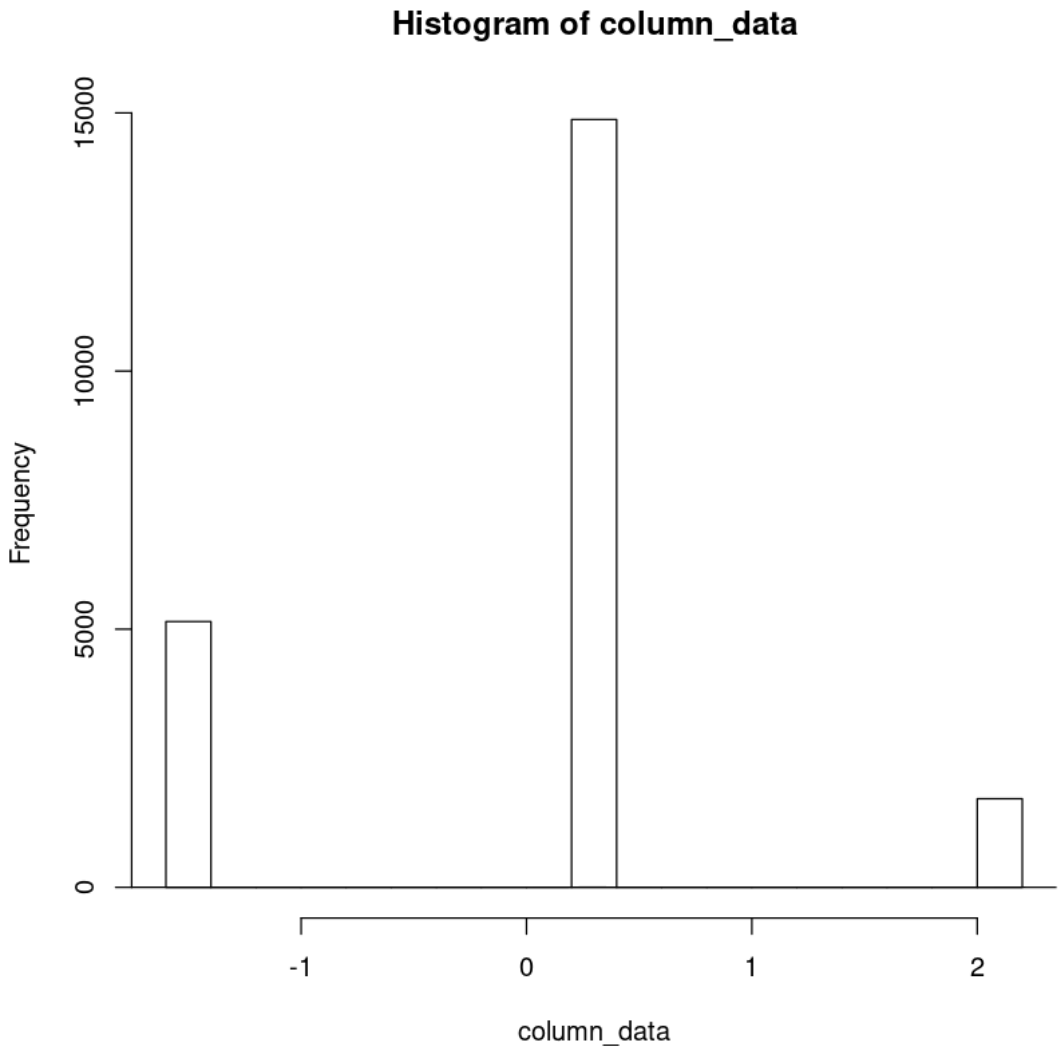
```
}
for (col_name in names(cols)[cols]) {
    cat("Processing column:", col_name, "\n")
    column_data <- data_standardized[[col_name]]
    hist_plot <- hist(column_data, freq = FALSE, main = paste("Histogram for",␣
 ↪col_name))
    print(plot(hist_plot))
    lines(density(column_data))
}
```

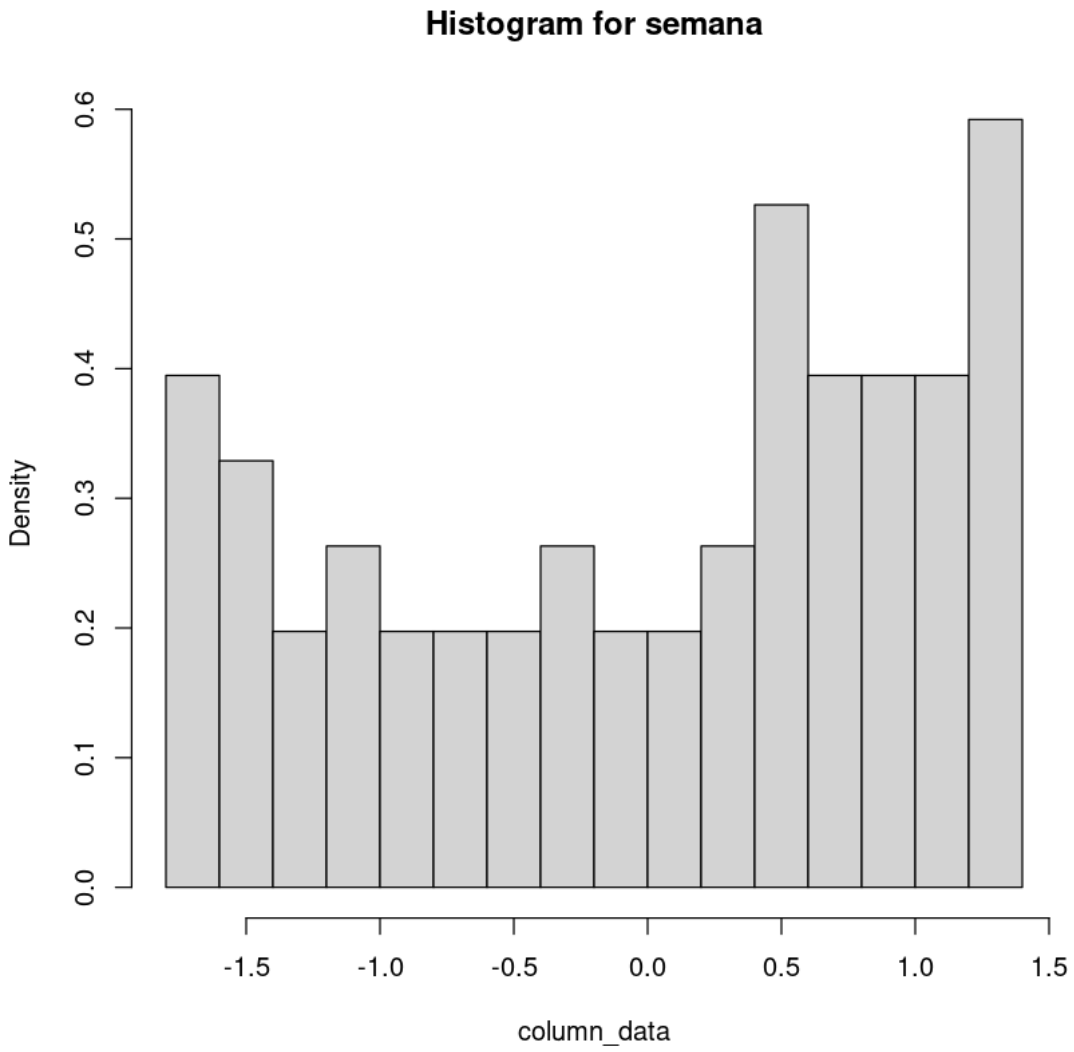
```
Processing column: ano
```



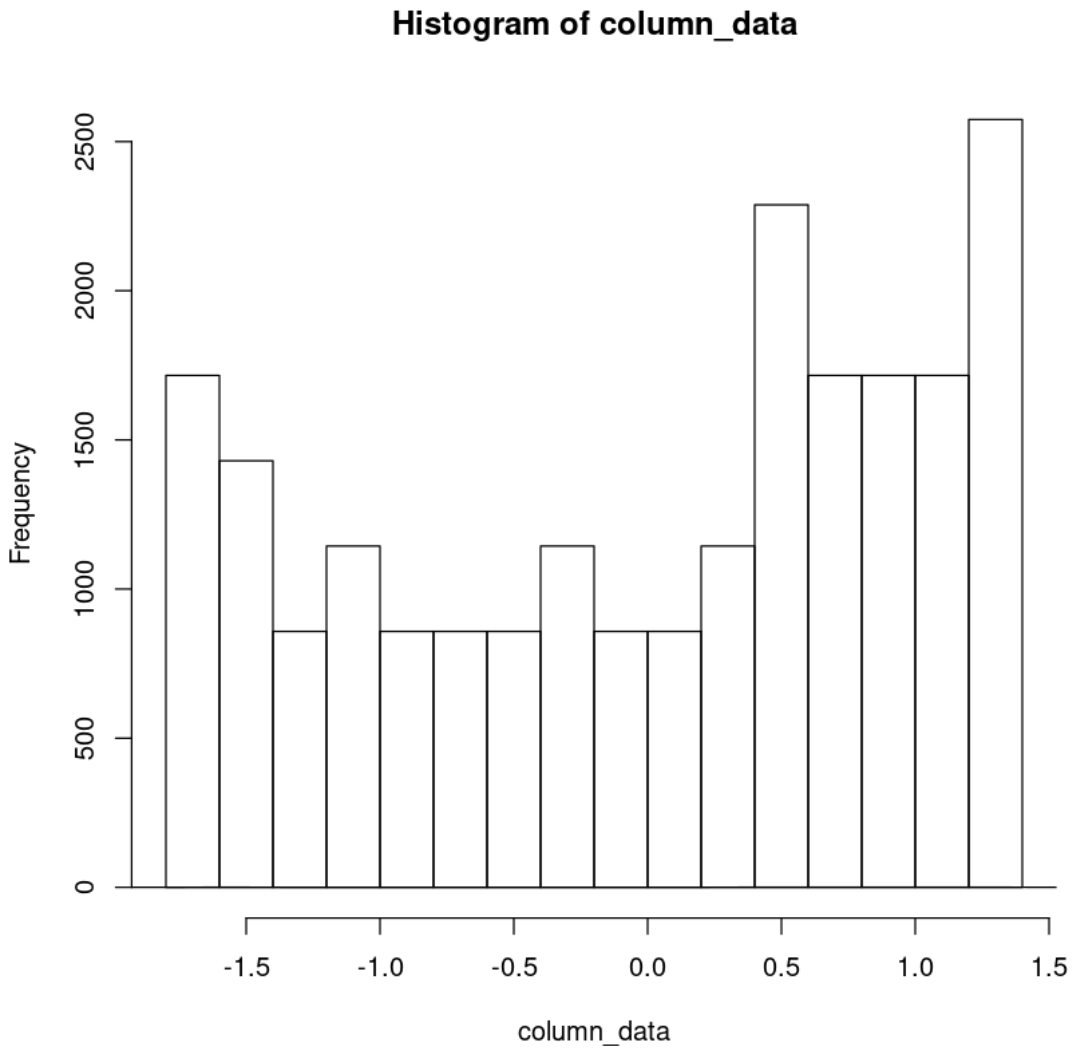

```
NULL
```

```
Processing column: semana
```



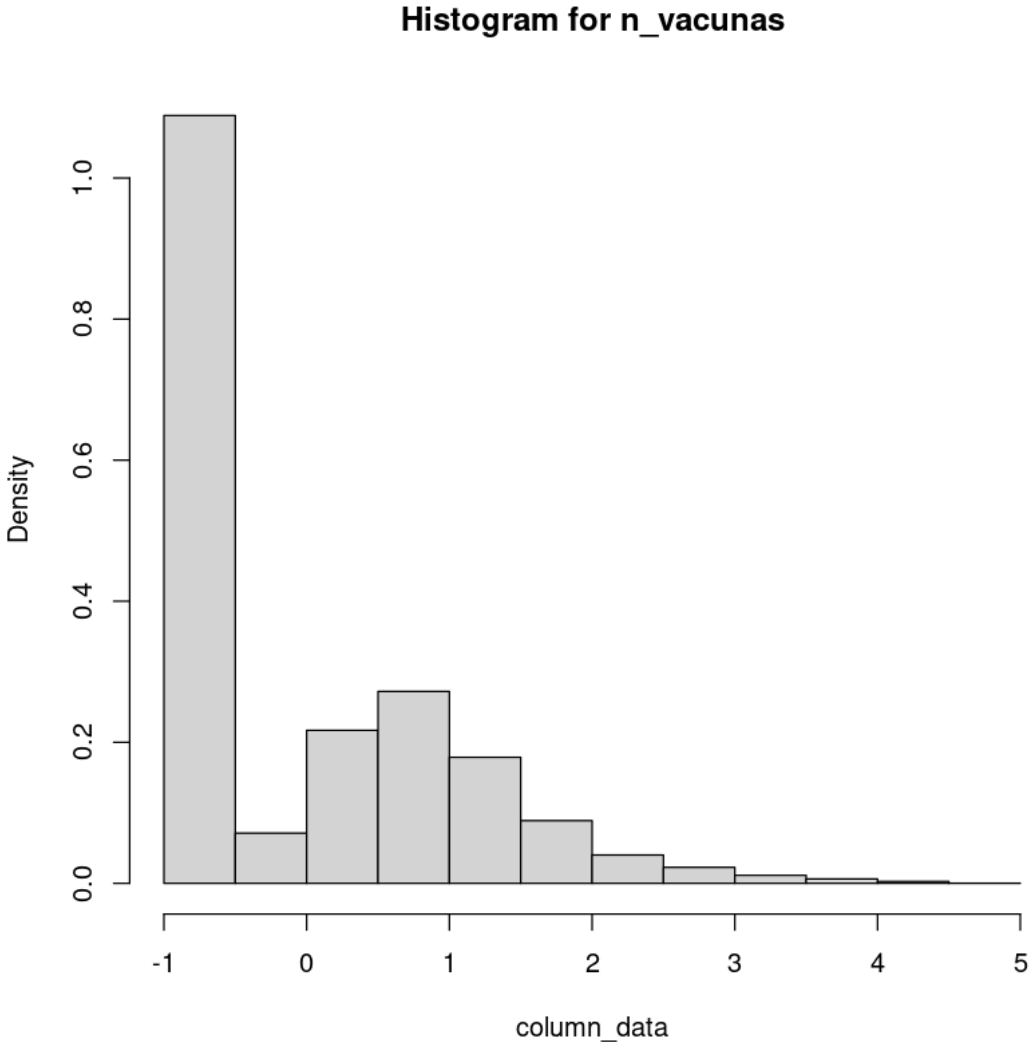


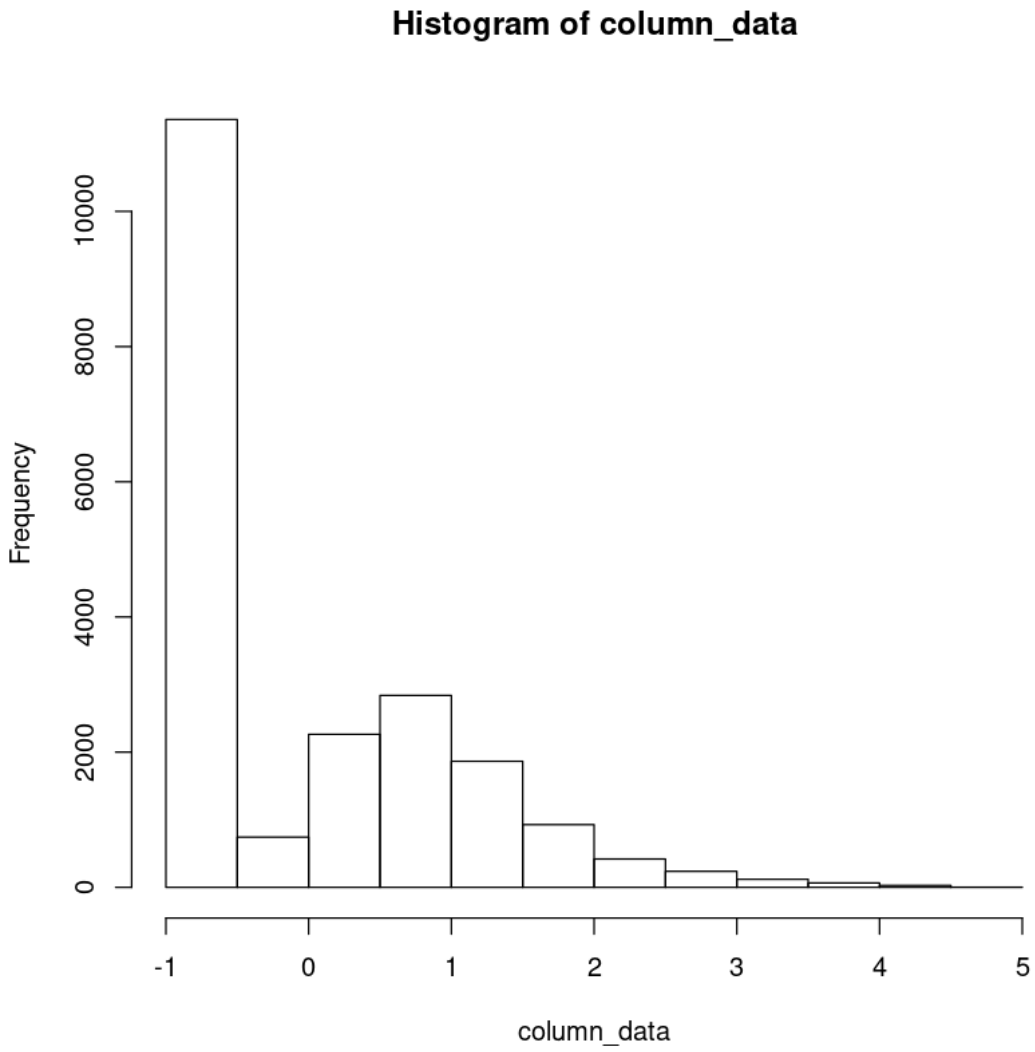

```
NULL
Processing column: n_vacunas
```




```
NULL
```

```
Error in density.default(column_data): 'x' contains missing values
Traceback:

1. lines(density(column_data))
2. density(column_data)
3. density.default(column_data)
4. stop("'x' contains missing values")
```


Histogram for n_vacunas
Density
0.0
0.2
0.4
0.6
0.8
1.0
-1
0
1
2
3
4
5
column_data



0.8 Numeric Variable Transformation: Distribution

0.8.1 Discretization Transform

Evaluating Discretization Transformations

Uniform Discretization Transform Select columns

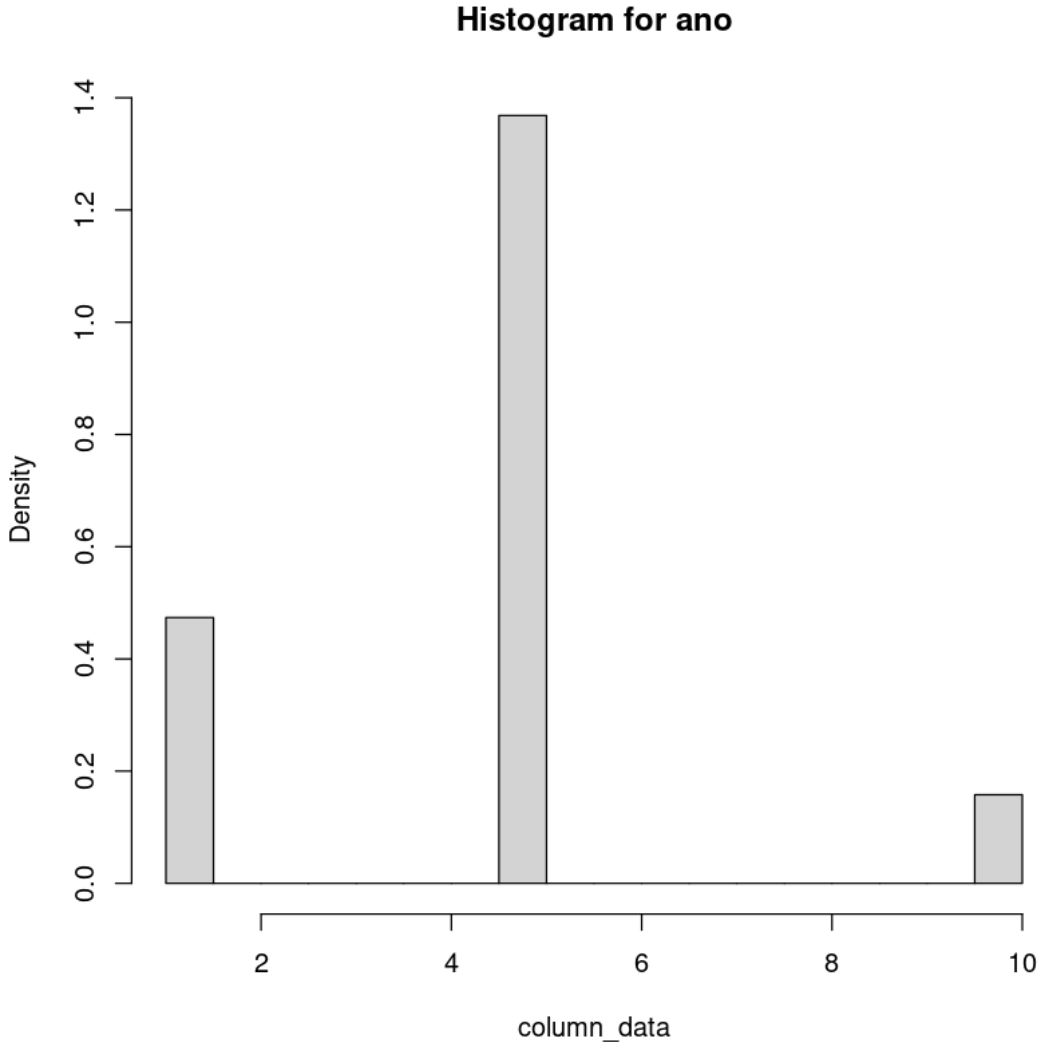
[28]:
```
cols <- sapply(data, is.numeric)
```

[ ]:
```

```

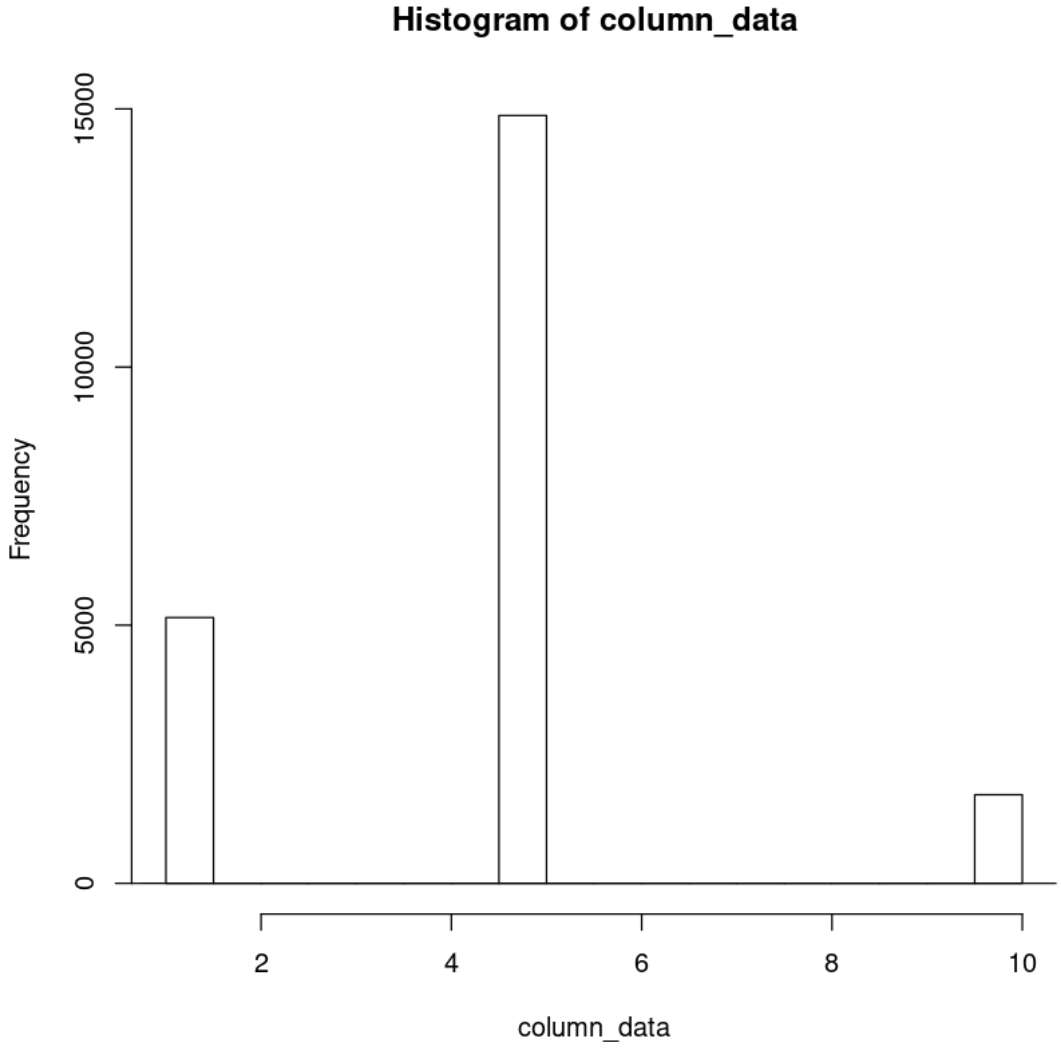
Operation

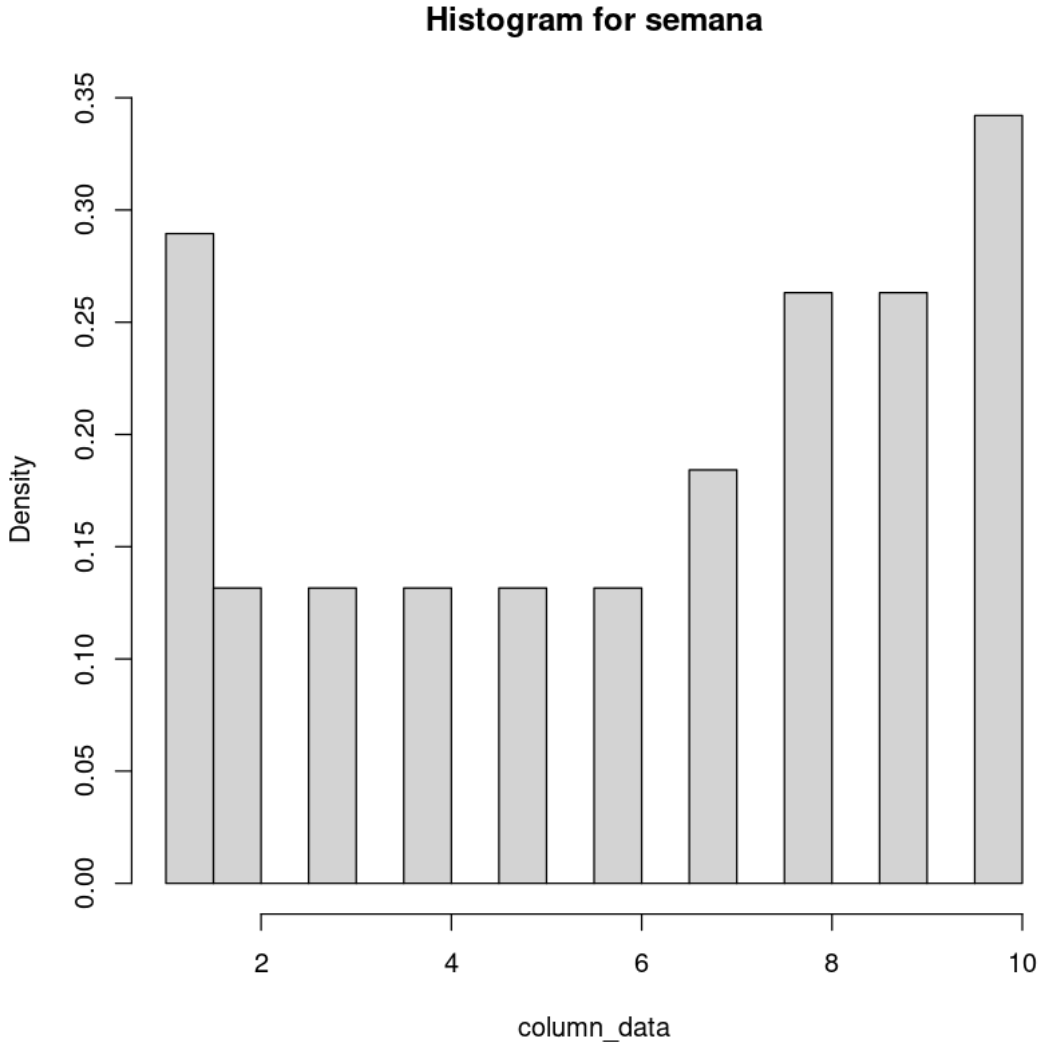
[32]:
```r
# create a copy of the original data frame
data_discretized <- data

# number of intervals
k <- 10  # change this value according to your needs

# discretize each numeric column
for (col_name in names(numeric_cols)[numeric_cols]) {
  data_discretized[[col_name]] <- cut(data[[col_name]], breaks = k, labels =␣
 ↪FALSE)
}
for (col_name in names(cols)[cols]) {
    cat("Processing column:", col_name, "\n")
    column_data <- data_discretized[[col_name]]
    hist_plot <- hist(column_data, freq = FALSE, main = paste("Histogram for",␣
 ↪col_name))
    print(plot(hist_plot))
    lines(density(column_data))
}
```

```
Processing column: ano
```

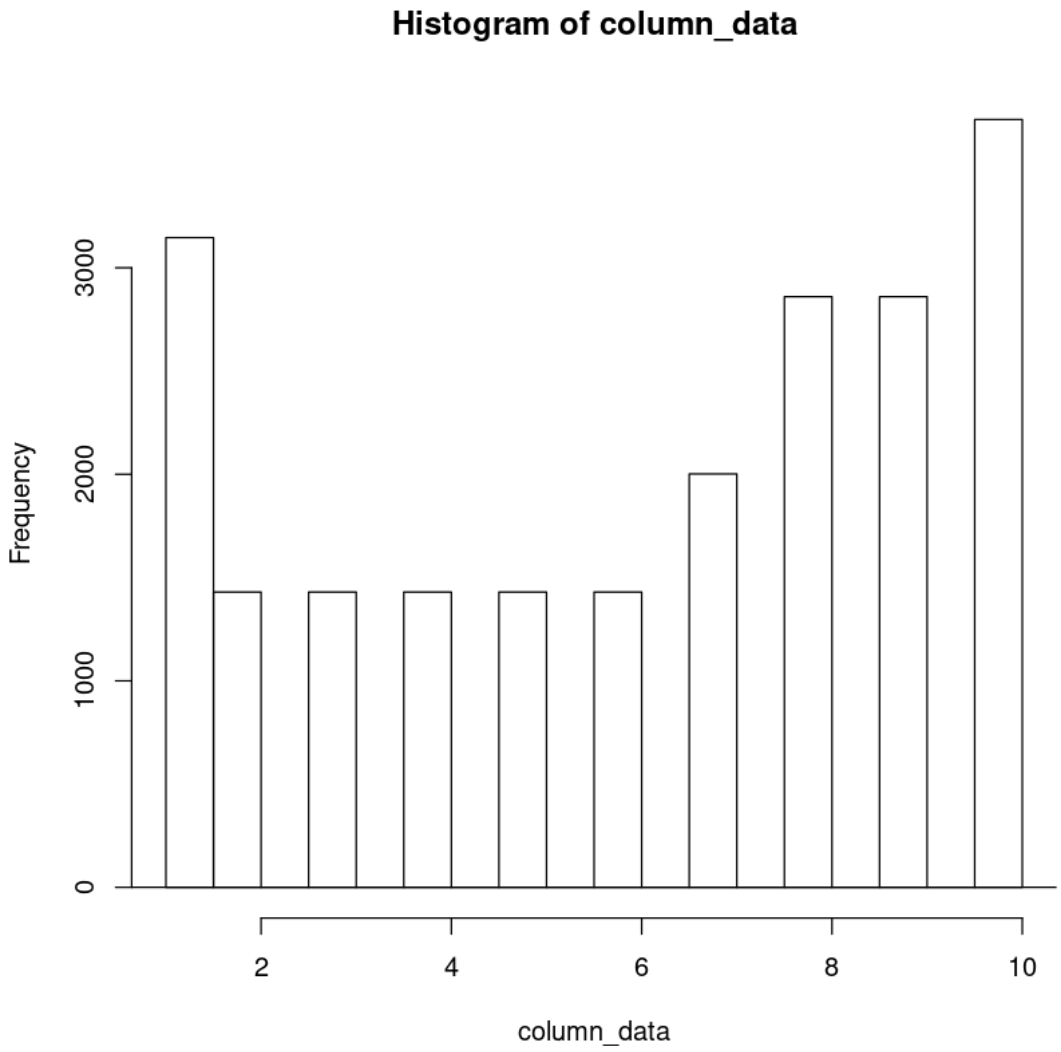



```
NULL
Processing column: semana
```


Histogram of column_data
Frequency
0
5000
10000
15000
2
4
6
8
10
column_data

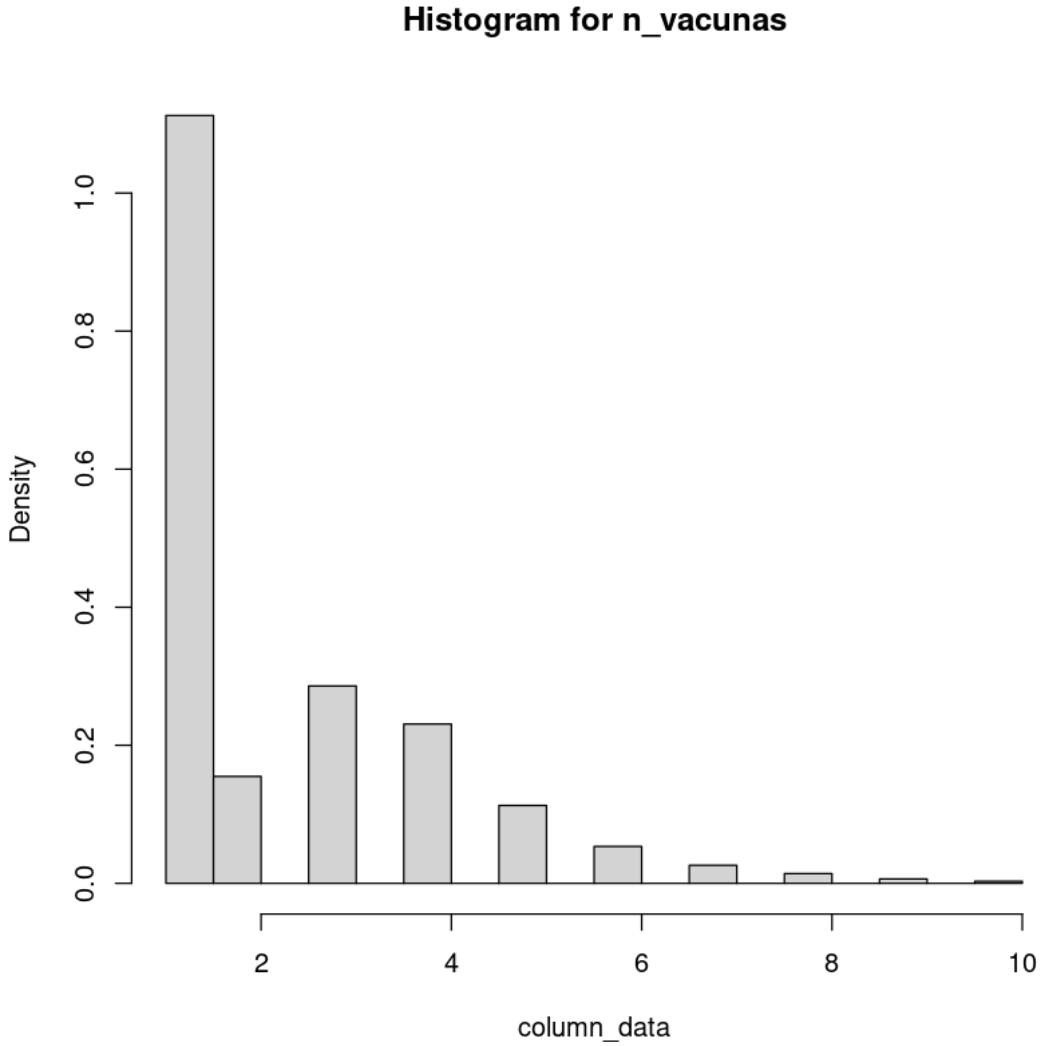


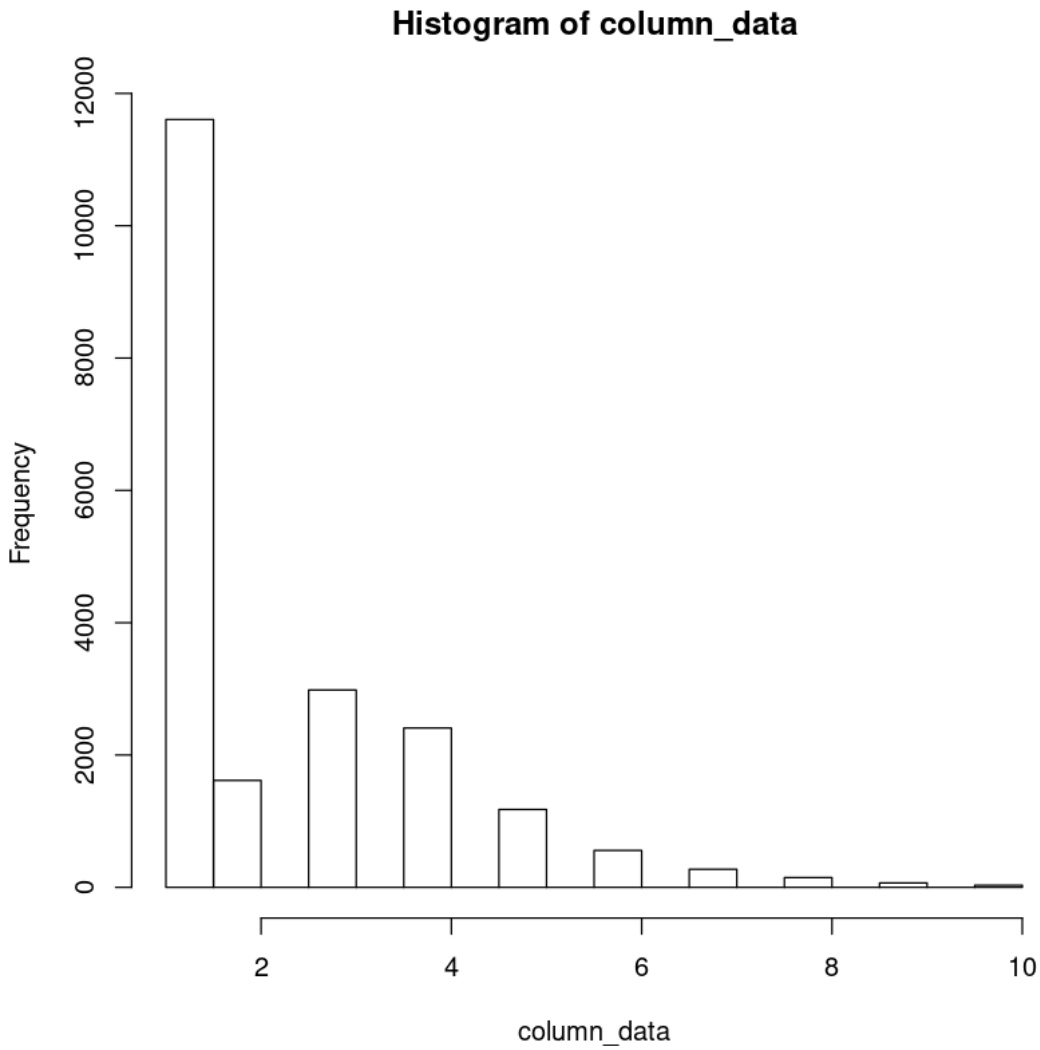

```
NULL
Processing column: n_vacunas
```




```
NULL
```

```
Error in density.default(column_data): 'x' contains missing values
Traceback:

1. lines(density(column_data))
2. density(column_data)
3. density.default(column_data)
4. stop("'x' contains missing values")
```


Histogram for n_vacunas
Density
0.0
0.2
0.4
0.6
0.8
1.0
2
4
6
8
10
column_data



0.8.2 Power Transform

Data to Transform

Evaluating Yeo-Johnson tranform

Yeo-Johnson Transform Select columns

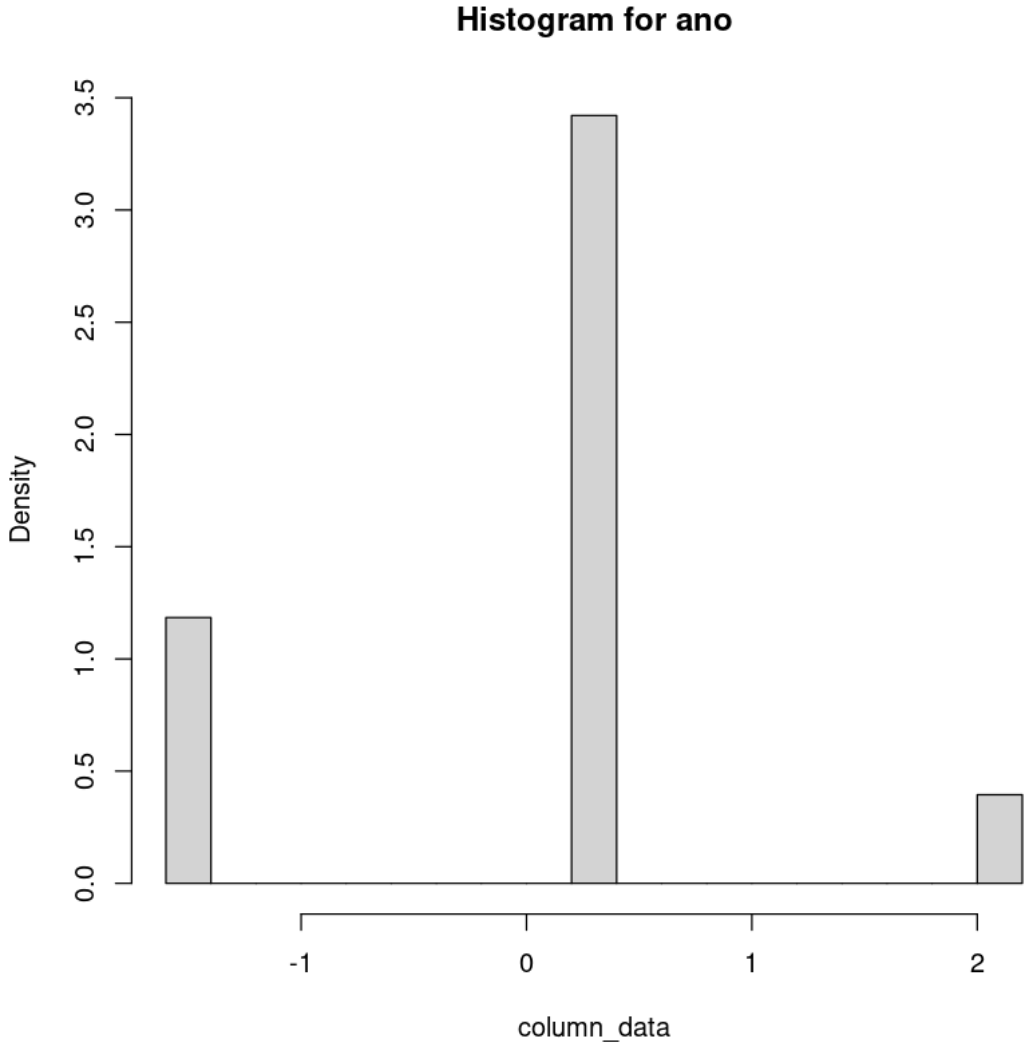
[37]:
```
cols <- sapply(data, is.numeric)
```

Operation

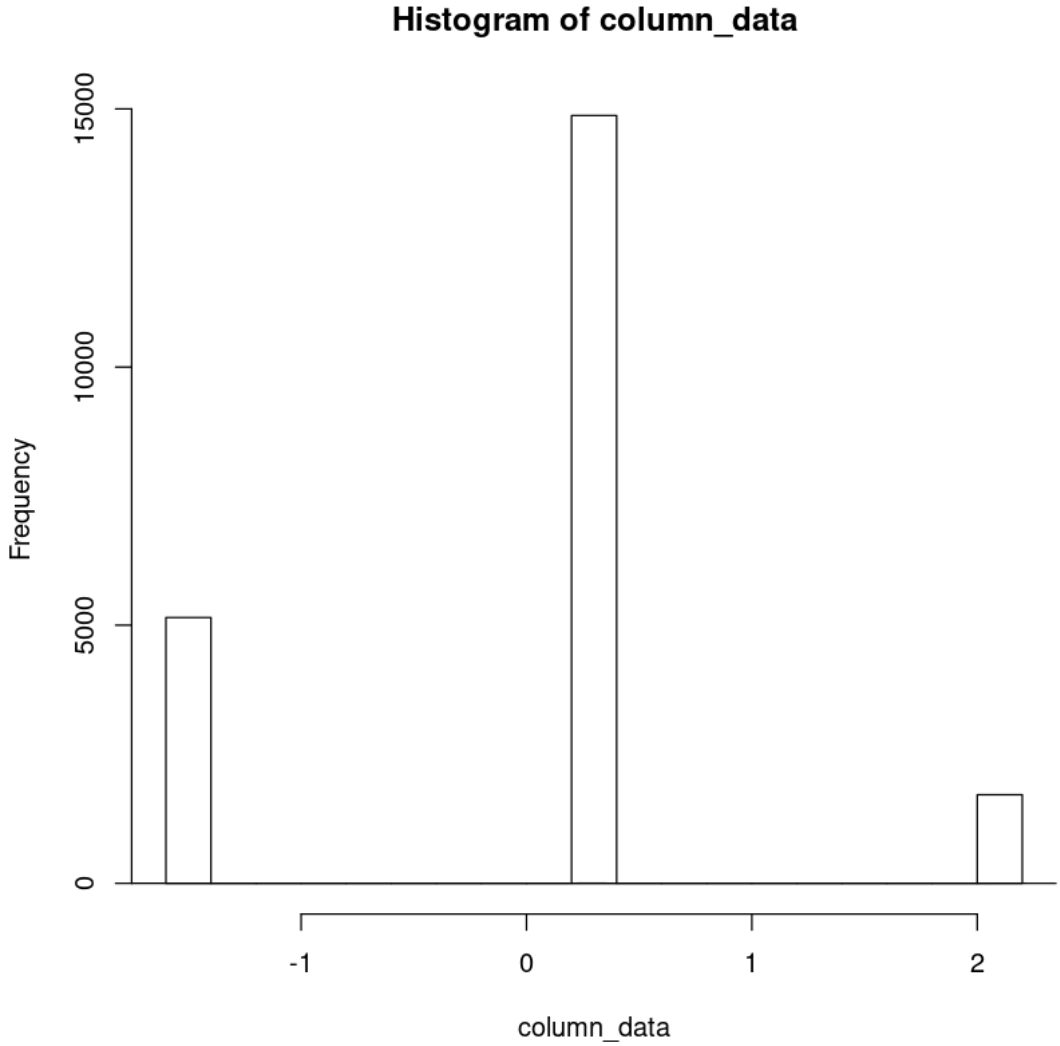
[39]:
```
if (!require(bestNormalize)) {
  install.packages('bestNormalize')
}

# load the bestNormalize package
library(bestNormalize)

# assuming 'data' is your data frame

# identify the numeric columns
numeric_cols <- sapply(data, is.numeric)

# create a copy of the original data frame
data_yeojohnson <- data

# apply the Yeo-Johnson transformation to each numeric column
for (col_name in names(numeric_cols)[numeric_cols]) {
  yj <- yeojohnson(data[[col_name]])
  data_yeojohnson[[col_name]] <- yj$x.t
}
for (col_name in names(cols)[cols]) {
    cat("Processing column:", col_name, "\n")
    column_data <- data_yeojohnson[[col_name]]
    hist_plot <- hist(column_data, freq = FALSE, main = paste("Histogram for",␣
 ↪col_name))
    print(plot(hist_plot))
    lines(density(column_data))
}
```

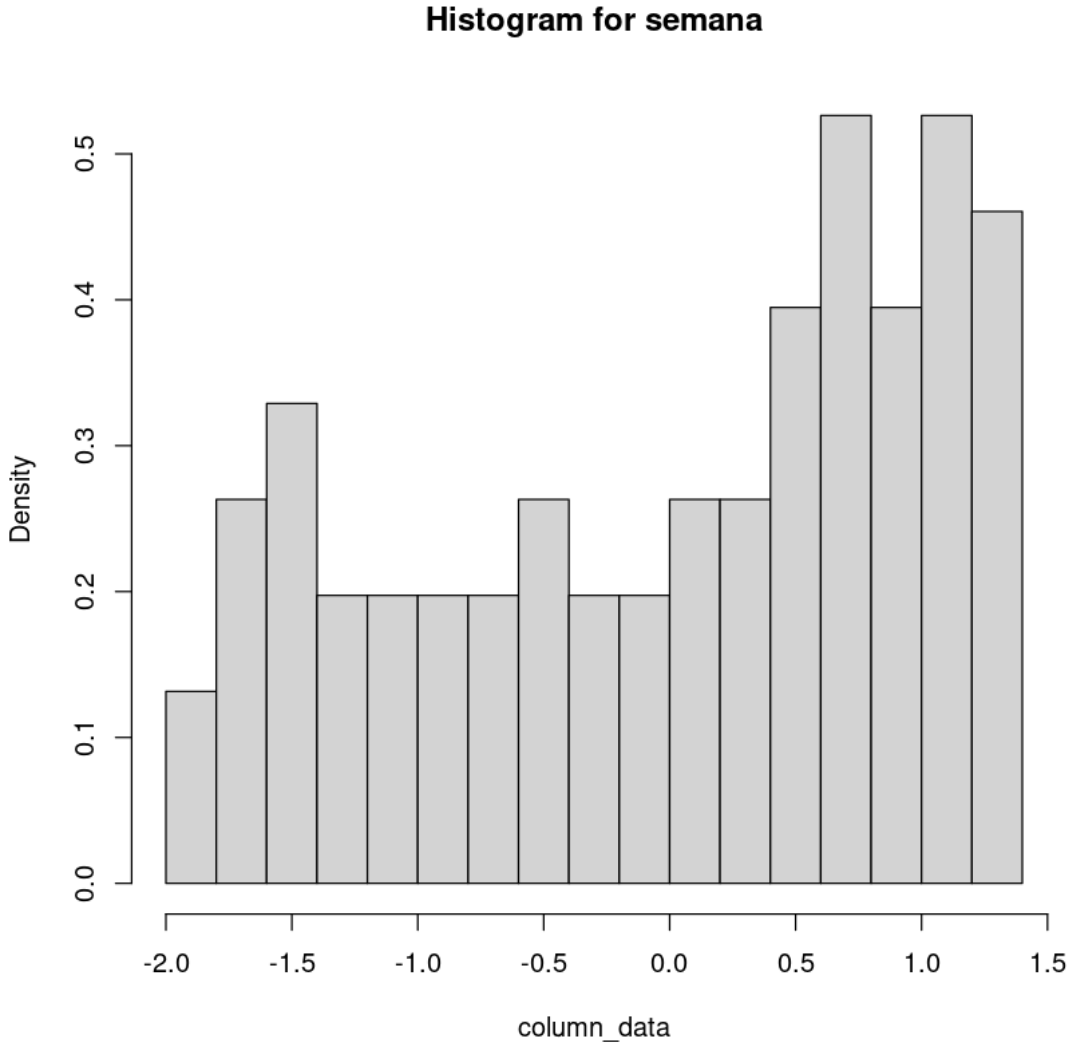
```
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
```

```
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"
Warning message in optimize(yj_loglik, lower = lower, upper = upper, maximum =
TRUE, :
"NA/Inf replaced by maximum positive value"

Processing column: ano
```

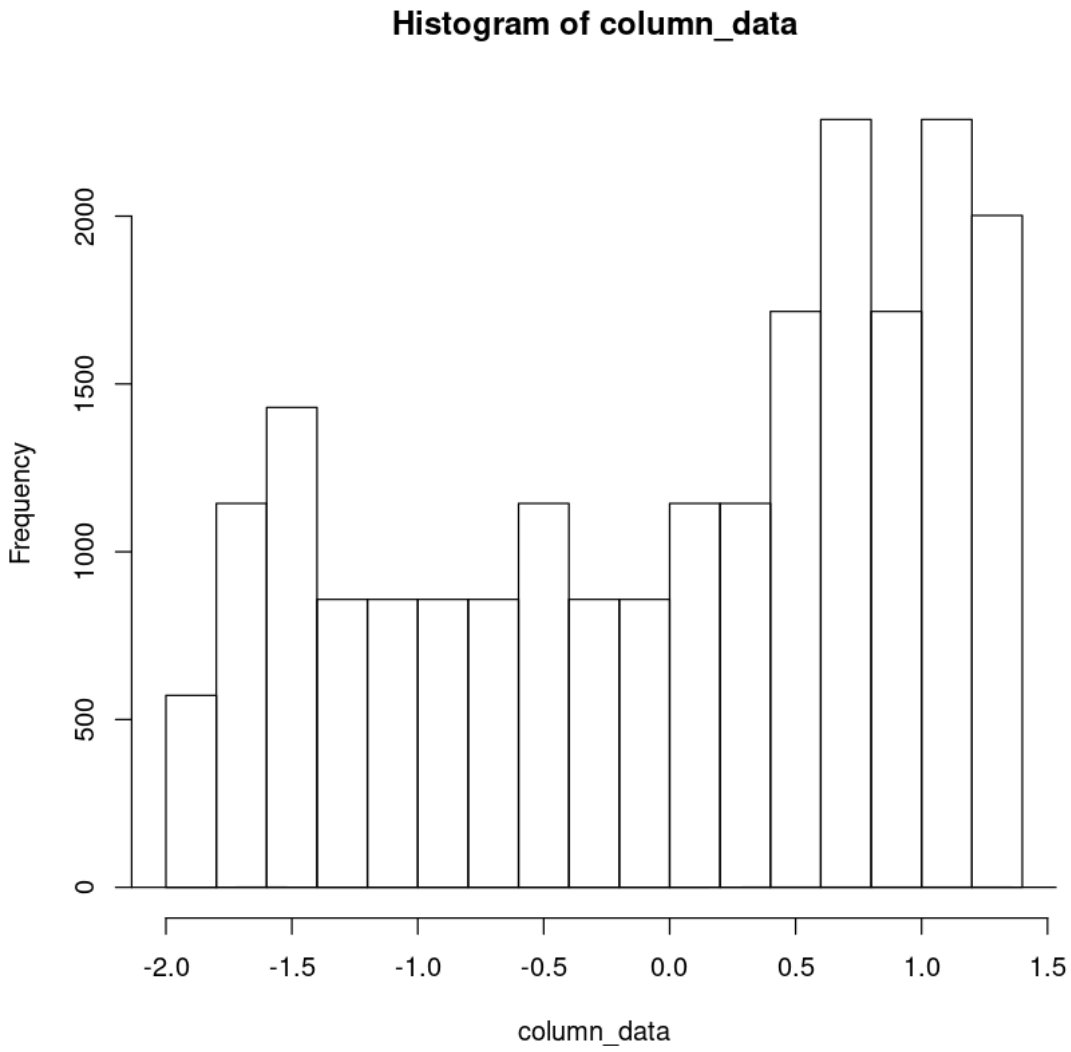



```
NULL
Processing column: semana
```


Histogram of column_data
Frequency
0
5000
10000
15000
-1
0
1
2
column_data

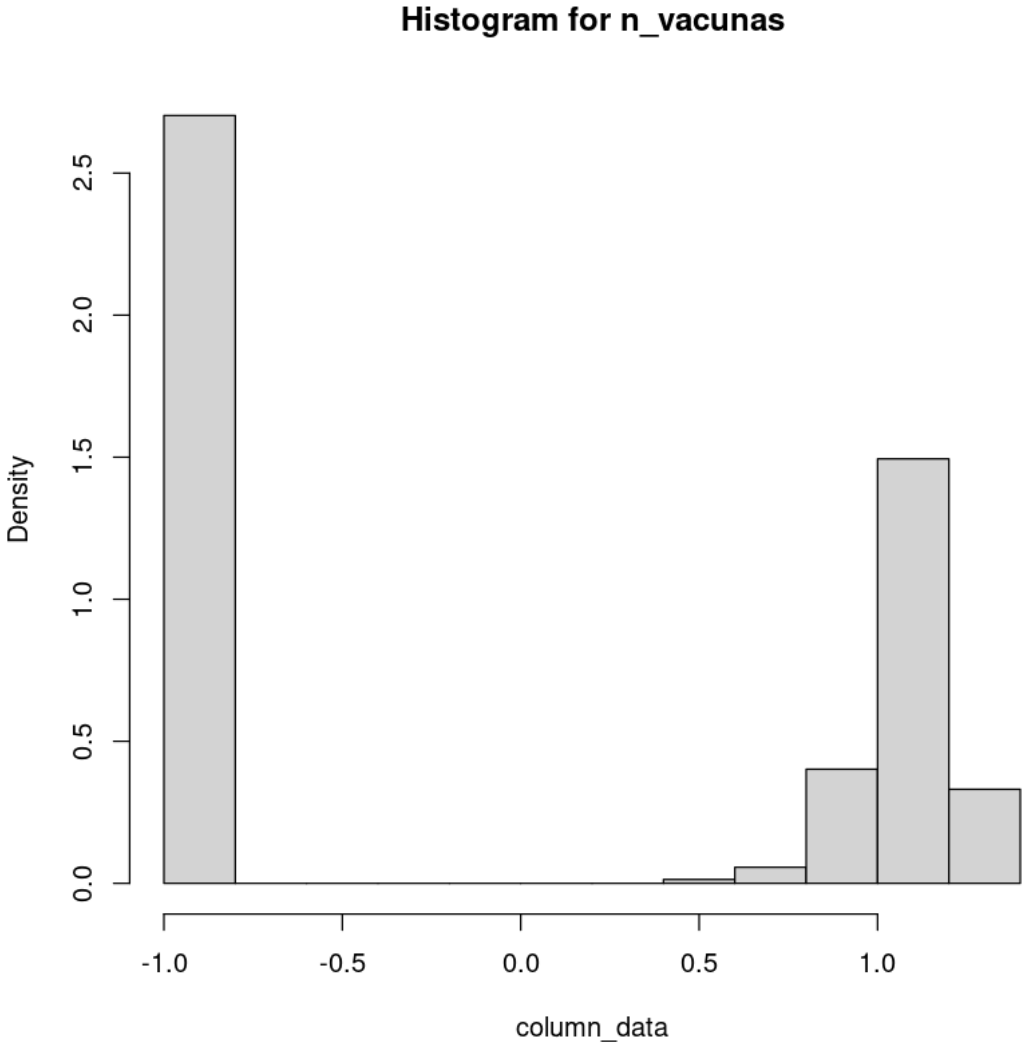


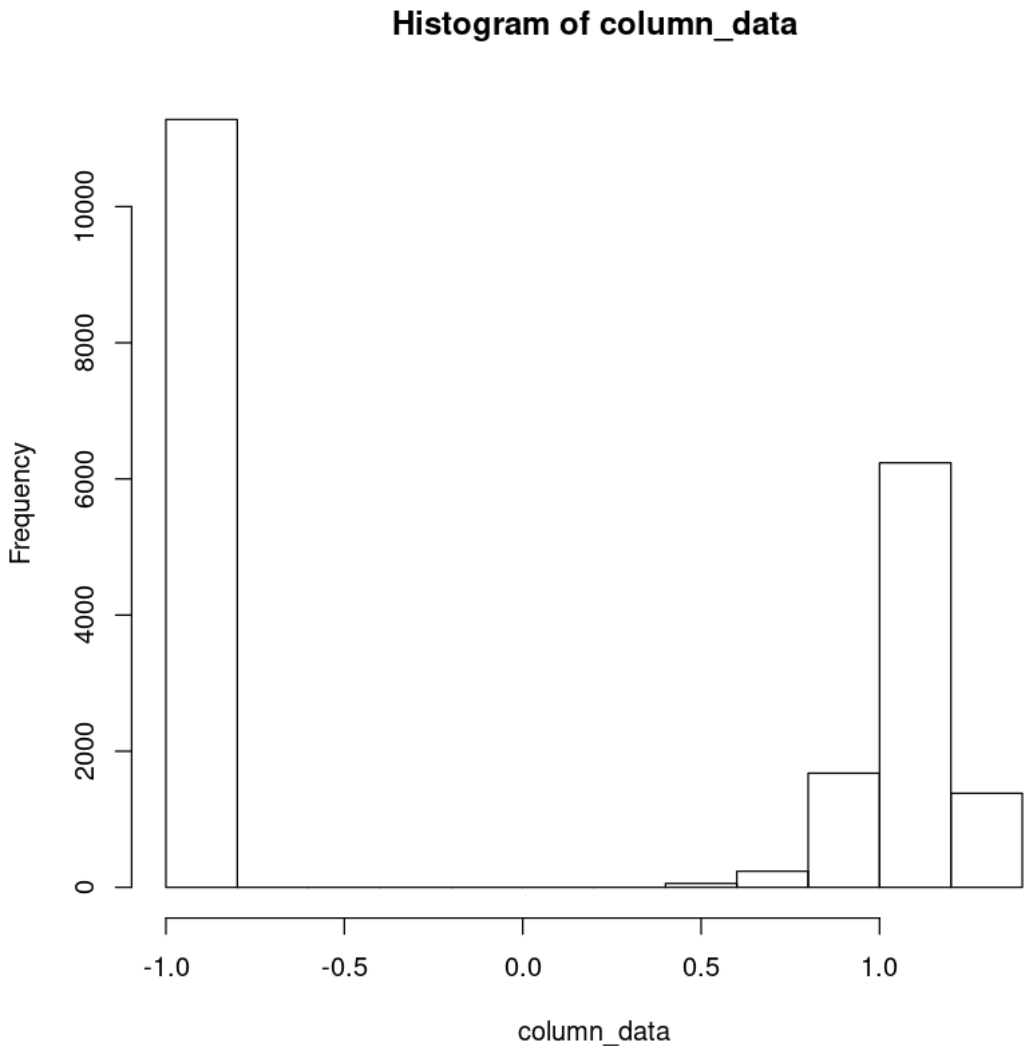

```
NULL
Processing column: n_vacunas
```



NULL

```
Error in density.default(column_data): 'x' contains missing values
Traceback:

1. lines(density(column_data))
2. density(column_data)
3. density.default(column_data)
4. stop("'x' contains missing values")
```


Histogram for n_vacunas
Density
0.0
0.5
1.0
1.5
2.0
2.5
-1.0
-0.5
0.0
0.5
1.0
column_data


Histogram of column_data
Frequency
0
2000
4000
6000
8000
10000
-1.0
-0.5
0.0
0.5
1.0
column_data

[ ]: