# Missing values

A picture containing graphical user interface

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Text

Description automatically generated with medium confidence

## Sume R rules

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| --- | --- |
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## Vectorized functions

These functions can also work with data frames.

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## Summary functions

|  |  |
| --- | --- |
| Shows the missing in each column | Shows the missing in each row. |
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We can also to add column using group\_by the dplyr.

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|  |  |
| --- | --- |
| Classify each column according to the number of missing values | Classify each row according to the number of missing values |
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Calculates the number of missing values in a specified variable for a repeating span. This is really useful in time series data, to look for weekly (7 day) patterns of missingness. It works with the group\_by operator from dplyr.

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Calculates the number of "runs" or "streaks" of missingness. This is useful to find unusual patterns of missingness, for example, you might find a repeating pattern of 5 complete and 5 missing. It works with the group\_by operator from dplyr.

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## Visualize missing values

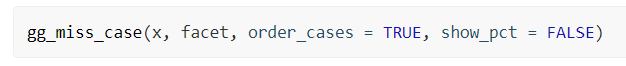
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Chart, waterfall chart

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This isn’t the real number of the variables.



Chart, scatter chart

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Chart, scatter chart

Description automatically generated

An upset plot of the airquality dataset shows there are only missing values in Ozone and Solar-dot-R, with 35 in only Ozone, 5 in Solar-dot-R, and in both Ozone and Solar-dot-R, there are 2 missing cases.

Chart

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The plot shows a grid that presents all combinations of missing (red) and observed (blue) values present in different variables. The bars to the right of the grid denote the percentage of the observations with the corresponding pattern, while the bars on top show the missing percentage for each variable. From the bottom row, we see that for roughly 84% of the observations there are no missing data in any variable. The second row from the bottom tells us that almost 9% of the observations have a missing value only for total cholesterol.

Chart

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This doesn’t faces

Chart, histogram

Description automatically generated

Soporta facet y funciona practicamente como un histograma de missing

Chart, bar chart

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We can make a t-test visually

Chart

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Let’s make an ANOVA in a plot

Chart

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## Searching for and replacing missing values

Searching

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Replacing

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## Filling down missing values

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Table

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## Tools to explore missing data dependence

### Bind shadow

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### Density plot

Chart

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### Boxplot

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### Scarlett plot

Chart, scatter chart

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Graphical user interface, chart, scatter chart

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Chart, scatter chart

Description automatically generated

Chart

Description automatically generated

### Checking two missing columns at once

Graphical user interface, chart

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## Flavors of missingness

### MCAR - Missing Completely at Random

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In this case we can:

* Delete observations if you are losing less than 5% of the data.
* Impute your data

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### MAR - Missing At Random

MAR is where missingness depends on data you have observed, but not data unobserved. For example if **test scores are more likely to be missing** for **workers with high depression**, then the data can be considered MAR.

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* Careful imputing the data
* Don’t delete observations with missing values.

We see that there is some definite clustering of missingness - this is a common symptom of data MAR.

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Then we can apply a statistical test

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### MNAR - Missing Not At Random.

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***It introduces bias into the estimation*** of associations and parameters of interest.

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Table

Description automatically generated

Graphical user interface, application

Description automatically generated

## Imputing the missing data

### Importance

1. What if these are the people whose cholesterol was so high that it maxed out the measuring device, and so it was not recorded? We would certainly not want to ignore these cases. **(It hides importance relationships)**
2. **Which of the two models is better?** We don’t know because the two models were trained on two different data samples (a different number of observations were removed) and **we cannot use the adjusted R-squared** to answer this.

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### Bad imputation

#### Lower value

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To track imputed values

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To visualize missings for two variables, we need to add a label that identifies whether there is a missing value in a column. The function add\_label\_shadow does this for us. We have now recreated the same figure as geom\_miss\_point!

Chart, scatter chart

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#### Mean imputation

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Chart, line chart, scatter chart

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### Good imputation

#### Imputation with lineal models

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Chart, scatter chart

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##### Comparing imputation models

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Calendar

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Chart, box and whisker chart

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Chart, scatter chart

Description automatically generated

### Is the imputation working?

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Chart, histogram

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