Redes Bayesianas como Ferramentas para o Raciocínio Clínico

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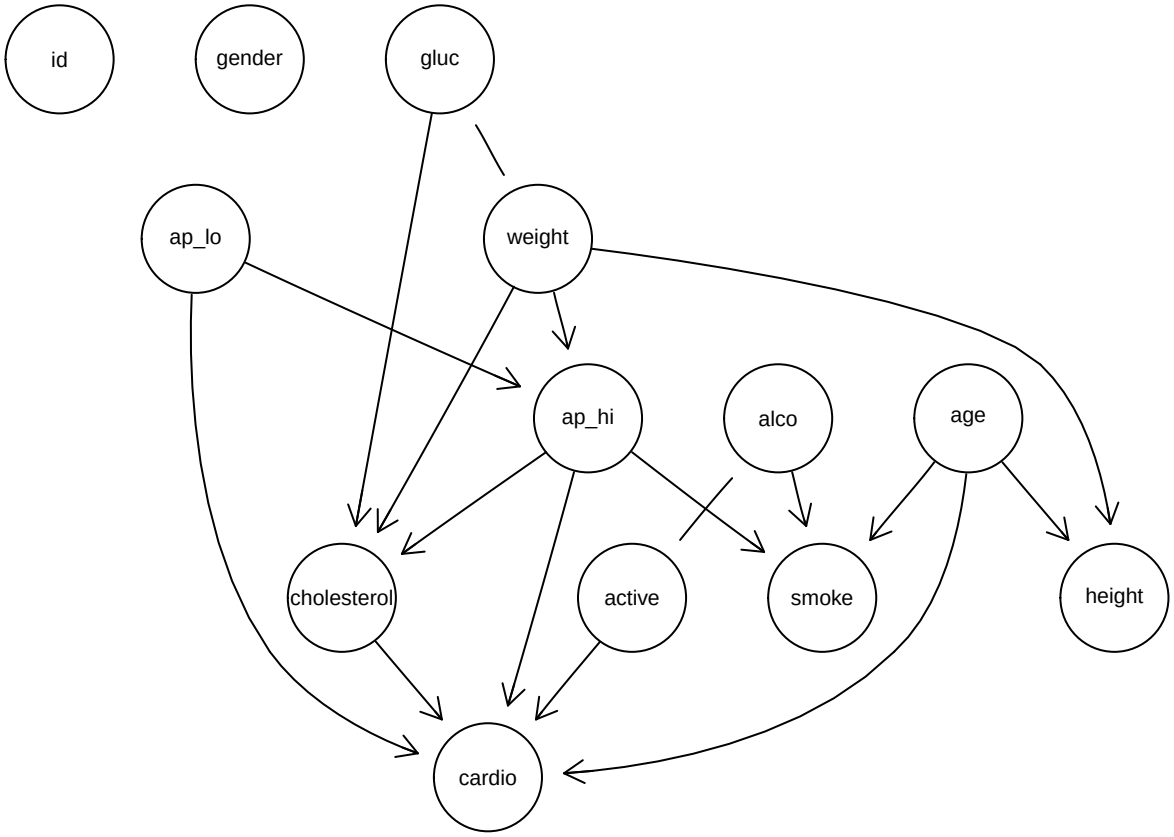
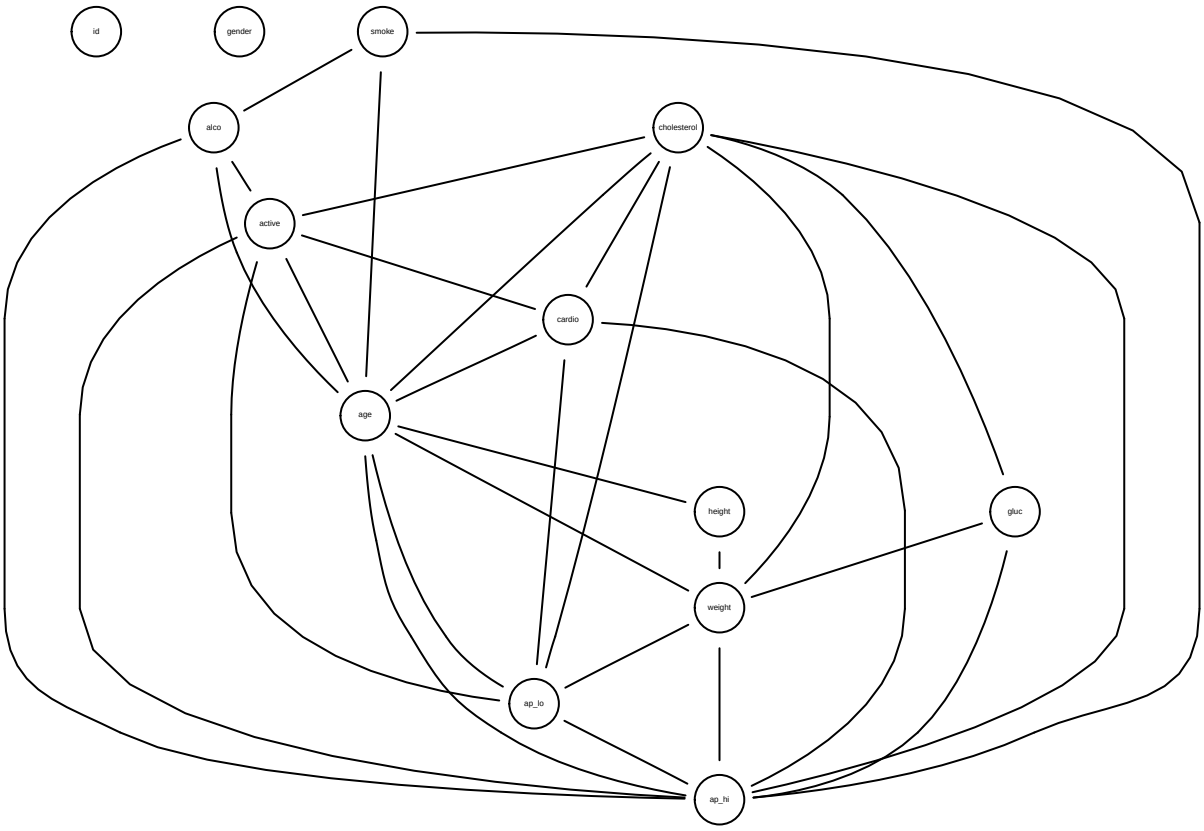
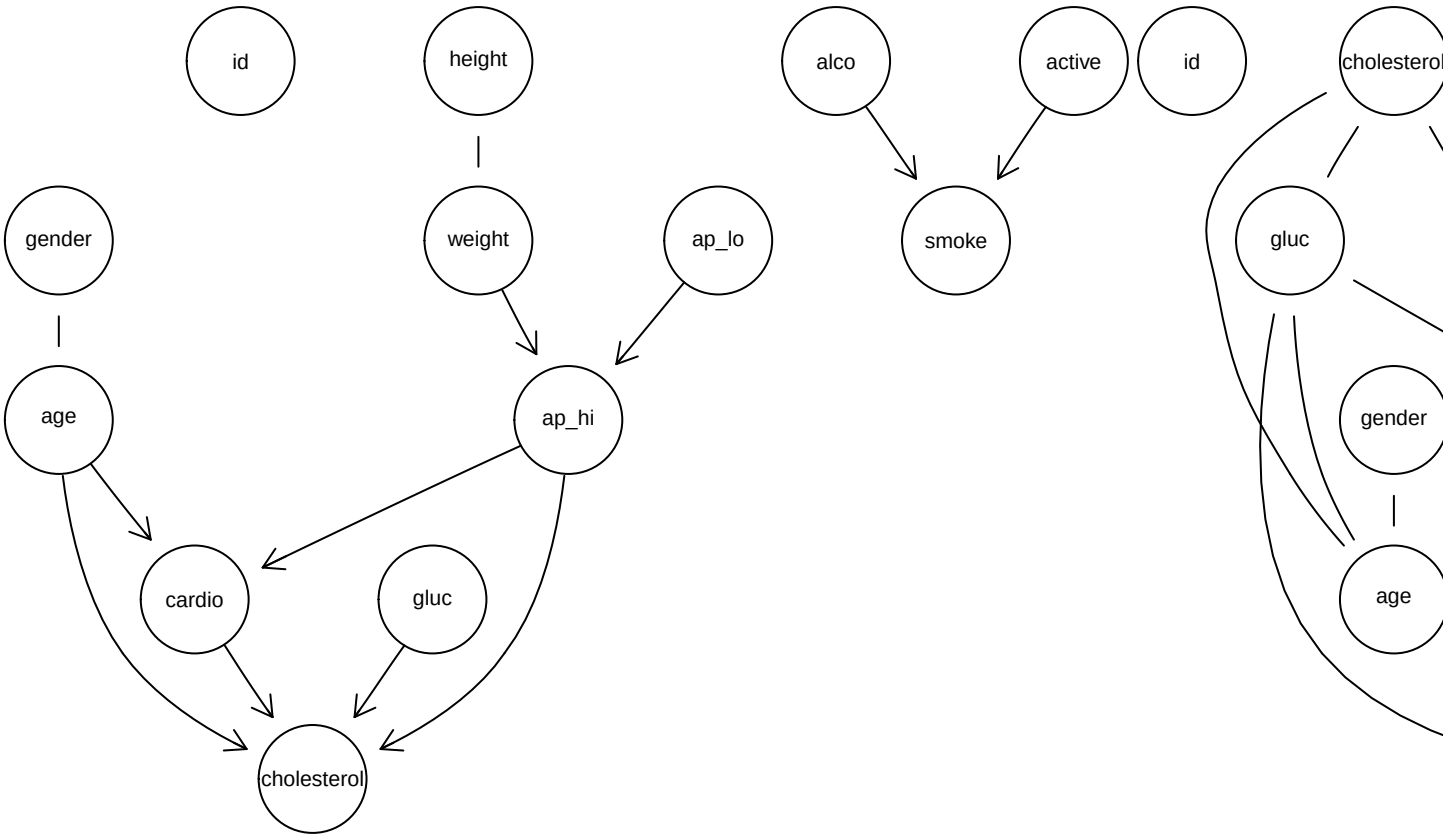
```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --
## v ggplot2 3.3.3     v purrr   0.3.4
## v tibble  3.0.6     v dplyr   1.0.4
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## Loading required package: graph
## Loading required package: BiocGenerics
## Loading required package: parallel
##
## Attaching package: 'BiocGenerics'
## The following objects are masked from 'package:parallel':
##
##     clusterApply, clusterApplyLB, clusterCall, clusterEvalQ,
##     clusterExport, clusterMap, parApply, parCapply, parLapply,
##     parLapplyLB, parRapply, parSapply, parSapplyLB
## The following objects are masked from 'package:dplyr':
##
##     combine, intersect, setdiff, union
## The following object is masked from 'package:bnlearn':
##
##     score
## The following objects are masked from 'package:stats':
##
##     IQR, mad, sd, var, xtabs
## The following objects are masked from 'package:base':
##
##     anyDuplicated, append, as.data.frame, basename, cbind, colnames,
##     dirname, do.call, duplicated, eval, evalq, Filter, Find, get, grep,
##     grepl, intersect, is.unsorted, lapply, Map, mapply, match, mget,
##     order, paste, pmax, pmax.int, pmin, pmin.int, Position, rank,
##     rbind, Reduce, rownames, sapply, setdiff, sort, table, tapply,
##     union, unique, unsplit, which.max, which.min
##
## Attaching package: 'graph'
```

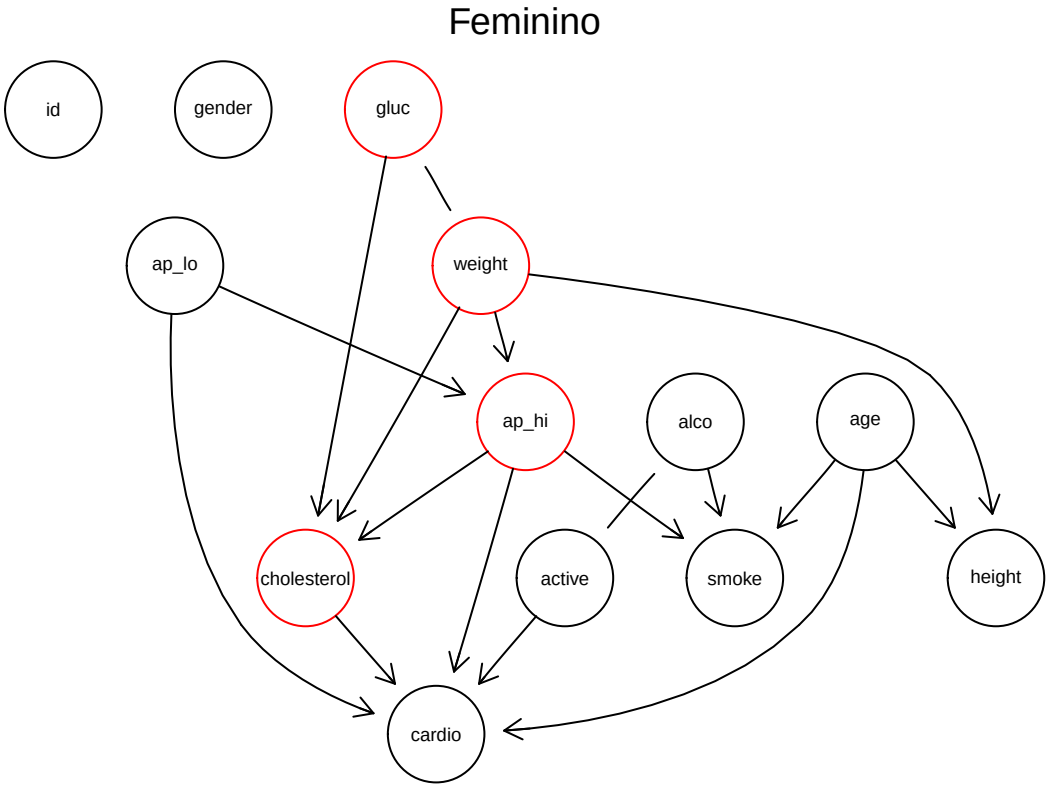
```
## The following object is masked from 'package:stringr':
##
##     boundary
## The following objects are masked from 'package:bnlearn':
##
##     degree, nodes, nodes<-
## Loading required package: grid
```

Learning Medical Application of Bayesian Networks. Usando a package *bnlearn*




id
gender
smoke
alco
cholesterol
active
cardio
age
height
gluc
weight
ap_lo
ap_hi


id
height
alco
active
id
cholesterol
gender
weight
ap_lo
smoke
gluc
age
ap_hi
gender
cardio
gluc
age
cholesterol

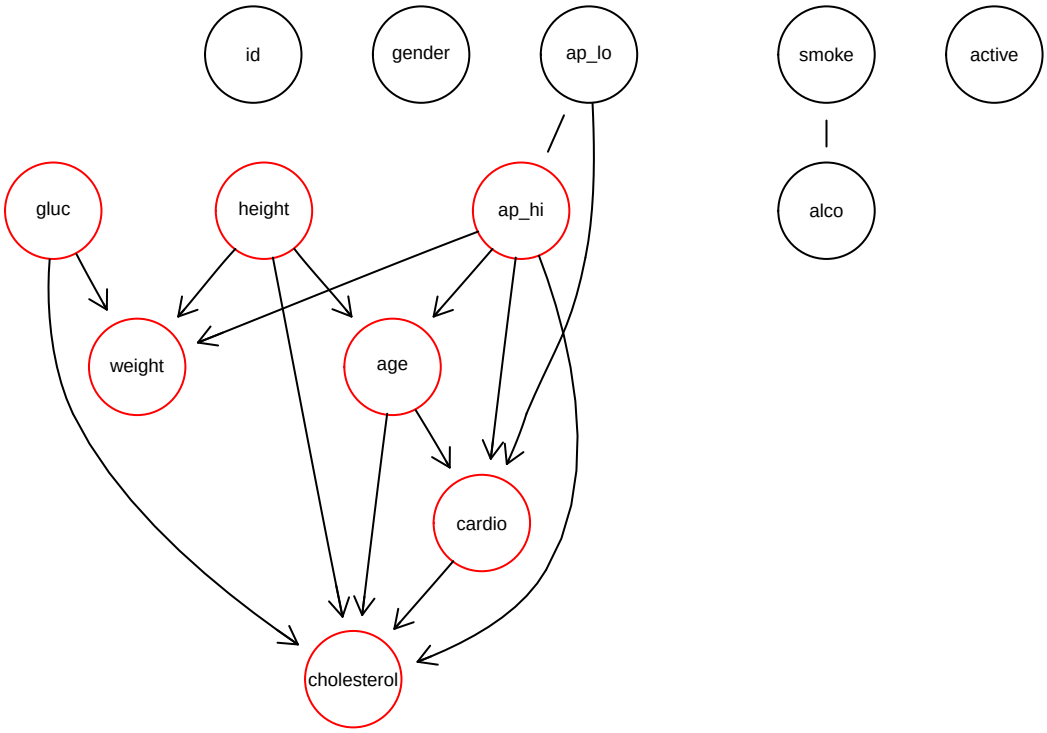


subtitulo

```
##           from          to strength  direction
## 1  cholesterol        gluc     1.00 0.35000000
## 2  cholesterol       smoke     0.32 1.00000000
## 3  cholesterol      cardio     1.00 0.54000000
## 4  cholesterol         age     0.88 0.53977273
## 5  cholesterol      height     0.18 0.72222222
## 6  cholesterol      weight     0.64 0.16406250
## 7  cholesterol       ap_hi     1.00 0.42000000
## 8         gluc cholesterol     1.00 0.65000000
## 9         gluc      height     0.10 0.30000000
## 10        gluc      weight     0.95 0.55263158
## 11       smoke cholesterol     0.32 0.00000000
## 12       smoke        alco     1.00 0.01000000
## 13       smoke      active     0.26 0.00000000
## 14       smoke      cardio     0.51 0.66666667
## 15       smoke         age     0.97 0.46391753
## 16       smoke      height     0.92 0.15217391
## 17       smoke      weight     0.53 0.00000000
## 18       smoke       ap_hi     0.97 0.02061856
## 19        alco       smoke     1.00 0.99000000
## 20        alco      active     0.06 0.58333333
## 21        alco      cardio     0.01 1.00000000
## 22        alco      height     0.02 1.00000000
## 23      active       smoke     0.26 1.00000000
## 24      active        alco     0.06 0.41666667
## 25      active      cardio     0.14 1.00000000
## 26      active      height     0.09 0.83333333
## 27      active      weight     0.04 0.62500000
```

```
## 28      active       ap_lo     0.11 0.50000000
## 29      active       ap_hi     0.01 1.00000000
## 30      cardio cholesterol     1.00 0.46000000
## 31      cardio       smoke     0.51 0.33333333
## 32      cardio        alco     0.01 0.00000000
## 33      cardio      active     0.14 0.00000000
## 34      cardio         age     1.00 0.22500000
## 35      cardio      weight     0.90 0.04444444
## 36      cardio       ap_lo     1.00 0.02000000
## 37      cardio       ap_hi     1.00 0.20500000
## 38         age cholesterol     0.88 0.46022727
## 39         age       smoke     0.97 0.53608247
## 40         age      cardio     1.00 0.77500000
## 41         age      height     1.00 0.43000000
## 42         age      weight     0.50 0.31000000
## 43         age       ap_hi     0.93 0.36559140
## 44      height cholesterol     0.18 0.27777778
## 45      height        gluc     0.10 0.70000000
## 46      height       smoke     0.92 0.84782609
## 47      height        alco     0.02 0.00000000
## 48      height      active     0.09 0.16666667
## 49      height         age     1.00 0.57000000
## 50      height      weight     1.00 0.53500000
## 51      height       ap_lo     0.22 0.00000000
## 52      height       ap_hi     0.07 0.00000000
## 53      weight cholesterol     0.64 0.83593750
## 54      weight        gluc     0.95 0.44736842
## 55      weight       smoke     0.53 1.00000000
## 56      weight      active     0.04 0.37500000
## 57      weight      cardio     0.90 0.95555556
## 58      weight         age     0.50 0.69000000
## 59      weight      height     1.00 0.46500000
## 60      weight       ap_lo     0.06 0.00000000
## 61      weight       ap_hi     1.00 0.76000000
## 62       ap_lo      active     0.11 0.50000000
## 63       ap_lo      cardio     1.00 0.98000000
## 64       ap_lo      height     0.22 1.00000000
## 65       ap_lo      weight     0.06 1.00000000
## 66       ap_lo       ap_hi     1.00 0.91500000
## 67       ap_hi cholesterol     1.00 0.58000000
## 68       ap_hi       smoke     0.97 0.97938144
## 69       ap_hi      active     0.01 0.00000000
## 70       ap_hi      cardio     1.00 0.79500000
## 71       ap_hi         age     0.93 0.63440860
## 72       ap_hi      height     0.07 1.00000000
## 73       ap_hi      weight     1.00 0.24000000
## 74       ap_hi       ap_lo     1.00 0.08500000
```

Masculino



subtitulo

```
##           from          to strength  direction
## 1  cholesterol        gluc     1.00 0.12000000
## 2  cholesterol      cardio     1.00 0.71000000
## 3  cholesterol         age     0.72 0.67361111
## 4  cholesterol      height     0.80 0.42500000
## 5  cholesterol      weight     0.55 0.70909091
## 6  cholesterol       ap_hi     0.79 0.07594937
## 7         gluc cholesterol     1.00 0.88000000
## 8        smoke        alco     0.98 0.50000000
## 9         alco       smoke     0.98 0.50000000
## 10      active         age     0.51 0.75490196
## 11      active      height     0.92 0.56521739
## 12      active      weight     0.65 0.72307692
## 13      cardio cholesterol     1.00 0.29000000
## 14      cardio         age     1.00 0.27500000
## 15      cardio      weight     0.68 0.16176471
## 16      cardio       ap_lo     0.98 0.09693878
## 17      cardio       ap_hi     1.00 0.18000000
## 18         age cholesterol     0.72 0.32638889
## 19         age      active     0.51 0.24509804
## 20         age      cardio     1.00 0.72500000
## 21         age      height     1.00 0.30000000
## 22         age      weight     0.65 0.39230769
## 23         age       ap_hi     0.88 0.19886364
## 24      height cholesterol     0.80 0.57500000
## 25      height      active     0.92 0.43478261
## 26      height         age     1.00 0.70000000
## 27      height      weight     1.00 0.67000000
```

```
## 28      weight cholesterol     0.55 0.29090909
## 29      weight      active     0.65 0.27692308
## 30      weight      cardio     0.68 0.83823529
## 31      weight         age     0.65 0.60769231
## 32      weight      height     1.00 0.33000000
## 33      weight       ap_hi     0.91 0.25274725
## 34       ap_lo      cardio     0.98 0.90306122
## 35       ap_lo       ap_hi     1.00 0.64000000
## 36       ap_hi cholesterol     0.79 0.92405063
## 37       ap_hi      cardio     1.00 0.82000000
## 38       ap_hi         age     0.88 0.80113636
## 39       ap_hi      weight     0.91 0.74725275
## 40       ap_hi       ap_lo     1.00 0.36000000
```