Primeira lista de exercícios - Estatística Aplicada II

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Com a base de dados “imoveiscwbav” obter os seguintes resultados com o auxílio do “R”

Estimar três modelos (Ridge, Lasso e Elasticnet) para explicar a variável Y (price), as demais variáveis da base de dados são todas variáveis explicativas; particione a base de dados em 80% para treino e 20% para teste; e apresente os resultados:

i. O valor ótimo do lambda para os modelos;

ii. O valor do alpha para o modelo ElasticNet;

iii. Os valores dos parâmetros para os modelos;

iv. O R^2 e RMSE dos modelos estimados;

v. Apresente os resultados de uma predição proposta por você mesmo para os modelos (valor estimado e intervalos de confiança).

Particionamento e normalização dos dados

```
## [1] "Quantidade treino: 432"
```

```
## [1] "Quantidade teste: 109"
```

```
## [1] "Treino:"
```

```
##      price               age              parea              tarea        
##  Min.   :-1.3962   Min.   :-1.0316   Min.   :-2.21140   Min.   :-1.87631  
##  1st Qu.:-0.7698   1st Qu.:-0.8735   1st Qu.:-0.84195   1st Qu.:-0.87101  
##  Median :-0.1468   Median :-0.3990   Median :-0.02029   Median :-0.03037  
##  Mean   : 0.0000   Mean   : 0.0000   Mean   : 0.00000   Mean   : 0.00000  
##  3rd Qu.: 0.4415   3rd Qu.: 0.7871   3rd Qu.: 0.73095   3rd Qu.: 0.74094  
##  Max.   : 3.8301   Max.   : 3.0012   Max.   : 2.48384   Max.   : 3.84351  
##       bath              ensuit            garag              plaz        
##  Min.   :-2.58714   Min.   :-1.5811   Min.   :-2.7017   Min.   :-1.7062  
##  1st Qu.:-0.85704   1st Qu.:-0.4847   1st Qu.:-1.2336   1st Qu.:-0.8699  
##  Median : 0.00801   Median :-0.4847   Median : 0.2345   Median :-0.1172  
##  Mean   : 0.00000   Mean   : 0.0000   Mean   : 0.0000   Mean   : 0.0000  
##  3rd Qu.: 0.87306   3rd Qu.: 0.6116   3rd Qu.: 0.2345   3rd Qu.: 0.7995  
##  Max.   : 1.73811   Max.   : 1.7080   Max.   : 3.1706   Max.   : 3.2316  
##       park              trans              kidca              school       
##  Min.   :-2.2664   Min.   :-2.5469   Min.   :-3.0755   Min.   :-2.09210  
##  1st Qu.:-0.7922   1st Qu.:-0.7871   1st Qu.:-0.6040   1st Qu.:-0.78496  
##  Median : 0.2556   Median : 0.2432   Median : 0.1991   Median :-0.01272  
##  Mean   : 0.0000   Mean   : 0.0000   Mean   : 0.0000   Mean   : 0.00000  
##  3rd Qu.: 0.8364   3rd Qu.: 0.8135   3rd Qu.: 0.7311   3rd Qu.: 0.60929  
##  Max.   : 1.7919   Max.   : 1.4529   Max.   : 2.1557   Max.   : 3.57300  
##      health              bike               barb              balc        
##  Min.   :-1.7859   Min.   :-1.7384   Min.   :0.0000   Min.   :0.0000  
##  1st Qu.:-0.7519   1st Qu.:-0.7398   1st Qu.:0.0000   1st Qu.:0.0000  
##  Median :-0.2239   Median :-0.1480   Median :0.0000   Median :0.0000  
##  Mean   : 0.0000   Mean   : 0.0000   Mean   :0.4931   Mean   :0.4537  
##  3rd Qu.: 0.6356   3rd Qu.: 0.7253   3rd Qu.:1.0000   3rd Qu.:1.0000  
##  Max.   : 3.7450   Max.   : 3.4700   Max.   :1.0000   Max.   :1.0000  
##       elev              fitg             party             categ       
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000  
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.0000  
##  Median :0.0000   Median :0.0000   Median :1.0000   Median :1.0000  
##  Mean   :0.3056   Mean   :0.3102   Mean   :0.5509   Mean   :0.9583  
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
```

```
## [1] "Teste:"
```

```
##      price               age                parea              tarea
##  Min.   :-1.28778   Min.   :-1.031647   Min.   :-1.80448   Min.   :-1.68565
##  1st Qu.:-0.71628   1st Qu.:-0.873495   1st Qu.:-0.77153   1st Qu.:-0.81901
##  Median :-0.03048   Median :-0.399040   Median : 0.04232   Median : 0.08229
##  Mean   : 0.04617   Mean   :-0.008739   Mean   : 0.08625   Mean   : 0.05764
##  3rd Qu.: 0.49569   3rd Qu.: 0.787097   3rd Qu.: 0.85616   3rd Qu.: 0.93160
##  Max.   : 6.46668   Max.   : 2.289538   Max.   : 2.45254   Max.   : 2.31822
##       bath              ensuit             garag               plaz
##  Min.   :-2.58714   Min.   :-1.58112   Min.   :-2.70165   Min.   :-1.69837
##  1st Qu.:-0.85704   1st Qu.:-0.48474   1st Qu.:-1.23359   1st Qu.:-0.81615
##  Median : 0.00801   Median :-0.48474   Median : 0.23448   Median :-0.25090
##  Mean   :-0.03961   Mean   : 0.06848   Mean   : 0.03246   Mean   :-0.08992
##  3rd Qu.: 0.87306   3rd Qu.: 0.61164   3rd Qu.: 0.23448   3rd Qu.: 0.53813
##  Max.   : 2.60316   Max.   : 1.70802   Max.   : 1.70255   Max.   : 2.25089
##       park               trans              kidca              school
##  Min.   :-2.314288   Min.   :-2.39764   Min.   :-3.33189   Min.   :-2.02285
##  1st Qu.:-0.615486   1st Qu.:-0.74228   1st Qu.:-0.56957   1st Qu.:-0.86112
##  Median : 0.238124   Median : 0.03660   Median : 0.28841   Median :-0.04805
##  Mean   : 0.002162   Mean   :-0.05999   Mean   : 0.04553   Mean   :-0.06285
##  3rd Qu.: 0.731567   3rd Qu.: 0.79724   3rd Qu.: 0.91254   3rd Qu.: 0.53332
##  Max.   : 1.534220   Max.   : 1.44502   Max.   : 1.95807   Max.   : 2.77798
##      health             bike               barb             balc
##  Min.   :-1.7459   Min.   :-1.74396   Min.   :0.0000   Min.   :0.000
##  1st Qu.:-0.7930   1st Qu.:-0.70889   1st Qu.:0.0000   1st Qu.:0.000
##  Median :-0.3740   Median : 0.02483   Median :1.0000   Median :0.000
##  Mean   :-0.1827   Mean   : 0.12571   Mean   :0.5046   Mean   :0.422
##  3rd Qu.: 0.3653   3rd Qu.: 0.96762   3rd Qu.:1.0000   3rd Qu.:1.000
##  Max.   : 1.9934   Max.   : 2.77855   Max.   :1.0000   Max.   :1.000
##       elev             fitg            party            categ
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.000
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.000
##  Median :0.0000   Median :0.0000   Median :1.0000   Median :1.000
##  Mean   :0.3211   Mean   :0.3028   Mean   :0.5229   Mean   :0.945
##  3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.000
##  Max.   :1.0000   Max.   :1.0000   Max.   :1.0000   Max.   :1.000
```

Valores que serão usados para predição:

- age: 9
- parea: 120
- tarea: 183
- bath: 3
- ensuit: 1
- garag: 2
- plaz: 0,2067
- park: 1,884
- trans: 2,0567
- kidca: 1,4
- school: 0,5675
- health: 0,3579
- bike: 0,3489
- barb: 0
- balc: 0

- elev: 0
- fitg: 0
- party: 1
- categ: 1

Ridge

Valor ótimo do lambda para o modelo Ridge

```
## [1] "Valor ótimo de lambda: 0.125892541179417"
```

Valores dos parâmetros para os modelo Ridge

```
## 19 x 1 sparse Matrix of class "dgCMatrix"
##                  s0
## age    -0.193260845
## parea   0.163255449
## tarea   0.195108610
## bath    0.087962001
## ensuit  0.181489032
## garag   0.201923934
## plaz    0.030745529
## park   -0.050808231
## trans   0.022732606
## kidca   0.029381461
## school  0.019643849
## health  0.003476952
## bike   -0.051139421
## barb   -0.085005561
## balc    0.143233157
## elev   -0.150954905
## fitg    0.192692116
## party   0.049228508
## categ   0.387509160
```

O R^2 e RMSE do modelo Ridge

```
## [1] "Treino: RMSE: 0.406965130076255 R^2: 0.833995112328703"
```

```
## [1] "Teste: RMSE: 0.592896455028309 R^2: 0.702807997354417"
```

Resultado da predição para o modelo Ridge

```
## [1] "Valor estimado: 965392.907531819"
```

```
## [1] "Intervalos de confiança: 917542.33147859 - 1013243.48358505"
```

Lasso

Valor ótimo do lambda para o modelo Lasso

```
## [1] "Valor ótimo de lambda: 0.00398107170553497"
```

Valores dos parâmetros para os modelo Lasso

```
## 19 x 1 sparse Matrix of class "dgCMatrix"
##                    s0
## age    -2.058244e-01
## parea   1.733126e-01
## tarea   2.076455e-01
## bath    6.192902e-02
## ensuit  1.979914e-01
## garag   2.167193e-01
## plaz    3.232967e-02
## park   -5.603821e-02
## trans   1.672568e-02
## kidca   2.508478e-02
## school  1.244843e-02
## health  4.958479e-05
## bike   -4.549025e-02
## barb   -1.042378e-01
## balc    1.434471e-01
## elev   -1.565126e-01
## fitg    1.968019e-01
## party   3.369758e-02
## categ   4.468851e-01
```

O R^2 e RMSE do modelo Lasso

```
## [1] "Treino: RMSE: 0.405025068919142 R^2: 0.835574077986829"
```

```
## [1] "Teste: RMSE: 0.585257367341435 R^2: 0.710416915339405"
```

Resultado da predição para o modelo Lasso

```
## [1] "Valor estimado: 966395.01956102"
```

```
## [1] "Intervalos de confiança: 917542.33147859 - 1013243.48358505"
```

ElasticNet

Valor ótimo do lambda / valor do alpha para o modelo ElasticNet

```
## + Fold01.Rep1: alpha=0.7934, lambda=0.007186
## - Fold01.Rep1: alpha=0.7934, lambda=0.007186
## + Fold01.Rep1: alpha=0.8940, lambda=1.361741
## - Fold01.Rep1: alpha=0.8940, lambda=1.361741
## + Fold01.Rep1: alpha=0.1708, lambda=0.001076
## - Fold01.Rep1: alpha=0.1708, lambda=0.001076
## + Fold01.Rep1: alpha=0.7484, lambda=0.004436
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## + Fold01.Rep1: alpha=0.7688, lambda=0.009401
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## + Fold01.Rep1: alpha=0.6662, lambda=0.003580
## - Fold01.Rep1: alpha=0.6662, lambda=0.003580
## + Fold01.Rep1: alpha=0.4686, lambda=0.002913
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## + Fold01.Rep1: alpha=0.7212, lambda=0.002224
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## + Fold01.Rep1: alpha=0.2887, lambda=0.024468
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## + Fold04.Rep5: alpha=0.3490, lambda=0.021205
## - Fold04.Rep5: alpha=0.3490, lambda=0.021205
## + Fold04.Rep5: alpha=0.2887, lambda=0.024468
## - Fold04.Rep5: alpha=0.2887, lambda=0.024468
## + Fold05.Rep5: alpha=0.7934, lambda=0.007186
## - Fold05.Rep5: alpha=0.7934, lambda=0.007186
## + Fold05.Rep5: alpha=0.8940, lambda=1.361741
## - Fold05.Rep5: alpha=0.8940, lambda=1.361741
## + Fold05.Rep5: alpha=0.1708, lambda=0.001076
## - Fold05.Rep5: alpha=0.1708, lambda=0.001076
## + Fold05.Rep5: alpha=0.7484, lambda=0.004436
## - Fold05.Rep5: alpha=0.7484, lambda=0.004436
## + Fold05.Rep5: alpha=0.7688, lambda=0.009401
## - Fold05.Rep5: alpha=0.7688, lambda=0.009401
## + Fold05.Rep5: alpha=0.6662, lambda=0.003580
## - Fold05.Rep5: alpha=0.6662, lambda=0.003580
## + Fold05.Rep5: alpha=0.4686, lambda=0.002913
## - Fold05.Rep5: alpha=0.4686, lambda=0.002913
## + Fold05.Rep5: alpha=0.7212, lambda=0.002224
```

```
## - Fold05.Rep5: alpha=0.7212, lambda=0.002224
## + Fold05.Rep5: alpha=0.3490, lambda=0.021205
## - Fold05.Rep5: alpha=0.3490, lambda=0.021205
## + Fold05.Rep5: alpha=0.2887, lambda=0.024468
## - Fold05.Rep5: alpha=0.2887, lambda=0.024468
## + Fold06.Rep5: alpha=0.7934, lambda=0.007186
## - Fold06.Rep5: alpha=0.7934, lambda=0.007186
## + Fold06.Rep5: alpha=0.8940, lambda=1.361741
## - Fold06.Rep5: alpha=0.8940, lambda=1.361741
## + Fold06.Rep5: alpha=0.1708, lambda=0.001076
## - Fold06.Rep5: alpha=0.1708, lambda=0.001076
## + Fold06.Rep5: alpha=0.7484, lambda=0.004436
## - Fold06.Rep5: alpha=0.7484, lambda=0.004436
## + Fold06.Rep5: alpha=0.7688, lambda=0.009401
## - Fold06.Rep5: alpha=0.7688, lambda=0.009401
## + Fold06.Rep5: alpha=0.6662, lambda=0.003580
## - Fold06.Rep5: alpha=0.6662, lambda=0.003580
## + Fold06.Rep5: alpha=0.4686, lambda=0.002913
## - Fold06.Rep5: alpha=0.4686, lambda=0.002913
## + Fold06.Rep5: alpha=0.7212, lambda=0.002224
## - Fold06.Rep5: alpha=0.7212, lambda=0.002224
## + Fold06.Rep5: alpha=0.3490, lambda=0.021205
## - Fold06.Rep5: alpha=0.3490, lambda=0.021205
## + Fold06.Rep5: alpha=0.2887, lambda=0.024468
## - Fold06.Rep5: alpha=0.2887, lambda=0.024468
## + Fold07.Rep5: alpha=0.7934, lambda=0.007186
## - Fold07.Rep5: alpha=0.7934, lambda=0.007186
## + Fold07.Rep5: alpha=0.8940, lambda=1.361741
## - Fold07.Rep5: alpha=0.8940, lambda=1.361741
## + Fold07.Rep5: alpha=0.1708, lambda=0.001076
## - Fold07.Rep5: alpha=0.1708, lambda=0.001076
## + Fold07.Rep5: alpha=0.7484, lambda=0.004436
## - Fold07.Rep5: alpha=0.7484, lambda=0.004436
## + Fold07.Rep5: alpha=0.7688, lambda=0.009401
## - Fold07.Rep5: alpha=0.7688, lambda=0.009401
## + Fold07.Rep5: alpha=0.6662, lambda=0.003580
## - Fold07.Rep5: alpha=0.6662, lambda=0.003580
## + Fold07.Rep5: alpha=0.4686, lambda=0.002913
## - Fold07.Rep5: alpha=0.4686, lambda=0.002913
## + Fold07.Rep5: alpha=0.7212, lambda=0.002224
## - Fold07.Rep5: alpha=0.7212, lambda=0.002224
## + Fold07.Rep5: alpha=0.3490, lambda=0.021205
## - Fold07.Rep5: alpha=0.3490, lambda=0.021205
## + Fold07.Rep5: alpha=0.2887, lambda=0.024468
## - Fold07.Rep5: alpha=0.2887, lambda=0.024468
## + Fold08.Rep5: alpha=0.7934, lambda=0.007186
## - Fold08.Rep5: alpha=0.7934, lambda=0.007186
## + Fold08.Rep5: alpha=0.8940, lambda=1.361741
## - Fold08.Rep5: alpha=0.8940, lambda=1.361741
## + Fold08.Rep5: alpha=0.1708, lambda=0.001076
## - Fold08.Rep5: alpha=0.1708, lambda=0.001076
## + Fold08.Rep5: alpha=0.7484, lambda=0.004436
## - Fold08.Rep5: alpha=0.7484, lambda=0.004436
## + Fold08.Rep5: alpha=0.7688, lambda=0.009401
## - Fold08.Rep5: alpha=0.7688, lambda=0.009401
## + Fold08.Rep5: alpha=0.6662, lambda=0.003580
```

```
## - Fold08.Rep5: alpha=0.6662, lambda=0.003580
## + Fold08.Rep5: alpha=0.4686, lambda=0.002913
## - Fold08.Rep5: alpha=0.4686, lambda=0.002913
## + Fold08.Rep5: alpha=0.7212, lambda=0.002224
## - Fold08.Rep5: alpha=0.7212, lambda=0.002224
## + Fold08.Rep5: alpha=0.3490, lambda=0.021205
## - Fold08.Rep5: alpha=0.3490, lambda=0.021205
## + Fold08.Rep5: alpha=0.2887, lambda=0.024468
## - Fold08.Rep5: alpha=0.2887, lambda=0.024468
## + Fold09.Rep5: alpha=0.7934, lambda=0.007186
## - Fold09.Rep5: alpha=0.7934, lambda=0.007186
## + Fold09.Rep5: alpha=0.8940, lambda=1.361741
## - Fold09.Rep5: alpha=0.8940, lambda=1.361741
## + Fold09.Rep5: alpha=0.1708, lambda=0.001076
## - Fold09.Rep5: alpha=0.1708, lambda=0.001076
## + Fold09.Rep5: alpha=0.7484, lambda=0.004436
## - Fold09.Rep5: alpha=0.7484, lambda=0.004436
## + Fold09.Rep5: alpha=0.7688, lambda=0.009401
## - Fold09.Rep5: alpha=0.7688, lambda=0.009401
## + Fold09.Rep5: alpha=0.6662, lambda=0.003580
## - Fold09.Rep5: alpha=0.6662, lambda=0.003580
## + Fold09.Rep5: alpha=0.4686, lambda=0.002913
## - Fold09.Rep5: alpha=0.4686, lambda=0.002913
## + Fold09.Rep5: alpha=0.7212, lambda=0.002224
## - Fold09.Rep5: alpha=0.7212, lambda=0.002224
## + Fold09.Rep5: alpha=0.3490, lambda=0.021205
## - Fold09.Rep5: alpha=0.3490, lambda=0.021205
## + Fold09.Rep5: alpha=0.2887, lambda=0.024468
## - Fold09.Rep5: alpha=0.2887, lambda=0.024468
## + Fold10.Rep5: alpha=0.7934, lambda=0.007186
## - Fold10.Rep5: alpha=0.7934, lambda=0.007186
## + Fold10.Rep5: alpha=0.8940, lambda=1.361741
## - Fold10.Rep5: alpha=0.8940, lambda=1.361741
## + Fold10.Rep5: alpha=0.1708, lambda=0.001076
## - Fold10.Rep5: alpha=0.1708, lambda=0.001076
## + Fold10.Rep5: alpha=0.7484, lambda=0.004436
## - Fold10.Rep5: alpha=0.7484, lambda=0.004436
## + Fold10.Rep5: alpha=0.7688, lambda=0.009401
## - Fold10.Rep5: alpha=0.7688, lambda=0.009401
## + Fold10.Rep5: alpha=0.6662, lambda=0.003580
## - Fold10.Rep5: alpha=0.6662, lambda=0.003580
## + Fold10.Rep5: alpha=0.4686, lambda=0.002913
## - Fold10.Rep5: alpha=0.4686, lambda=0.002913
## + Fold10.Rep5: alpha=0.7212, lambda=0.002224
## - Fold10.Rep5: alpha=0.7212, lambda=0.002224
## + Fold10.Rep5: alpha=0.3490, lambda=0.021205
## - Fold10.Rep5: alpha=0.3490, lambda=0.021205
## + Fold10.Rep5: alpha=0.2887, lambda=0.024468
## - Fold10.Rep5: alpha=0.2887, lambda=0.024468
## Aggregating results
## Selecting tuning parameters
## Fitting alpha = 0.289, lambda = 0.0245 on full training set
```

```
##       alpha     lambda
## 2 0.2887028 0.02446799
```

Valores dos parâmetros para os modelo ElasticNet

```
## 19 x 69 sparse Matrix of class "dgCMatrix"
##
## age    . .           .           .          .          .          .
## parea  . .           0.007819287 0.01802082 0.02759508 0.03654711 0.04485769
## tarea  . 0.022147812 0.037167374 0.04982563 0.06205175 0.07383680 0.08519493
## bath   . .           0.002848441 0.01272196 0.02196203 0.03055804 0.03849429
## ensuit . 0.003265459 0.018382751 0.03116968 0.04362663 0.05573324 0.06748358
## garag  . 0.009194398 0.024439252 0.03794439 0.05115297 0.06403454 0.07656466
## plaz   . .           .           .          .          .          .
## park   . .           .           .          .          .          .
## trans  . .           .           .          .          .          .
## kidca  . .           .           .          .          .          .
## school . .           .           .          .          .          .
## health . .           .           .          .          .          .
## bike   . .           .           .          .          .          .
## barb   . .           .           .          .          .          .
## balc   . .           .           .          .          .          .
## elev   . .           .           .          .          .          .
## fitg   . .           .           .          .          .          .
## party  . .           .           .          .          .          .
## categ  . .           .           .          .          .          .
##
## age    -0.005690896 -0.01684378 -0.02766834 -0.03815864 -0.04829590
## parea   0.052631649  0.06001366  0.06683956  0.07315034  0.07896181
## tarea   0.095667783  0.10531098  0.11446803  0.12316894  0.13142764
## bath    0.045736950  0.05239655  0.05846997  0.06398944  0.06897413
## ensuit  0.077945219  0.08701122  0.09559010  0.10368336  0.11130355
## garag   0.087798279  0.09757858  0.10688274  0.11569236  0.12401351
## plaz    .            .           .           .           .
## park    .            .           .           .           .
## trans   .            .           .           .           .
## kidca   .            .           .           .           .
## school  .            .           .           .           .
## health  .            .           .           .           .
## bike    .            .           .           .           .
## barb    .            .           .           .           .
## balc    .            .           .           .           .
## elev    .            .           .           .           .
## fitg    .            .           .           .           .
## party   .            .           .           .           .
## categ   .            .           .           .           .
##
## age    -0.057950529 -0.06633084 -0.07430745 -0.08188755 -0.088962870
## parea   0.084316425  0.08964189  0.09456767  0.09914483  0.103410335
## tarea   0.139250870  0.14638896  0.15315447  0.15955405  0.165637053
## bath    0.073368080  0.07667811  0.07951483  0.08191855  0.083861882
## ensuit  0.118360605  0.12394924  0.12911461  0.13386403  0.138207187
## garag   0.131795680  0.13865323  0.14507162  0.15105995  0.156528511
## plaz    .            .           .           .           .
## park    .            .           .           .           .
## trans   .            .           .           .           .
## kidca   .            .           .           .           .
## school  .            .           .           .           .
## health  .            .           .           .           .
## bike    .            .           .           .           .
```

```
## barb    .            .           .           .           .
## balc    .            .           .           .           0.001623376
## elev    .            .           .           .           .
## fitg    0.001844475  0.01849973  0.03443594  0.04965054  0.063731731
## party   .            .           .           .           .
## categ   .            .           .           .           .
##
## age    -0.095115817 -0.10095833 -0.10644583 -0.11207718 -0.11749641 -0.12265221
## parea   0.107148839  0.11073402  0.11405787  0.11680022  0.11898427  0.12105406
## tarea   0.171233274  0.17659850  0.18167960  0.18593896  0.18949322  0.19284663
## bath    0.085100194  0.08605562  0.08671196  0.08696064  0.08661434  0.08615273
## ensuit  0.142285031  0.14599093  0.14941258  0.15293792  0.15669463  0.16017110
## garag   0.161493238  0.16599127  0.17014956  0.17358653  0.17673192  0.17951022
## plaz    .            .           .           .           .           .
## park    .            .           .          -0.00434217 -0.01101109 -0.01732770
## trans   .            .           .           .           .           .
## kidca   .            .           .           .           .           .
## school  .            .           .           .           .           .
## health  .            .           .           .           .           .
## bike    .            .           .           .           .           .
## barb    .            .           .           .           .           .
## balc    0.009536258  0.01679233  0.02349545  0.02924724  0.03441445  0.03907059
## elev    .            .           .           .           .           .
## fitg    0.075482771  0.08657923  0.09703680  0.10684286  0.11602507  0.12462527
## party   .            .           .           .           .           .
## categ   .            .           .           .           .           .
##
## age    -0.12742868 -0.13196857 -0.136319155 -0.140318166 -0.144180043
## parea   0.12283371  0.12458144  0.126869844  0.129969398  0.133187016
## tarea   0.19605540  0.19895694  0.201408948  0.203357872  0.204917976
## bath    0.08544747  0.08466581  0.083833157  0.082723168  0.081663810
## ensuit  0.16353647  0.16665266  0.169479521  0.172377794  0.174961167
## garag   0.18207891  0.18436784  0.186462343  0.188882410  0.191019599
## plaz    .           .           .            .            .
## park   -0.02331521 -0.02896954 -0.033701967 -0.036865542 -0.039790147
## trans   .           .           .            .            .
## kidca   .           .           .            .            .
## school  .           .           .            .            .
## health  .           .           .            .            .
## bike    .           .          -0.001231801 -0.004525904 -0.007558494
## barb    .           .           .            .            .
## balc    0.04334303  0.04719341  0.050731167  0.054253184  0.057402994
## elev    .           .           .            .            .
## fitg    0.13265093  0.14015264  0.146586931  0.150864857  0.154798867
## party   .           .           .            .            .
## categ   .           .           0.008470341  0.040445940  0.070654645
##
## age    -0.14776661 -0.15112447 -0.1545851122 -0.1583775241 -0.162338788
## parea   0.13628764  0.13926966  0.1421841056  0.1451168674  0.147224095
## tarea   0.20643180  0.20761263  0.2081871930  0.2085174521  0.208966486
## bath    0.08049192  0.07931632  0.0784900527  0.0777211931  0.076908608
## ensuit  0.17739648  0.17968553  0.1814225437  0.1824720024  0.183684548
## garag   0.19291153  0.19471131  0.1963044635  0.1972488051  0.199162808
## plaz    .           .           .             .             .
## park   -0.04247725 -0.04497891 -0.0474185841 -0.0490431934 -0.050132471
## trans   .           .           .             .             .
```

```
## kidca   .           .           0.0001488122  0.0027500687  0.004972882
## school  .           .           .             .             .
## health  .           .           .             .             .
## bike   -0.01035565 -0.01292914 -0.0151424933 -0.0176958796 -0.019290428
## barb    .           .           .            -0.0005948582 -0.010836738
## balc    0.06024754  0.06288605  0.0669916778  0.0726092591  0.079419864
## elev    .           .          -0.0075136030 -0.0209524182 -0.032201795
## fitg    0.15840114  0.16166248  0.1656108159  0.1698684427  0.173824347
## party   .           .           .             .             .
## categ   0.09898176  0.12550712  0.1513302349  0.1750604681  0.197887193
##
## age    -0.166123008 -1.696494e-01 -0.172951389 -0.176040339 -1.787399e-01
## parea   0.149527355  1.517475e-01  0.153694622  0.155764483  1.570910e-01
## tarea   0.209189613  2.093309e-01  0.209388707  0.209422613  2.096477e-01
## bath    0.076235719  7.556448e-02  0.074884926  0.074250399  7.347207e-02
## ensuit  0.184606204  1.854341e-01  0.186224215  0.186868129  1.877808e-01
## garag   0.200743839  2.021880e-01  0.203567989  0.204697780  2.058689e-01
## plaz    .           .             .            0.002388235  5.443352e-03
## park   -0.051114148 -5.199571e-02 -0.052001460 -0.052792054 -5.399537e-02
## trans   .           .             .            .            .
## kidca   0.007039182  8.950367e-03  0.010838339  0.012705358  1.447958e-02
## school  .            9.840821e-06  0.001892574  0.002981163  3.680138e-03
## health  .           .             .            .            .
## bike   -0.020784354 -2.214563e-02 -0.023888326 -0.025791304 -2.761783e-02
## barb   -0.020267508 -2.902339e-02 -0.036459271 -0.043065014 -4.906797e-02
## balc    0.085787219  9.173397e-02  0.097438998  0.102474551  1.070326e-01
## elev   -0.042734124 -5.252197e-02 -0.061395289 -0.069289512 -7.644603e-02
## fitg    0.177508358  1.808840e-01  0.183297078  0.185531817  1.875991e-01
## party   .           .             .            .            2.257860e-06
## categ   0.219286809  2.392176e-01  0.258674252  0.276176321  2.914729e-01
##
## age    -0.181434845 -0.183685687 -0.185846888 -0.187854838 -0.189674231
## parea   0.158768885  0.159728261  0.160815399  0.161886984  0.162804346
## tarea   0.209429467  0.209485325  0.209365192  0.209218913  0.209174388
## bath    0.072729416  0.071956555  0.071287512  0.070657159  0.070021536
## ensuit  0.188497964  0.189391573  0.190126459  0.190783082  0.191444459
## garag   0.206754179  0.207717107  0.208569596  0.209329124  0.210028071
## plaz    0.008197160  0.010636709  0.012896531  0.014972662  0.016911958
## park   -0.054512507 -0.054591276 -0.054722273 -0.054831965 -0.055028695
## trans   0.001227497  0.002930509  0.004425234  0.005796103  0.007018961
## kidca   0.015715502  0.016690172  0.017601802  0.018439273  0.019194981
## school  0.004498883  0.005421139  0.006237445  0.006982070  0.007603265
## health  .           .            .            .            .
## bike   -0.029411427 -0.031139843 -0.032711548 -0.034154049 -0.035441729
## barb   -0.054459882 -0.059365063 -0.063877764 -0.068027054 -0.071822151
## balc    0.110592999  0.113908984  0.116959632  0.119764689  0.122294739
## elev   -0.084138201 -0.091320121 -0.097979021 -0.104125546 -0.109774936
## fitg    0.188650210  0.189686534  0.190539562  0.191301953  0.192012297
## party   0.003205948  0.006263386  0.009128223  0.011786775  0.014232567
## categ   0.306084400  0.319583714  0.332119729  0.343704891  0.354238524
##
## age    -0.191367652 -0.192935001 -0.194377716 -0.195703061 -0.19691964
## parea   0.163712603  0.164601573  0.165440529  0.166224843  0.16695616
## tarea   0.209008875  0.208825108  0.208639269  0.208454045  0.20827102
## bath    0.069456300  0.068935453  0.068449614  0.067996311  0.06757430
## ensuit  0.192014884  0.192518788  0.192976731  0.193395612  0.19377886
```

```
## garag   0.210679780  0.211265236  0.211797081  0.212283067  0.21272763
## plaz    0.018660258  0.020255606  0.021715610  0.023051394  0.02427296
## park   -0.055102982 -0.055149449 -0.055183108 -0.055206806 -0.05522234
## trans   0.008186779  0.009263801  0.010253993  0.011164156  0.01200032
## kidca   0.019902577  0.020549326  0.021141340  0.021683377  0.02217951
## school  0.008232898  0.008814862  0.009348666  0.009838322  0.01028741
## health  .            .            .            .            .
## bike   -0.036662406 -0.037783072 -0.038810639 -0.039752682 -0.04061595
## barb   -0.075317050 -0.078522519 -0.081460824 -0.084152335 -0.08661654
## balc    0.124679783  0.126870638  0.128883056  0.130730899  0.13242659
## elev   -0.114986167 -0.119787289 -0.124201603 -0.128256871 -0.13197985
## fitg    0.192607151  0.193135191  0.193605477  0.194023649  0.19439561
## party   0.016517198  0.018630330  0.020581376  0.022381556  0.02404108
## categ   0.364026156  0.373069211  0.381387531  0.389029250  0.39604467
##
## age    -0.19803576 -0.19905919 -0.19999716 -0.20085642 -0.20164321 -0.20236337
## parea   0.16763705  0.16827010  0.16885784  0.16940275  0.16990730  0.17037391
## tarea   0.20809173  0.20791753  0.20774947  0.20758833  0.20743464  0.20728873
## bath    0.06718222  0.06681859  0.06648187  0.06617048  0.06588290  0.06561760
## ensuit  0.19412929  0.19444957  0.19474220  0.19500949  0.19525358  0.19547643
## garag   0.21313421  0.21350591  0.21384564  0.21415605  0.21443962  0.21469861
## plaz    0.02538965  0.02641013  0.02734243  0.02819394  0.02897150  0.02968136
## park   -0.05523130 -0.05523505 -0.05523473 -0.05523129 -0.05522550 -0.05521799
## trans   0.01276796  0.01347224  0.01411798  0.01470972  0.01525170  0.01574788
## kidca   0.02263346  0.02304869  0.02342837  0.02377546  0.02409267  0.02438249
## school  0.01069911  0.01107636  0.01142189  0.01173823  0.01202775  0.01229262
## health  .           .           .           .           .           .
## bike   -0.04140664 -0.04213054 -0.04279301 -0.04339903 -0.04395323 -0.04445987
## barb   -0.08887167 -0.09093468 -0.09282128 -0.09454600 -0.09612226 -0.09756247
## balc    0.13398169  0.13540703  0.13671277  0.13790838  0.13900266  0.14000382
## elev   -0.13539567 -0.13852786 -0.14139846 -0.14402801 -0.14643567 -0.14863926
## fitg    0.19472679  0.19502199  0.19528541  0.19552072  0.19573115  0.19591953
## party   0.02556955  0.02697610  0.02826940  0.02945769  0.03054875  0.03154989
## categ   0.40248147  0.40838421  0.41379446  0.41875097  0.42328981  0.42744450
##
## age    -0.20300987 -0.20360704 -0.20415667 -2.046611e-01 -0.2050759596
## parea   0.17077746  0.17113694  0.17149421  1.718335e-01  0.1722147488
## tarea   0.20722487  0.20710774  0.20698189  2.068610e-01  0.2067746054
## bath    0.06537355  0.06514680  0.06493934  6.474935e-02  0.0646295410
## ensuit  0.19569705  0.19589677  0.19606929  1.962226e-01  0.1964296581
## garag   0.21492215  0.21514468  0.21534667  2.155286e-01  0.2156128818
## plaz    0.03035490  0.03095207  0.03149076  3.198070e-02  0.0323968144
## park   -0.05528010 -0.05528257 -0.05526871 -5.525204e-02 -0.0553941653
## trans   0.01617738  0.01659154  0.01697397  1.732366e-02  0.0175302053
## kidca   0.02463194  0.02487487  0.02509741  2.530023e-02  0.0256930511
## school  0.01249785  0.01271451  0.01291984  1.310835e-02  0.0134565959
## health  .           .           .           5.234289e-05  0.0008180023
## bike   -0.04489851 -0.04532054 -0.04570949 -4.605774e-02 -0.0462617241
## barb   -0.09884609 -0.10005026 -0.10114922 -1.021611e-01 -0.1031193585
## balc    0.14085303  0.14169329  0.14246423  1.431771e-01  0.1438633099
## elev   -0.15065611 -0.15249532 -0.15418020 -1.557252e-01 -0.1572006653
## fitg    0.19610061  0.19625256  0.19638609  1.965154e-01  0.1966319206
## party   0.03245906  0.03330023  0.03407287  3.477849e-02  0.0353451260
## categ   0.43119784  0.43463384  0.43780672  4.407351e-01  0.4436269281
##
## age    -0.205452738 -0.205789338 -0.206093361 -0.206369517 -0.206621044
```

```
## parea   0.172511556  0.172781357  0.173026537  0.173249884  0.173454017
## tarea   0.206687671  0.206605953  0.206530224  0.206459937  0.206394700
## bath    0.064486447  0.064341619  0.064203837  0.064075800  0.063957840
## ensuit  0.196666657  0.196893038  0.197104105  0.197298733  0.197477231
## garag   0.215696078  0.215780043  0.215860659  0.215935945  0.216005276
## plaz    0.032779571  0.033126484  0.033441630  0.033728528  0.033989908
## park   -0.055481340 -0.055552002 -0.055613683 -0.055668945 -0.055718846
## trans   0.017702379  0.017860578  0.018005898  0.018138833  0.018260152
## kidca   0.026075300  0.026428532  0.026751751  0.027047149  0.027317032
## school  0.013798914  0.014118228  0.014411773  0.014680553  0.014926290
## health  0.001506321  0.002134404  0.002707874  0.003231489  0.003709516
## bike   -0.046481634 -0.046687859 -0.046877137 -0.047050148 -0.047208099
## barb   -0.103991593 -0.104784421 -0.105506590 -0.106164982 -0.106765385
## balc    0.144554809  0.145193014  0.145777939  0.146312922  0.146801740
## elev   -0.158503708 -0.159690097 -0.160772757 -0.161760886 -0.162662710
## fitg    0.196718969  0.196788534  0.196847809  0.196899787  0.196945917
## party   0.035836460  0.036288366  0.036702487  0.037081256  0.037427413
## categ   0.446215883  0.448580275  0.450739491  0.452710502  0.454509608
##
## age    -0.206850382 -0.207059556 -0.207252359 -0.20743302 -0.20759443
## parea   0.173640901  0.173812060  0.173986003  0.17411430  0.17423439
## tarea   0.206334257  0.206278372  0.206261491  0.20622806  0.20618703
## bath    0.063849519  0.063750186  0.063687958  0.06362028  0.06355087
## ensuit  0.197640540  0.197789801  0.197891689  0.19800963  0.19812374
## garag   0.216068713  0.216126598  0.216164723  0.21620520  0.21624685
## plaz    0.034228102  0.034445188  0.034664217  0.03484888  0.03501341
## park   -0.055764046 -0.055805052 -0.055878526 -0.05592288 -0.05595581
## trans   0.018370740  0.018471496  0.018582110  0.01866879  0.01874417
## kidca   0.027563544  0.027788660  0.027960516  0.02814109  0.02831271
## school  0.015150794  0.015355815  0.015507076  0.01566833  0.01582378
## health  0.004145861  0.004544104  0.004887041  0.00521816  0.00552246
## bike   -0.047352221 -0.047483685 -0.047597844 -0.04770047 -0.04779819
## barb   -0.107312937 -0.107812279 -0.108243041 -0.10865896 -0.10904044
## balc    0.147248146  0.147655696  0.147939393  0.14826394  0.14857647
## elev   -0.163485684 -0.164236606 -0.164922336 -0.16555794 -0.16613063
## fitg    0.196987093  0.197023962  0.197091383  0.19712459  0.19714995
## party   0.037743613  0.038032352  0.038316529  0.03856233  0.03878079
## categ   0.456151703  0.457650319  0.459012516  0.46024930  0.46138026
```

O R^2 e RMSE do modelo ElasticNet

```
## [1] "Treino: RMSE: 0.40578266859743 R^2: 0.834958385090695"
```

```
## [1] "Teste: RMSE: 0.587861237294966 R^2: 0.707834413593687"
```

Resultado da predição para o modelo ElasticNet

```
## [1] "Valor estimado: 960677.074538217"
```

```
## [1] "Intervalos de confiança: 917542.33147859 - 1013243.48358505"
```