

Introduction: in this project, I analyzed the mobile dataset of sales of mobile phones of various companies to predict a price range of mobile phones (0 is low cost, 1 is medium cost, 2 is high cost, and 3 is very high cost) for the stakeholder's mobile company. More details about the dataset, what each field represents, please refer to this link: <https://www.kaggle.com/datasets/iabhishekofficial/mobile-price-classification>.

Action: Let's load the dataset and look at the snapshot of the data:

```
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##   filter, lag

## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union

mobile = read.csv("Documents/Anna_Projects/Mobile/train.csv")
mobile_test = read.csv("Documents/Anna_Projects/Mobile/test.csv")
head(mobile)

##   battery_power blue clock_speed dual_sim fc four_g int_memory m_dep
mobile_wt
## 1           842    0           2.2        0  1         0           7  0.6
188
## 2          1021    1           0.5        1  0         1          53  0.7
136
## 3           563    1           0.5        1  2         1          41  0.9
145
## 4           615    1           2.5        0  0         0          10  0.8
131
## 5          1821    1           1.2        0 13         1          44  0.6
141
## 6          1859    0           0.5        1  3         0          22  0.7
164
##   n_cores pc px_height px_width  ram sc_h sc_w talk_time three_g
touch_screen
## 1      2  2         20       756 2549   9   7         19         0
0
## 2      3  6         905      1988 2631  17   3          7         1
1
## 3      5  6        1263      1716 2603  11   2          9         1
1
## 4      6  9        1216      1786 2769  16   8         11         1
0
## 5      2 14        1208      1212 1411   8   2         15         1
```

```

1
## 6      1  7      1004      1654 1067      17      1      10      1
0
##   wifi price_range
## 1      1          1
## 2      0          2
## 3      0          2
## 4      0          2
## 5      0          1
## 6      0          1

head(mobile_test)

##   id battery_power blue clock_speed dual_sim fc four_g int_memory m_dep
## 1  1          1043    1          1.8        1 14         0         5  0.1
## 2  2           841    1          0.5        1  4         1        61  0.8
## 3  3          1807    1          2.8        0  1         0        27  0.9
## 4  4          1546    0          0.5        1 18         1        25  0.5
## 5  5          1434    0          1.4        0 11         1        49  0.5
## 6  6          1464    1          2.9        1  5         1        50  0.8
##   mobile_wt n_cores pc px_height px_width ram sc_h sc_w talk_time three_g
## 1          193      3 16         226      1412 3476   12   7         2         0
## 2          191      5 12         746       857 3895    6   0         7         1
## 3          186      3  4        1270      1366 2396   17  10        10         0
## 4           96      8 20         295      1752 3893   10   0         7         1
## 5          108      6 18         749       810 1773   15   8         7         1
## 6          198      8  9         569       939 3506   10   7         3         1
##   touch_screen wifi
## 1              1   0
## 2              0   0
## 3              1   1
## 4              1   0
## 5              0   1
## 6              1   1

```

Let's look at the summary statistics of the training dataset since that's the one we will work on:

```

summary(mobile)

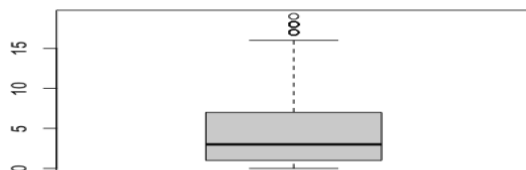
##   battery_power      blue      clock_speed      dual_sim
##   Min.   : 501.0    Min.   :0.000    Min.   :0.500    Min.   :0.0000
##   1st Qu.: 851.8    1st Qu.:0.000    1st Qu.:0.700    1st Qu.:0.0000
##   Median :1226.0    Median :0.000    Median :1.500    Median :1.0000
##   Mean   :1238.5    Mean   :0.495    Mean   :1.522    Mean   :0.5095
##   3rd Qu.:1615.2    3rd Qu.:1.000    3rd Qu.:2.200    3rd Qu.:1.0000
##   Max.   :1998.0    Max.   :1.000    Max.   :3.000    Max.   :1.0000
##           fc         four_g      int_memory      m_dep
##   Min.   : 0.000    Min.   :0.0000    Min.   : 2.00    Min.   :0.1000
##   1st Qu.: 1.000    1st Qu.:0.0000    1st Qu.:16.00    1st Qu.:0.2000
##   Median : 3.000    Median :1.0000    Median :32.00    Median :0.5000

```

```
## Mean : 4.309 Mean :0.5215 Mean :32.05 Mean :0.5018
## 3rd Qu.: 7.000 3rd Qu.:1.0000 3rd Qu.:48.00 3rd Qu.:0.8000
## Max. :19.000 Max. :1.0000 Max. :64.00 Max. :1.0000
## mobile_wt n_cores pc px_height
## Min. : 80.0 Min. :1.000 Min. : 0.000 Min. : 0.0
## 1st Qu.:109.0 1st Qu.:3.000 1st Qu.: 5.000 1st Qu.: 282.8
## Median :141.0 Median :4.000 Median :10.000 Median : 564.0
## Mean :140.2 Mean :4.521 Mean : 9.916 Mean : 645.1
## 3rd Qu.:170.0 3rd Qu.:7.000 3rd Qu.:15.000 3rd Qu.: 947.2
## Max. :200.0 Max. :8.000 Max. :20.000 Max. :1960.0
## px_width ram sc_h sc_w
## Min. : 500.0 Min. : 256 Min. : 5.00 Min. : 0.000
## 1st Qu.: 874.8 1st Qu.:1208 1st Qu.: 9.00 1st Qu.: 2.000
## Median :1247.0 Median :2146 Median :12.00 Median : 5.000
## Mean :1251.5 Mean :2124 Mean :12.31 Mean : 5.767
## 3rd Qu.:1633.0 3rd Qu.:3064 3rd Qu.:16.00 3rd Qu.: 9.000
## Max. :1998.0 Max. :3998 Max. :19.00 Max. :18.000
## talk_time three_g touch_screen wifi
## Min. : 2.00 Min. :0.0000 Min. :0.000 Min. :0.000
## 1st Qu.: 6.00 1st Qu.:1.0000 1st Qu.:0.000 1st Qu.:0.000
## Median :11.00 Median :1.0000 Median :1.000 Median :1.000
## Mean :11.01 Mean :0.7615 Mean :0.503 Mean :0.507
## 3rd Qu.:16.00 3rd Qu.:1.0000 3rd Qu.:1.000 3rd Qu.:1.000
## Max. :20.00 Max. :1.0000 Max. :1.000 Max. :1.000
## price_range
## Min. :0.00
## 1st Qu.:0.75
## Median :1.50
## Mean :1.50
## 3rd Qu.:2.25
## Max. :3.00
```

Let's look at the boxplot of variables that have outliers. As you can see here, fc variable (which is Front Camera mega pixels) has outliers, but we won't remove them because they are necessary to our analysis and won't affect the quality of our analysis:

```
boxplot(mobile$fc)
```



I have visualized the data on Tableau. You can check out the PDF file of my visualization on Github for this project.

Since our test dataset does not have our target variable (price range) so we will split the data into train and test set on our training set instead:

```
index <- sample(nrow(mobile), nrow(mobile)*0.80)
mobile_train = mobile[index,]
mobile_test = mobile[-index,]
```

Let's fit a multinomial logistic regression model since we are dealing with categorical target variable:

```
require(nnet)

## Loading required package: nnet

mobile_fit<- multinom(price_range~., data=mobile)

## # weights: 88 (63 variable)
## initial value 2772.588722
## iter 10 value 2278.873193
## iter 20 value 2091.713216
## iter 30 value 2022.764973
## iter 40 value 1903.676281
## iter 50 value 1262.768204
## iter 60 value 845.730700
## iter 70 value 114.102724
## iter 80 value 59.550574
## iter 90 value 52.272073
## iter 100 value 50.459436
## final value 50.459436
## stopped after 100 iterations

summary(mobile_fit)

## Call:
## multinom(formula = price_range ~ ., data = mobile)
##
## Coefficients:
## (Intercept) battery_power blue clock_speed dual_sim fc
## 1 -303.3233 0.07812402 -0.1675040 -1.414468 -1.9927593 -0.08569361
## 2 -698.4733 0.14919727 -0.1240238 -1.007756 -3.0881257 -0.20722002
## 3 -1258.7997 0.22639985 -2.0430114 -1.419961 -0.9882229 -0.43595982
## four_g int_memory m_dep mobile_wt n_cores pc
px_height
## 1 -0.9340613 0.06247778 1.268177 -0.1540870 0.7498262 0.01323991
0.04641030
## 2 -3.6395283 0.18188994 -2.394653 -0.2644901 1.4023570 0.32032953
0.08536856
## 3 -2.6596360 0.36429689 -2.039866 -0.4888186 1.8538620 0.50892860
0.13647732
## px_width ram sc_h sc_w talk_time three_g
## 1 0.04384566 0.1264917 -0.1746131 -0.12264719 -0.2286088 -0.8826741
```

```
## 2 0.08691156 0.2392899 -0.2675052 0.01432578 -0.1958756 0.2280727
## 3 0.13346288 0.3679691 0.2388637 0.23293990 -0.1465138 -0.2401603
## touch_screen wifi
## 1 -0.1437923 -2.462186
## 2 -1.5084518 -6.376919
## 3 -3.3619333 -10.615380
##
## Std. Errors:
## (Intercept) battery_power blue clock_speed dual_sim fc
## 1 0.002103281 0.001674641 0.23323024 0.3127158 0.2655237 0.1732664
## 2 0.004669525 0.001939570 0.18973144 0.2989930 0.3539950 0.2289064
## 3 0.003351228 0.002239402 0.08207498 0.2535087 0.2411639 0.3229582
## four_g int_memory m_dep mobile_wt n_cores pc
px_height
## 1 0.1499019 0.03296092 0.13460349 0.02010530 0.2400660 0.1386194
0.001963515
## 2 0.2590706 0.04384748 0.15540335 0.02408642 0.3120130 0.1610439
0.002558076
## 3 0.1882883 0.05200537 0.09544672 0.03029524 0.3692456 0.2058391
0.002793424
## px_width ram sc_h sc_w talk_time three_g
touch_screen
## 1 0.002157978 0.001998714 0.1669912 0.1658079 0.08943871 0.1984570
0.1743907
## 2 0.002558105 0.002256751 0.2065236 0.2218165 0.12636500 0.2479001
0.3403630
## 3 0.003001403 0.002461947 0.2474521 0.2575421 0.14905948 0.1658275
0.2422977
## wifi
## 1 0.2740933
## 2 0.3454778
## 3 0.2364156
##
## Residual Deviance: 100.9189
## AIC: 226.9189
```

Let's conduct variable selection to find the best variables for our model. As you can see here, the variable selection attempts to find the best model that has the smallest AIC (it provides a mean for model selection), so let's use these variables to build our best model:

```
mobile_back <- step(mobile_fit, direction = "both")

## Start: AIC=226.92
## price_range ~ battery_power + blue + clock_speed + dual_sim +
## fc + four_g + int_memory + m_dep + mobile_wt + n_cores +
## pc + px_height + px_width + ram + sc_h + sc_w + talk_time +
## three_g + touch_screen + wifi
##
## trying - battery_power
## # weights: 84 (60 variable)
```

```
## initial value 2772.588722
## iter 10 value 2313.490685
## iter 20 value 2091.410663
## iter 30 value 2023.917433
## iter 40 value 1780.534067
## iter 50 value 1249.222994
## iter 60 value 1010.425708
## iter 70 value 773.935814
## iter 80 value 772.805333
## iter 90 value 772.677456
## final value 772.677438
## converged
## trying - blue
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.873685
## iter 20 value 2091.800495
## iter 30 value 2023.412939
## iter 40 value 1899.372856
## iter 50 value 1283.275267
## iter 60 value 757.220148
## iter 70 value 85.325680
## iter 80 value 58.641416
## iter 90 value 52.847635
## iter 100 value 51.569709
## final value 51.569709
## stopped after 100 iterations
## trying - clock_speed
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.877850
## iter 20 value 2092.684851
## iter 30 value 2028.705942
## iter 40 value 1793.542251
## iter 50 value 1245.270288
## iter 60 value 766.708962
## iter 70 value 81.886045
## iter 80 value 57.132719
## iter 90 value 52.021849
## iter 100 value 50.642863
## final value 50.642863
## stopped after 100 iterations
## trying - dual_sim
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.873807
## iter 20 value 2091.895115
## iter 30 value 2025.020714
## iter 40 value 1882.844382
## iter 50 value 1290.227496
```

```
## iter 60 value 754.816661
## iter 70 value 93.574511
## iter 80 value 58.233620
## iter 90 value 52.876013
## iter 100 value 51.442097
## final value 51.442097
## stopped after 100 iterations
## trying - fc
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.912927
## iter 20 value 2091.393309
## iter 30 value 2033.261382
## iter 40 value 1775.604637
## iter 50 value 1168.464018
## iter 60 value 596.518076
## iter 70 value 72.606036
## iter 80 value 57.644823
## iter 90 value 52.568761
## iter 100 value 51.143632
## final value 51.143632
## stopped after 100 iterations
## trying - four_g
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.873585
## iter 20 value 2091.820960
## iter 30 value 2024.690766
## iter 40 value 1888.333759
## iter 50 value 1245.670221
## iter 60 value 750.095309
## iter 70 value 80.985049
## iter 80 value 57.317257
## iter 90 value 53.287087
## iter 100 value 51.937943
## final value 51.937943
## stopped after 100 iterations
## trying - int_memory
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2280.473614
## iter 20 value 2066.750540
## iter 30 value 2012.990660
## iter 40 value 1806.481823
## iter 50 value 1141.789914
## iter 60 value 665.276681
## iter 70 value 85.234048
## iter 80 value 70.397355
## iter 90 value 66.441562
## iter 100 value 65.464843
```

```
## final value 65.464843
## stopped after 100 iterations
## trying - m_dep
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.873725
## iter 20 value 2091.843311
## iter 30 value 2026.344621
## iter 40 value 1891.392040
## iter 50 value 1300.470592
## iter 60 value 753.408396
## iter 70 value 97.931091
## iter 80 value 59.135504
## iter 90 value 53.616902
## iter 100 value 51.965117
## final value 51.965117
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2313.220341
## iter 20 value 2116.138042
## iter 30 value 2036.272349
## iter 40 value 1848.978766
## iter 50 value 1178.311188
## iter 60 value 687.581379
## iter 70 value 139.417136
## iter 80 value 129.868532
## iter 90 value 128.955729
## iter 100 value 128.848668
## final value 128.848668
## stopped after 100 iterations
## trying - n_cores
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.915959
## iter 20 value 2101.396912
## iter 30 value 2041.688644
## iter 40 value 1797.429176
## iter 50 value 1158.330137
## iter 60 value 587.923790
## iter 70 value 79.501812
## iter 80 value 62.772735
## iter 90 value 59.116771
## iter 100 value 58.182676
## final value 58.182676
## stopped after 100 iterations
## trying - pc
## # weights: 84 (60 variable)
## initial value 2772.588722
```



```
## iter 10 value 2279.042383
## iter 20 value 2093.359841
## iter 30 value 2031.131395
## iter 40 value 1802.178269
## iter 50 value 1155.226981
## iter 60 value 627.782915
## iter 70 value 79.256891
## iter 80 value 60.891559
## iter 90 value 55.753003
## iter 100 value 54.410635
## final value 54.410635
## stopped after 100 iterations
## trying - px_height
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2238.969078
## iter 20 value 2103.752564
## iter 30 value 2045.364785
## iter 40 value 1712.071460
## iter 50 value 1185.641645
## iter 60 value 812.094256
## iter 70 value 376.936213
## iter 80 value 372.124950
## iter 90 value 370.158955
## iter 100 value 370.143394
## final value 370.143394
## stopped after 100 iterations
## trying - px_width
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2289.841902
## iter 20 value 2055.064027
## iter 30 value 1989.367399
## iter 40 value 1682.236767
## iter 50 value 1161.231826
## iter 60 value 701.612010
## iter 70 value 365.832328
## iter 80 value 364.402115
## iter 90 value 363.425671
## iter 100 value 363.402615
## final value 363.402615
## stopped after 100 iterations
## trying - ram
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2738.535530
## iter 20 value 2706.110632
## iter 30 value 2694.789913
## iter 40 value 2675.105838
## iter 50 value 2651.610821
```

```
## iter 60 value 2649.741344
## final value 2649.712187
## converged
## trying - sc_h
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2279.132668
## iter 20 value 2115.338935
## iter 30 value 2042.679472
## iter 40 value 1801.050082
## iter 50 value 1174.052253
## iter 60 value 624.850300
## iter 70 value 79.176582
## iter 80 value 60.227575
## iter 90 value 55.619142
## iter 100 value 54.242439
## final value 54.242439
## stopped after 100 iterations
## trying - sc_w
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.918260
## iter 20 value 2093.607225
## iter 30 value 2024.350088
## iter 40 value 1776.445321
## iter 50 value 1161.562228
## iter 60 value 577.497228
## iter 70 value 76.094353
## iter 80 value 56.497651
## iter 90 value 52.254981
## iter 100 value 51.260118
## final value 51.260118
## stopped after 100 iterations
## trying - talk_time
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2279.115564
## iter 20 value 2098.915852
## iter 30 value 2014.366408
## iter 40 value 1813.391331
## iter 50 value 1146.968946
## iter 60 value 629.058519
## iter 70 value 77.337275
## iter 80 value 57.640896
## iter 90 value 52.348575
## iter 100 value 51.182643
## final value 51.182643
## stopped after 100 iterations
## trying - three_g
## # weights: 84 (60 variable)
```

```

## initial value 2772.588722
## iter 10 value 2278.874261
## iter 20 value 2091.929285
## iter 30 value 2025.849240
## iter 40 value 1886.110904
## iter 50 value 1226.167542
## iter 60 value 630.150452
## iter 70 value 75.699639
## iter 80 value 56.372052
## iter 90 value 51.440841
## iter 100 value 49.851922
## final value 49.851922
## stopped after 100 iterations
## trying - touch_screen
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.873809
## iter 20 value 2091.890877
## iter 30 value 2025.580381
## iter 40 value 1881.693241
## iter 50 value 1308.016515
## iter 60 value 717.833430
## iter 70 value 90.539875
## iter 80 value 58.560931
## iter 90 value 52.622995
## iter 100 value 51.065349
## final value 51.065349
## stopped after 100 iterations
## trying - wifi
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.873634
## iter 20 value 2091.821409
## iter 30 value 2024.392192
## iter 40 value 1890.040236
## iter 50 value 1351.650761
## iter 60 value 766.423610
## iter 70 value 93.563739
## iter 80 value 64.184776
## iter 90 value 60.548609
## iter 100 value 59.706593
## final value 59.706593
## stopped after 100 iterations
##           Df      AIC
## - three_g    60 219.7038
## - clock_speed 60 221.2857
## - touch_screen 60 222.1307
## - fc          60 222.2873
## - talk_time   60 222.3653
## - sc_w        60 222.5202

```

```

## - dual_sim      60  222.8842
## - blue          60  223.1394
## - four_g        60  223.8759
## - m_dep         60  223.9302
## <none>          63  226.9189
## - sc_h          60  228.4849
## - pc            60  228.8213
## - n_cores       60  236.3654
## - wifi          60  239.4132
## - int_memory    60  250.9297
## - mobile_wt     60  377.6973
## - px_width      60  846.8052
## - px_height     60  860.2868
## - battery_power 60 1665.3549
## - ram           60 5419.4244
## # weights:  84 (60 variable)
## initial value 2772.588722
## iter  10 value 2278.874261
## iter  20 value 2091.929285
## iter  30 value 2025.849240
## iter  40 value 1886.110904
## iter  50 value 1226.167542
## iter  60 value 630.150452
## iter  70 value 75.699639
## iter  80 value 56.372052
## iter  90 value 51.440841
## iter 100 value 49.851922
## final value 49.851922
## stopped after 100 iterations
##
## Step:  AIC=219.7
## price_range ~ battery_power + blue + clock_speed + dual_sim +
##      fc + four_g + int_memory + m_dep + mobile_wt + n_cores +
##      pc + px_height + px_width + ram + sc_h + sc_w + talk_time +
##      touch_screen + wifi
##
## trying - battery_power
## # weights:  80 (57 variable)
## initial value 2772.588722
## iter  10 value 2313.490616
## iter  20 value 2091.970717
## iter  30 value 2027.367949
## iter  40 value 1642.722374
## iter  50 value 1225.130122
## iter  60 value 821.244849
## iter  70 value 775.112661
## iter  80 value 774.637209
## final value 774.591090
## converged
## trying - blue

```

```
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.874753
## iter 20 value 2092.016505
## iter 30 value 2026.461669
## iter 40 value 1881.751487
## iter 50 value 1228.338011
## iter 60 value 358.523605
## iter 70 value 66.892912
## iter 80 value 55.249600
## iter 90 value 52.246179
## iter 100 value 51.193664
## final value 51.193664
## stopped after 100 iterations
## trying - clock_speed
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.878918
## iter 20 value 2092.900240
## iter 30 value 2032.011536
## iter 40 value 1821.422536
## iter 50 value 1266.350798
## iter 60 value 375.700711
## iter 70 value 69.697366
## iter 80 value 55.671539
## iter 90 value 51.728247
## iter 100 value 50.717201
## final value 50.717201
## stopped after 100 iterations
## trying - dual_sim
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.874875
## iter 20 value 2092.111126
## iter 30 value 2028.198506
## iter 40 value 1870.668873
## iter 50 value 1244.157967
## iter 60 value 473.371857
## iter 70 value 67.792764
## iter 80 value 56.788427
## iter 90 value 52.654583
## iter 100 value 51.522785
## final value 51.522785
## stopped after 100 iterations
## trying - fc
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.913995
## iter 20 value 2091.609652
## iter 30 value 2035.907422
```

```
## iter 40 value 1697.018890
## iter 50 value 1116.280510
## iter 60 value 331.931305
## iter 70 value 65.899571
## iter 80 value 55.297468
## iter 90 value 52.093341
## iter 100 value 50.685671
## final value 50.685671
## stopped after 100 iterations
## trying - four_g
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.874653
## iter 20 value 2092.037961
## iter 30 value 2027.833186
## iter 40 value 1879.305051
## iter 50 value 1237.819387
## iter 60 value 342.088638
## iter 70 value 70.713180
## iter 80 value 57.000342
## iter 90 value 52.864630
## iter 100 value 51.472094
## final value 51.472094
## stopped after 100 iterations
## trying - int_memory
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2280.474681
## iter 20 value 2067.286767
## iter 30 value 2015.651676
## iter 40 value 1694.465006
## iter 50 value 1141.017870
## iter 60 value 327.888677
## iter 70 value 77.138948
## iter 80 value 68.545188
## iter 90 value 66.282803
## iter 100 value 65.871305
## final value 65.871305
## stopped after 100 iterations
## trying - m_dep
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.874793
## iter 20 value 2092.059377
## iter 30 value 2029.594079
## iter 40 value 1880.563709
## iter 50 value 1253.660867
## iter 60 value 543.571413
## iter 70 value 70.067317
## iter 80 value 56.604202
```

```
## iter 90 value 52.440846
## iter 100 value 51.200726
## final value 51.200726
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2313.220982
## iter 20 value 2117.562105
## iter 30 value 2040.872988
## iter 40 value 1761.566015
## iter 50 value 1061.467474
## iter 60 value 437.263270
## iter 70 value 136.255756
## iter 80 value 131.702882
## iter 90 value 131.286675
## iter 100 value 131.220640
## final value 131.220640
## stopped after 100 iterations
## trying - n_cores
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.917027
## iter 20 value 2101.613249
## iter 30 value 2043.094274
## iter 40 value 1726.561769
## iter 50 value 1106.016950
## iter 60 value 317.642392
## iter 70 value 72.552971
## iter 80 value 61.479715
## iter 90 value 59.137454
## iter 100 value 58.408353
## final value 58.408353
## stopped after 100 iterations
## trying - pc
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2279.043452
## iter 20 value 2093.586348
## iter 30 value 2028.270748
## iter 40 value 1692.033119
## iter 50 value 1076.045232
## iter 60 value 364.150116
## iter 70 value 69.570578
## iter 80 value 58.415992
## iter 90 value 55.082513
## iter 100 value 54.101604
## final value 54.101604
## stopped after 100 iterations
## trying - px_height
```

```
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2238.974218
## iter 20 value 2104.604301
## iter 30 value 2048.888374
## iter 40 value 1631.173163
## iter 50 value 1117.782381
## iter 60 value 594.002249
## iter 70 value 374.554622
## iter 80 value 371.457307
## iter 90 value 370.208192
## iter 100 value 370.194435
## final value 370.194435
## stopped after 100 iterations
## trying - px_width
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2289.843054
## iter 20 value 2055.700442
## iter 30 value 1992.012857
## iter 40 value 1638.082827
## iter 50 value 1061.618732
## iter 60 value 479.771859
## iter 70 value 368.863173
## iter 80 value 366.508913
## iter 90 value 366.145788
## iter 100 value 366.132573
## final value 366.132573
## stopped after 100 iterations
## trying - ram
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2738.535628
## iter 20 value 2706.234391
## iter 30 value 2696.255659
## iter 40 value 2677.157304
## iter 50 value 2652.869332
## iter 60 value 2651.483282
## final value 2651.474081
## converged
## trying - sc_h
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2279.133736
## iter 20 value 2115.573924
## iter 30 value 2043.849913
## iter 40 value 1706.792875
## iter 50 value 1117.905955
## iter 60 value 348.936337
## iter 70 value 72.015341
```



```
## iter 80 value 58.828244
## iter 90 value 55.661416
## iter 100 value 54.567777
## final value 54.567777
## stopped after 100 iterations
## trying - sc_w
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.919328
## iter 20 value 2093.827297
## iter 30 value 2025.367339
## iter 40 value 1677.529550
## iter 50 value 1135.399126
## iter 60 value 343.161972
## iter 70 value 67.065654
## iter 80 value 55.129650
## iter 90 value 52.074809
## iter 100 value 51.220913
## final value 51.220913
## stopped after 100 iterations
## trying - talk_time
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2279.116632
## iter 20 value 2099.167476
## iter 30 value 2017.431443
## iter 40 value 1702.202272
## iter 50 value 1123.661178
## iter 60 value 327.012702
## iter 70 value 68.371474
## iter 80 value 54.949977
## iter 90 value 51.877284
## iter 100 value 50.995813
## final value 50.995813
## stopped after 100 iterations
## trying - touch_screen
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.874878
## iter 20 value 2092.106939
## iter 30 value 2028.716034
## iter 40 value 1872.978496
## iter 50 value 1261.003465
## iter 60 value 404.686881
## iter 70 value 70.427919
## iter 80 value 57.530734
## iter 90 value 52.113271
## iter 100 value 50.805568
## final value 50.805568
## stopped after 100 iterations
```

```

## trying - wifi
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.874702
## iter 20 value 2092.037477
## iter 30 value 2027.608392
## iter 40 value 1894.418676
## iter 50 value 1225.857519
## iter 60 value 375.509315
## iter 70 value 73.441161
## iter 80 value 62.988280
## iter 90 value 60.479686
## iter 100 value 59.867262
## final value 59.867262
## stopped after 100 iterations
## trying + three_g
## # weights: 88 (63 variable)
## initial value 2772.588722
## iter 10 value 2278.873193
## iter 20 value 2091.713216
## iter 30 value 2022.764973
## iter 40 value 1903.676281
## iter 50 value 1262.768204
## iter 60 value 845.730701
## iter 70 value 114.102724
## iter 80 value 59.550574
## iter 90 value 52.272073
## iter 100 value 50.459436
## final value 50.459436
## stopped after 100 iterations
##           Df      AIC
## - fc          57 215.3713
## - clock_speed  57 215.4344
## - touch_screen 57 215.6111
## - talk_time    57 215.9916
## - blue         57 216.3873
## - m_dep        57 216.4015
## - sc_w         57 216.4418
## - four_g       57 216.9442
## - dual_sim     57 217.0456
## <none>        60 219.7038
## - pc          57 222.2032
## - sc_h        57 223.1356
## + +three_g    63 226.9189
## - n_cores     57 230.8167
## - wifi        57 233.7345
## - int_memory  57 245.7426
## - mobile_wt   57 376.4413
## - px_width    57 846.2651
## - px_height   57 854.3889

```

```
## - battery_power 57 1663.1822
## - ram           57 5416.9482
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.913995
## iter 20 value 2091.609652
## iter 30 value 2035.907422
## iter 40 value 1697.018890
## iter 50 value 1116.280510
## iter 60 value 331.931305
## iter 70 value 65.899571
## iter 80 value 55.297468
## iter 90 value 52.093341
## iter 100 value 50.685671
## final value 50.685671
## stopped after 100 iterations
##
## Step: AIC=215.37
## price_range ~ battery_power + blue + clock_speed + dual_sim +
##   four_g + int_memory + m_dep + mobile_wt + n_cores + pc +
##   px_height + px_width + ram + sc_h + sc_w + talk_time + touch_screen +
##   wifi
##
## trying - battery_power
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2313.437965
## iter 20 value 2091.026207
## iter 30 value 2024.811981
## iter 40 value 1447.521969
## iter 50 value 1162.769380
## iter 60 value 787.487109
## iter 70 value 776.250890
## iter 80 value 776.047697
## final value 776.044133
## converged
## trying - blue
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.914488
## iter 20 value 2091.697243
## iter 30 value 2036.377992
## iter 40 value 1699.012660
## iter 50 value 965.835808
## iter 60 value 183.266245
## iter 70 value 63.773069
## iter 80 value 55.329003
## iter 90 value 52.896571
## iter 100 value 52.212180
## final value 52.212180
```

```
## stopped after 100 iterations
## trying - clock_speed
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.918653
## iter 20 value 2092.586331
## iter 30 value 2039.086353
## iter 40 value 1640.857335
## iter 50 value 1039.892599
## iter 60 value 191.352877
## iter 70 value 64.145955
## iter 80 value 54.666297
## iter 90 value 52.138417
## iter 100 value 51.573687
## final value 51.573687
## stopped after 100 iterations
## trying - dual_sim
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.914609
## iter 20 value 2091.788790
## iter 30 value 2036.133018
## iter 40 value 1696.955763
## iter 50 value 1044.900158
## iter 60 value 219.831154
## iter 70 value 63.619096
## iter 80 value 55.815518
## iter 90 value 53.118808
## iter 100 value 52.611820
## final value 52.611820
## stopped after 100 iterations
## trying - four_g
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.914387
## iter 20 value 2091.717611
## iter 30 value 2037.476451
## iter 40 value 1690.491814
## iter 50 value 1021.171981
## iter 60 value 186.349870
## iter 70 value 64.717441
## iter 80 value 55.370044
## iter 90 value 52.875169
## iter 100 value 52.140318
## final value 52.140318
## stopped after 100 iterations
## trying - int_memory
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2280.514238
```

```
## iter 20 value 2086.348075
## iter 30 value 2021.913171
## iter 40 value 1456.283109
## iter 50 value 954.765606
## iter 60 value 163.978297
## iter 70 value 74.292421
## iter 80 value 68.489679
## iter 90 value 67.070004
## iter 100 value 66.729196
## final value 66.729196
## stopped after 100 iterations
## trying - m_dep
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.914528
## iter 20 value 2091.738751
## iter 30 value 2037.186989
## iter 40 value 1687.003034
## iter 50 value 1039.866659
## iter 60 value 236.550339
## iter 70 value 64.994591
## iter 80 value 55.790553
## iter 90 value 53.319713
## iter 100 value 52.531574
## final value 52.531574
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2313.244793
## iter 20 value 2113.377195
## iter 30 value 2033.624156
## iter 40 value 1498.271730
## iter 50 value 972.223344
## iter 60 value 184.380594
## iter 70 value 133.862332
## iter 80 value 132.023436
## iter 90 value 131.871807
## iter 100 value 131.763083
## final value 131.763083
## stopped after 100 iterations
## trying - n_cores
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.956758
## iter 20 value 2101.267924
## iter 30 value 2031.576100
## iter 40 value 1496.880710
## iter 50 value 957.297302
## iter 60 value 223.451029
```

```
## iter 70 value 68.626449
## iter 80 value 61.227015
## iter 90 value 59.833862
## iter 100 value 59.578941
## final value 59.578941
## stopped after 100 iterations
## trying - pc
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2279.083606
## iter 20 value 2096.923490
## iter 30 value 2014.845903
## iter 40 value 1470.971580
## iter 50 value 911.280622
## iter 60 value 159.470099
## iter 70 value 65.141630
## iter 80 value 57.429490
## iter 90 value 55.354154
## iter 100 value 54.824565
## final value 54.824565
## stopped after 100 iterations
## trying - px_height
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2239.151877
## iter 20 value 2102.790196
## iter 30 value 2044.525251
## iter 40 value 1460.800584
## iter 50 value 1004.478648
## iter 60 value 432.539571
## iter 70 value 374.297598
## iter 80 value 371.834593
## iter 90 value 371.571899
## iter 100 value 371.568971
## final value 371.568971
## stopped after 100 iterations
## trying - px_width
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2289.880893
## iter 20 value 2053.524773
## iter 30 value 1987.712754
## iter 40 value 1352.615265
## iter 50 value 964.267266
## iter 60 value 386.729341
## iter 70 value 370.002246
## iter 80 value 367.655745
## iter 90 value 367.578026
## iter 100 value 367.556881
## final value 367.556881
```

```
## stopped after 100 iterations
## trying - ram
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2738.545613
## iter 20 value 2706.163741
## iter 30 value 2694.902232
## iter 40 value 2667.323019
## iter 50 value 2653.125902
## iter 60 value 2652.212500
## iter 60 value 2652.212500
## iter 60 value 2652.212500
## final value 2652.212500
## converged
## trying - sc_h
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2279.173461
## iter 20 value 2115.146374
## iter 30 value 2040.214045
## iter 40 value 1469.012493
## iter 50 value 978.883374
## iter 60 value 173.238481
## iter 70 value 64.422050
## iter 80 value 57.937643
## iter 90 value 55.943547
## iter 100 value 55.376119
## final value 55.376119
## stopped after 100 iterations
## trying - sc_w
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.959060
## iter 20 value 2093.563287
## iter 30 value 2020.134868
## iter 40 value 1473.307902
## iter 50 value 889.308501
## iter 60 value 145.129250
## iter 70 value 60.762748
## iter 80 value 54.165932
## iter 90 value 52.452919
## iter 100 value 51.890490
## final value 51.890490
## stopped after 100 iterations
## trying - talk_time
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2279.156347
## iter 20 value 2098.767306
## iter 30 value 2024.600542
```

```
## iter 40 value 1456.399897
## iter 50 value 901.184240
## iter 60 value 142.627728
## iter 70 value 62.021411
## iter 80 value 54.374105
## iter 90 value 52.361026
## iter 100 value 51.756438
## final value 51.756438
## stopped after 100 iterations
## trying - touch_screen
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.914612
## iter 20 value 2091.786347
## iter 30 value 2036.535036
## iter 40 value 1700.590483
## iter 50 value 1153.502508
## iter 60 value 242.507535
## iter 70 value 67.296887
## iter 80 value 55.470193
## iter 90 value 52.653784
## iter 100 value 51.942539
## final value 51.942539
## stopped after 100 iterations
## trying - wifi
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.914437
## iter 20 value 2091.717344
## iter 30 value 2037.359912
## iter 40 value 1703.686204
## iter 50 value 1118.225137
## iter 60 value 221.757013
## iter 70 value 68.534051
## iter 80 value 61.304283
## iter 90 value 60.067986
## iter 100 value 59.733621
## final value 59.733621
## stopped after 100 iterations
## trying + fc
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.874261
## iter 20 value 2091.929285
## iter 30 value 2025.849239
## iter 40 value 1886.110905
## iter 50 value 1226.167662
## iter 60 value 630.153103
## iter 70 value 75.699751
## iter 80 value 56.372045
```



```

## iter 90 value 51.440850
## iter 100 value 49.851921
## final value 49.851921
## stopped after 100 iterations
## trying + three_g
## # weights: 84 (60 variable)
## initial value 2772.588722
## iter 10 value 2278.912927
## iter 20 value 2091.393309
## iter 30 value 2033.261382
## iter 40 value 1775.604637
## iter 50 value 1168.464018
## iter 60 value 596.518076
## iter 70 value 72.606036
## iter 80 value 57.644823
## iter 90 value 52.568761
## iter 100 value 51.143632
## final value 51.143632
## stopped after 100 iterations
##           Df      AIC
## - clock_speed 54 211.1474
## - talk_time   54 211.5129
## - sc_w         54 211.7810
## - touch_screen 54 211.8851
## - four_g       54 212.2806
## - blue         54 212.4244
## - m_dep        54 213.0631
## - dual_sim     54 213.2236
## <none>         57 215.3713
## - pc           54 217.6491
## - sc_h         54 218.7522
## + +fc          60 219.7038
## + +three_g     60 222.2873
## - n_cores      54 227.1579
## - wifi         54 227.4672
## - int_memory   54 241.4584
## - mobile_wt    54 371.5262
## - px_width     54 843.1138
## - px_height    54 851.1379
## - battery_power 54 1660.0883
## - ram          54 5412.4250
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.918653
## iter 20 value 2092.586331
## iter 30 value 2039.086353
## iter 40 value 1640.857335
## iter 50 value 1039.892599
## iter 60 value 191.352877
## iter 70 value 64.145955

```

```
## iter 80 value 54.666297
## iter 90 value 52.138417
## iter 100 value 51.573687
## final value 51.573687
## stopped after 100 iterations
##
## Step: AIC=211.15
## price_range ~ battery_power + blue + dual_sim + four_g + int_memory +
## m_dep + mobile_wt + n_cores + pc + px_height + px_width +
## ram + sc_h + sc_w + talk_time + touch_screen + wifi
##
## trying - battery_power
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2313.439042
## iter 20 value 2094.329534
## iter 30 value 2023.073115
## iter 40 value 1413.090683
## iter 50 value 1060.189996
## iter 60 value 779.460932
## iter 70 value 777.462666
## iter 80 value 777.292897
## final value 777.292758
## converged
## trying - blue
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919146
## iter 20 value 2092.674422
## iter 30 value 2043.069864
## iter 40 value 1609.798677
## iter 50 value 948.068044
## iter 60 value 114.019237
## iter 70 value 61.603394
## iter 80 value 55.548253
## iter 90 value 53.536611
## iter 100 value 53.123646
## final value 53.123646
## stopped after 100 iterations
## trying - dual_sim
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919267
## iter 20 value 2092.765115
## iter 30 value 2043.891833
## iter 40 value 1596.661483
## iter 50 value 993.809179
## iter 60 value 168.575052
## iter 70 value 61.993240
## iter 80 value 55.858697
```

```
## iter 90 value 54.003973
## iter 100 value 53.766499
## final value 53.766499
## stopped after 100 iterations
## trying - four_g
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919045
## iter 20 value 2092.693632
## iter 30 value 2044.083762
## iter 40 value 1607.201006
## iter 50 value 1023.757013
## iter 60 value 118.868665
## iter 70 value 60.872162
## iter 80 value 54.843636
## iter 90 value 52.968678
## iter 100 value 52.689525
## final value 52.689525
## stopped after 100 iterations
## trying - int_memory
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2280.518894
## iter 20 value 2089.345696
## iter 30 value 2021.820631
## iter 40 value 1490.260804
## iter 50 value 895.337165
## iter 60 value 158.426375
## iter 70 value 74.377385
## iter 80 value 69.879045
## iter 90 value 68.711819
## iter 100 value 68.530984
## final value 68.530984
## stopped after 100 iterations
## trying - m_dep
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919185
## iter 20 value 2092.715079
## iter 30 value 2045.562062
## iter 40 value 1486.652250
## iter 50 value 989.796022
## iter 60 value 123.704930
## iter 70 value 60.924178
## iter 80 value 55.007485
## iter 90 value 53.619525
## iter 100 value 53.201427
## final value 53.201427
## stopped after 100 iterations
## trying - mobile_wt
```

```
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2313.247546
## iter 20 value 2119.410721
## iter 30 value 2033.512746
## iter 40 value 1454.337160
## iter 50 value 803.006103
## iter 60 value 154.273934
## iter 70 value 135.077449
## iter 80 value 134.182570
## iter 90 value 134.096799
## iter 100 value 133.955462
## final value 133.955462
## stopped after 100 iterations
## trying - n_cores
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.961416
## iter 20 value 2102.236975
## iter 30 value 2026.630798
## iter 40 value 1451.525729
## iter 50 value 752.899990
## iter 60 value 106.793141
## iter 70 value 66.141048
## iter 80 value 61.808834
## iter 90 value 60.852044
## iter 100 value 60.678848
## final value 60.678848
## stopped after 100 iterations
## trying - pc
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2279.088264
## iter 20 value 2097.984090
## iter 30 value 2009.729947
## iter 40 value 1389.957914
## iter 50 value 860.691144
## iter 60 value 125.026592
## iter 70 value 64.082853
## iter 80 value 59.249632
## iter 90 value 57.899190
## iter 100 value 57.718396
## final value 57.718396
## stopped after 100 iterations
## trying - px_height
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2239.174103
## iter 20 value 2106.060629
## iter 30 value 2037.660865
```

```
## iter 40 value 1324.912370
## iter 50 value 925.767162
## iter 60 value 380.082102
## iter 70 value 375.315400
## iter 80 value 372.709537
## iter 90 value 372.674199
## iter 100 value 372.615438
## final value 372.615438
## stopped after 100 iterations
## trying - px_width
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2289.887628
## iter 20 value 2057.354945
## iter 30 value 1984.320020
## iter 40 value 1288.695864
## iter 50 value 876.278879
## iter 60 value 370.985928
## iter 70 value 369.306541
## iter 80 value 368.056946
## iter 90 value 368.028422
## iter 100 value 367.976077
## final value 367.976077
## stopped after 100 iterations
## trying - ram
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2738.547406
## iter 20 value 2707.125631
## iter 30 value 2697.257697
## iter 40 value 2661.436676
## iter 50 value 2653.159819
## final value 2652.871284
## converged
## trying - sc_h
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2279.178118
## iter 20 value 2116.193609
## iter 30 value 2044.621892
## iter 40 value 1402.415746
## iter 50 value 958.720928
## iter 60 value 113.175447
## iter 70 value 62.037588
## iter 80 value 57.776727
## iter 90 value 56.675408
## iter 100 value 56.443365
## final value 56.443365
## stopped after 100 iterations
## trying - sc_w
```

```
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.963718
## iter 20 value 2094.556355
## iter 30 value 2018.115134
## iter 40 value 1352.444301
## iter 50 value 868.842336
## iter 60 value 115.332263
## iter 70 value 61.492409
## iter 80 value 54.665924
## iter 90 value 52.813110
## iter 100 value 52.493960
## final value 52.493960
## stopped after 100 iterations
## trying - talk_time
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2279.161003
## iter 20 value 2099.953334
## iter 30 value 2019.084231
## iter 40 value 1405.330195
## iter 50 value 946.059055
## iter 60 value 109.812779
## iter 70 value 59.679608
## iter 80 value 54.248464
## iter 90 value 53.042453
## iter 100 value 52.725338
## final value 52.725338
## stopped after 100 iterations
## trying - touch_screen
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919270
## iter 20 value 2092.762859
## iter 30 value 2044.502538
## iter 40 value 1615.722821
## iter 50 value 965.599386
## iter 60 value 118.259229
## iter 70 value 60.958882
## iter 80 value 54.881375
## iter 90 value 53.089864
## iter 100 value 52.582333
## final value 52.582333
## stopped after 100 iterations
## trying - wifi
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919095
## iter 20 value 2092.693829
## iter 30 value 2044.268272
```

```
## iter 40 value 1619.071380
## iter 50 value 1048.979170
## iter 60 value 111.431208
## iter 70 value 66.201458
## iter 80 value 61.950943
## iter 90 value 61.188668
## iter 100 value 60.986307
## final value 60.986307
## stopped after 100 iterations
## trying + clock_speed
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.913995
## iter 20 value 2091.609652
## iter 30 value 2035.907418
## iter 40 value 1697.018801
## iter 50 value 1116.279495
## iter 60 value 331.942851
## iter 70 value 65.899311
## iter 80 value 55.297492
## iter 90 value 52.093375
## iter 100 value 50.685690
## final value 50.685690
## stopped after 100 iterations
## trying + fc
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.878918
## iter 20 value 2092.900240
## iter 30 value 2032.011535
## iter 40 value 1821.422526
## iter 50 value 1266.350936
## iter 60 value 375.700723
## iter 70 value 69.697372
## iter 80 value 55.671539
## iter 90 value 51.728247
## iter 100 value 50.717200
## final value 50.717200
## stopped after 100 iterations
## trying + three_g
## # weights: 80 (57 variable)
## initial value 2772.588722
## iter 10 value 2278.917585
## iter 20 value 2092.370654
## iter 30 value 2036.584214
## iter 40 value 1624.950831
## iter 50 value 1097.288701
## iter 60 value 391.266831
## iter 70 value 65.897467
## iter 80 value 55.997558
```

```

## iter 90 value 52.503075
## iter 100 value 51.407732
## final value 51.407732
## stopped after 100 iterations
##           Df          AIC
## - sc_w          51  206.9879
## - touch_screen  51  207.1647
## - four_g         51  207.3791
## - talk_time      51  207.4507
## - blue           51  208.2473
## - m_dep          51  208.4029
## - dual_sim       51  209.5330
## <none>          54  211.1474
## - sc_h           51  214.8867
## + +clock_speed  57  215.3714
## + +fc           57  215.4344
## + +three_g      57  216.8155
## - pc            51  217.4368
## - n_cores       51  223.3577
## - wifi          51  223.9726
## - int_memory    51  239.0620
## - mobile_wt     51  369.9109
## - px_width      51  837.9522
## - px_height     51  847.2309
## - battery_power 51 1656.5855
## - ram           51 5407.7426
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.963718
## iter 20 value 2094.556355
## iter 30 value 2018.115134
## iter 40 value 1352.444301
## iter 50 value 868.842336
## iter 60 value 115.332263
## iter 70 value 61.492409
## iter 80 value 54.665924
## iter 90 value 52.813110
## iter 100 value 52.493960
## final value 52.493960
## stopped after 100 iterations
##
## Step: AIC=206.99
## price_range ~ battery_power + blue + dual_sim + four_g + int_memory +
##             m_dep + mobile_wt + n_cores + pc + px_height + px_width +
##             ram + sc_h + talk_time + touch_screen + wifi
##
## trying - battery_power
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2313.460465

```



```
## iter 20 value 2098.160461
## iter 30 value 1971.882903
## iter 40 value 1273.622374
## iter 50 value 890.445570
## iter 60 value 779.350854
## iter 70 value 778.440070
## iter 80 value 778.342684
## iter 80 value 778.342679
## iter 80 value 778.342679
## final value 778.342679
## converged
## trying - blue
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964210
## iter 20 value 2094.645349
## iter 30 value 2013.889603
## iter 40 value 1417.453152
## iter 50 value 654.560885
## iter 60 value 77.889804
## iter 70 value 58.502510
## iter 80 value 54.945998
## iter 90 value 54.438480
## iter 100 value 54.321179
## final value 54.321179
## stopped after 100 iterations
## trying - dual_sim
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964332
## iter 20 value 2094.735771
## iter 30 value 2009.668103
## iter 40 value 1508.082606
## iter 50 value 647.396928
## iter 60 value 82.802409
## iter 70 value 59.516821
## iter 80 value 55.639016
## iter 90 value 54.648661
## iter 100 value 54.475998
## final value 54.475998
## stopped after 100 iterations
## trying - four_g
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964110
## iter 20 value 2094.665281
## iter 30 value 2015.492078
## iter 40 value 1463.627293
## iter 50 value 588.964693
## iter 60 value 77.864234
```

```
## iter 70 value 59.756294
## iter 80 value 54.507754
## iter 90 value 53.332599
## iter 100 value 53.154779
## final value 53.154779
## stopped after 100 iterations
## trying - int_memory
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2280.564060
## iter 20 value 2085.117962
## iter 30 value 1956.316215
## iter 40 value 1298.066823
## iter 50 value 424.835120
## iter 60 value 82.116256
## iter 70 value 71.906951
## iter 80 value 69.656220
## iter 90 value 69.248617
## iter 100 value 69.201064
## final value 69.201064
## stopped after 100 iterations
## trying - m_dep
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964250
## iter 20 value 2094.685248
## iter 30 value 2017.984030
## iter 40 value 1308.980497
## iter 50 value 669.922266
## iter 60 value 76.817571
## iter 70 value 58.836504
## iter 80 value 54.690111
## iter 90 value 54.008384
## iter 100 value 53.891079
## final value 53.891079
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2313.273518
## iter 20 value 2123.226361
## iter 30 value 1960.685837
## iter 40 value 1323.381698
## iter 50 value 508.100799
## iter 60 value 140.131262
## iter 70 value 135.682306
## iter 80 value 135.297741
## iter 90 value 135.215473
## iter 100 value 134.980228
## final value 134.980228
```

```
## stopped after 100 iterations
## trying - n_cores
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2279.006480
## iter 20 value 2104.416748
## iter 30 value 1990.075045
## iter 40 value 1224.964152
## iter 50 value 543.073880
## iter 60 value 76.250055
## iter 70 value 63.662616
## iter 80 value 61.802127
## iter 90 value 61.485355
## iter 100 value 61.424880
## final value 61.424880
## stopped after 100 iterations
## trying - pc
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2279.133311
## iter 20 value 2100.032475
## iter 30 value 1954.176430
## iter 40 value 1203.377587
## iter 50 value 472.513569
## iter 60 value 78.489481
## iter 70 value 63.053122
## iter 80 value 59.226307
## iter 90 value 58.656589
## iter 100 value 58.571537
## final value 58.571537
## stopped after 100 iterations
## trying - px_height
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2239.386718
## iter 20 value 2108.067383
## iter 30 value 2021.436207
## iter 40 value 1224.559497
## iter 50 value 637.672998
## iter 60 value 377.810043
## iter 70 value 374.064522
## iter 80 value 373.179927
## iter 90 value 373.167805
## iter 100 value 373.146855
## final value 373.146855
## stopped after 100 iterations
## trying - px_width
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2289.977749
```

```
## iter 20 value 2062.471024
## iter 30 value 1957.273025
## iter 40 value 1188.854722
## iter 50 value 593.273706
## iter 60 value 371.340521
## iter 70 value 370.034314
## iter 80 value 369.410485
## iter 90 value 369.365443
## iter 100 value 369.299124
## final value 369.299124
## stopped after 100 iterations
## trying - ram
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2738.562733
## iter 20 value 2708.871562
## iter 30 value 2691.900960
## iter 40 value 2658.910389
## iter 50 value 2654.200619
## final value 2654.117632
## converged
## trying - sc_h
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2279.223410
## iter 20 value 2111.005844
## iter 30 value 2015.065038
## iter 40 value 1205.781583
## iter 50 value 479.364923
## iter 60 value 75.698251
## iter 70 value 62.957825
## iter 80 value 59.789551
## iter 90 value 59.226181
## iter 100 value 59.131868
## final value 59.131868
## stopped after 100 iterations
## trying - talk_time
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2279.206039
## iter 20 value 2101.645078
## iter 30 value 1980.410970
## iter 40 value 1198.764184
## iter 50 value 423.713408
## iter 60 value 76.371027
## iter 70 value 58.790819
## iter 80 value 54.454513
## iter 90 value 53.793355
## iter 100 value 53.590463
## final value 53.590463
```

```
## stopped after 100 iterations
## trying - touch_screen
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964335
## iter 20 value 2094.735269
## iter 30 value 2013.013660
## iter 40 value 1424.289692
## iter 50 value 697.740619
## iter 60 value 76.849353
## iter 70 value 58.753265
## iter 80 value 54.390418
## iter 90 value 53.604042
## iter 100 value 53.420623
## final value 53.420623
## stopped after 100 iterations
## trying - wifi
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964159
## iter 20 value 2094.666093
## iter 30 value 2014.862146
## iter 40 value 1415.228839
## iter 50 value 712.415128
## iter 60 value 77.085680
## iter 70 value 64.659210
## iter 80 value 62.171667
## iter 90 value 61.749313
## iter 100 value 61.668350
## final value 61.668350
## stopped after 100 iterations
## trying + clock_speed
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.959060
## iter 20 value 2093.563287
## iter 30 value 2020.134868
## iter 40 value 1473.307906
## iter 50 value 889.308933
## iter 60 value 145.129413
## iter 70 value 60.762759
## iter 80 value 54.165941
## iter 90 value 52.452924
## iter 100 value 51.890492
## final value 51.890492
## stopped after 100 iterations
## trying + fc
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.923986
```

```

## iter 20 value 2094.815488
## iter 30 value 2017.037221
## iter 40 value 1615.186093
## iter 50 value 1047.119398
## iter 60 value 210.421983
## iter 70 value 65.274016
## iter 80 value 54.701002
## iter 90 value 51.978430
## iter 100 value 51.490452
## final value 51.490452
## stopped after 100 iterations
## trying + sc_w
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.918653
## iter 20 value 2092.586331
## iter 30 value 2039.086353
## iter 40 value 1640.857338
## iter 50 value 1039.892598
## iter 60 value 191.352891
## iter 70 value 64.145955
## iter 80 value 54.666297
## iter 90 value 52.138417
## iter 100 value 51.573687
## final value 51.573687
## stopped after 100 iterations
## trying + three_g
## # weights: 76 (54 variable)
## initial value 2772.588722
## iter 10 value 2278.962649
## iter 20 value 2094.336886
## iter 30 value 2021.515780
## iter 40 value 1368.653267
## iter 50 value 954.147822
## iter 60 value 163.264978
## iter 70 value 61.057545
## iter 80 value 54.504245
## iter 90 value 52.572193
## iter 100 value 52.130946
## final value 52.130946
## stopped after 100 iterations
##
##           Df      AIC
## - four_g    48  202.3096
## - touch_screen 48  202.8412
## - talk_time  48  203.1809
## - m_dep      48  203.7822
## - blue       48  204.6424
## - dual_sim   48  204.9520
## <none>       51  206.9879
## + +fc       54  210.9809

```

```

## + +sc_w          54  211.1474
## + +clock_speed  54  211.7810
## + +three_g      54  212.2619
## - pc            48  213.1431
## - sc_h          48  214.2637
## - n_cores       48  218.8498
## - wifi          48  219.3367
## - int_memory    48  234.4021
## - mobile_wt     48  365.9605
## - px_width      48  834.5982
## - px_height     48  842.2937
## - battery_power 48 1652.6854
## - ram           48 5404.2353
## # weights:  68 (48 variable)
## initial value 2772.588722
## iter  10 value 2278.964110
## iter  20 value 2094.665281
## iter  30 value 2015.492078
## iter  40 value 1463.627293
## iter  50 value 588.964693
## iter  60 value 77.864234
## iter  70 value 59.756294
## iter  80 value 54.507754
## iter  90 value 53.332599
## iter 100 value 53.154779
## final value 53.154779
## stopped after 100 iterations
##
## Step:  AIC=202.31
## price_range ~ battery_power + blue + dual_sim + int_memory +
##      m_dep + mobile_wt + n_cores + pc + px_height + px_width +
##      ram + sc_h + talk_time + touch_screen + wifi
##
## trying - battery_power
## # weights:  64 (45 variable)
## initial value 2772.588722
## iter  10 value 2313.460850
## iter  20 value 2098.564035
## iter  30 value 1965.658286
## iter  40 value 1273.491863
## iter  50 value 802.866600
## iter  60 value 780.292763
## iter  70 value 779.994555
## final value 779.984899
## converged
## trying - blue
## # weights:  64 (45 variable)
## initial value 2772.588722
## iter  10 value 2278.964602
## iter  20 value 2094.754299

```

```
## iter 30 value 2010.784250
## iter 40 value 1475.775930
## iter 50 value 307.658535
## iter 60 value 70.976071
## iter 70 value 58.807566
## iter 80 value 55.864379
## iter 90 value 55.316584
## iter 100 value 55.259821
## final value 55.259821
## stopped after 100 iterations
## trying - dual_sim
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2278.964724
## iter 20 value 2094.844701
## iter 30 value 2006.248238
## iter 40 value 1464.824438
## iter 50 value 449.394269
## iter 60 value 71.113121
## iter 70 value 60.197192
## iter 80 value 57.092585
## iter 90 value 56.652477
## iter 100 value 56.610123
## final value 56.610123
## stopped after 100 iterations
## trying - int_memory
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2280.564453
## iter 20 value 2085.470455
## iter 30 value 1946.254450
## iter 40 value 1151.724430
## iter 50 value 405.381840
## iter 60 value 79.096195
## iter 70 value 72.548906
## iter 80 value 71.069362
## iter 90 value 70.859819
## iter 100 value 70.839300
## final value 70.839300
## stopped after 100 iterations
## trying - m_dep
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2278.964642
## iter 20 value 2094.794148
## iter 30 value 2015.501523
## iter 40 value 1300.905242
## iter 50 value 445.240700
## iter 60 value 69.712190
## iter 70 value 58.301268
```



```
## iter 80 value 55.157635
## iter 90 value 54.587452
## iter 100 value 54.556647
## final value 54.556647
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2313.273741
## iter 20 value 2123.621878
## iter 30 value 1959.186451
## iter 40 value 1383.512694
## iter 50 value 406.053631
## iter 60 value 139.535411
## iter 70 value 136.680402
## iter 80 value 136.439960
## iter 90 value 136.350141
## iter 100 value 136.288318
## final value 136.288318
## stopped after 100 iterations
## trying - n_cores
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.006872
## iter 20 value 2104.521049
## iter 30 value 2034.902966
## iter 40 value 1208.652507
## iter 50 value 270.510638
## iter 60 value 72.420473
## iter 70 value 64.642289
## iter 80 value 63.072818
## iter 90 value 62.860126
## iter 100 value 62.843231
## final value 62.843231
## stopped after 100 iterations
## trying - pc
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.133703
## iter 20 value 2100.150962
## iter 30 value 1953.490523
## iter 40 value 1243.050868
## iter 50 value 496.686664
## iter 60 value 73.355403
## iter 70 value 63.038970
## iter 80 value 60.083440
## iter 90 value 59.570314
## iter 100 value 59.524295
## final value 59.524295
## stopped after 100 iterations
```

```
## trying - px_height
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2239.388870
## iter 20 value 2108.496892
## iter 30 value 1993.381807
## iter 40 value 1196.964710
## iter 50 value 433.484998
## iter 60 value 382.049456
## iter 70 value 377.824592
## iter 80 value 377.618741
## iter 90 value 377.595258
## iter 100 value 377.589407
## final value 377.589407
## stopped after 100 iterations
## trying - px_width
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2289.978470
## iter 20 value 2062.917687
## iter 30 value 1837.416106
## iter 40 value 1242.452980
## iter 50 value 532.396129
## iter 60 value 371.715764
## iter 70 value 370.322868
## iter 80 value 369.937639
## iter 90 value 369.890566
## iter 100 value 369.865791
## final value 369.865791
## stopped after 100 iterations
## trying - ram
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2738.562905
## iter 20 value 2709.042888
## iter 30 value 2692.757917
## iter 40 value 2660.528610
## iter 50 value 2655.405943
## final value 2655.405881
## converged
## trying - sc_h
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.223802
## iter 20 value 2111.103424
## iter 30 value 1994.731091
## iter 40 value 1227.994918
## iter 50 value 354.148956
## iter 60 value 72.765299
## iter 70 value 63.324962
```

```
## iter 80 value 60.779792
## iter 90 value 60.246053
## iter 100 value 60.224932
## final value 60.224932
## stopped after 100 iterations
## trying - talk_time
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.206430
## iter 20 value 2101.766206
## iter 30 value 1967.780618
## iter 40 value 1214.945462
## iter 50 value 520.170994
## iter 60 value 73.190965
## iter 70 value 59.336190
## iter 80 value 55.255988
## iter 90 value 54.642368
## iter 100 value 54.598887
## final value 54.598887
## stopped after 100 iterations
## trying - touch_screen
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2278.964727
## iter 20 value 2094.844168
## iter 30 value 2009.755585
## iter 40 value 1316.411724
## iter 50 value 317.053992
## iter 60 value 69.322601
## iter 70 value 57.851297
## iter 80 value 54.836378
## iter 90 value 54.408176
## iter 100 value 54.345927
## final value 54.345927
## stopped after 100 iterations
## trying - wifi
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2278.964551
## iter 20 value 2094.774942
## iter 30 value 2011.764541
## iter 40 value 1395.413129
## iter 50 value 432.464528
## iter 60 value 72.219204
## iter 70 value 64.714410
## iter 80 value 62.867211
## iter 90 value 62.543402
## iter 100 value 62.514015
## final value 62.514015
## stopped after 100 iterations
```

```
## trying + clock_speed
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.959452
## iter 20 value 2093.672884
## iter 30 value 2034.287245
## iter 40 value 1450.522185
## iter 50 value 899.647728
## iter 60 value 104.937528
## iter 70 value 60.867603
## iter 80 value 54.984947
## iter 90 value 53.502150
## iter 100 value 53.171648
## final value 53.171648
## stopped after 100 iterations
## trying + fc
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.924378
## iter 20 value 2094.925253
## iter 30 value 2017.273002
## iter 40 value 1636.871581
## iter 50 value 986.511706
## iter 60 value 117.637334
## iter 70 value 61.183449
## iter 80 value 54.988399
## iter 90 value 53.094410
## iter 100 value 52.876393
## final value 52.876393
## stopped after 100 iterations
## trying + four_g
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.963718
## iter 20 value 2094.556355
## iter 30 value 2018.115136
## iter 40 value 1352.444328
## iter 50 value 868.842426
## iter 60 value 115.332275
## iter 70 value 61.492408
## iter 80 value 54.665924
## iter 90 value 52.813110
## iter 100 value 52.493961
## final value 52.493961
## stopped after 100 iterations
## trying + sc_w
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.919045
## iter 20 value 2092.693632
```

```

## iter 30 value 2044.083762
## iter 40 value 1607.201004
## iter 50 value 1023.757010
## iter 60 value 118.868666
## iter 70 value 60.872162
## iter 80 value 54.843636
## iter 90 value 52.968678
## iter 100 value 52.689525
## final value 52.689525
## stopped after 100 iterations
## trying + three_g
## # weights: 72 (51 variable)
## initial value 2772.588722
## iter 10 value 2278.963041
## iter 20 value 2094.444863
## iter 30 value 2023.033639
## iter 40 value 1370.582122
## iter 50 value 927.859689
## iter 60 value 104.446059
## iter 70 value 60.969250
## iter 80 value 55.084470
## iter 90 value 53.672273
## iter 100 value 53.261562
## final value 53.261562
## stopped after 100 iterations
##           Df      AIC
## - touch_screen 45 198.6919
## - m_dep         45 199.1133
## - talk_time     45 199.1978
## - blue          45 200.5196
## <none>          48 202.3096
## - dual_sim      45 203.2202
## + +four_g       51 206.9879
## + +sc_w         51 207.3791
## + +fc           51 207.7528
## + +clock_speed  51 208.3433
## + +three_g      51 208.5231
## - pc            45 209.0486
## - sc_h          45 210.4499
## - wifi          45 215.0280
## - n_cores       45 215.6865
## - int_memory    45 231.6786
## - mobile_wt     45 362.5766
## - px_width      45 829.7316
## - px_height     45 845.1788
## - battery_power 45 1649.9698
## - ram           45 5400.8118
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2278.964727

```

```
## iter 20 value 2094.844168
## iter 30 value 2009.755585
## iter 40 value 1316.411724
## iter 50 value 317.053992
## iter 60 value 69.322601
## iter 70 value 57.851297
## iter 80 value 54.836378
## iter 90 value 54.408176
## iter 100 value 54.345927
## final value 54.345927
## stopped after 100 iterations
##
## Step: AIC=198.69
## price_range ~ battery_power + blue + dual_sim + int_memory +
## m_dep + mobile_wt + n_cores + pc + px_height + px_width +
## ram + sc_h + talk_time + wifi
##
## trying - battery_power
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2313.461872
## iter 20 value 2099.259608
## iter 30 value 1939.529412
## iter 40 value 1312.077704
## iter 50 value 785.547536
## iter 60 value 781.865667
## iter 70 value 781.500181
## final value 781.498660
## converged
## trying - blue
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2278.965219
## iter 20 value 2094.933210
## iter 30 value 2003.658414
## iter 40 value 1336.603284
## iter 50 value 159.822698
## iter 60 value 67.398336
## iter 70 value 58.760916
## iter 80 value 56.850349
## iter 90 value 56.717732
## iter 100 value 56.694241
## final value 56.694241
## stopped after 100 iterations
## trying - dual_sim
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2278.965340
## iter 20 value 2095.023487
## iter 30 value 1998.074686
```

```
## iter 40 value 1326.112158
## iter 50 value 170.809547
## iter 60 value 66.932350
## iter 70 value 59.864616
## iter 80 value 58.334104
## iter 90 value 58.122592
## iter 100 value 58.096713
## final value 58.096713
## stopped after 100 iterations
## trying - int_memory
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2280.565067
## iter 20 value 2085.995284
## iter 30 value 1937.589796
## iter 40 value 1232.190354
## iter 50 value 188.225749
## iter 60 value 78.608805
## iter 70 value 72.490694
## iter 80 value 71.448049
## iter 90 value 71.331442
## iter 100 value 71.324721
## final value 71.324721
## stopped after 100 iterations
## trying - m_dep
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2278.965259
## iter 20 value 2094.972963
## iter 30 value 2009.922183
## iter 40 value 1331.199581
## iter 50 value 220.014410
## iter 60 value 66.148050
## iter 70 value 57.466916
## iter 80 value 56.013386
## iter 90 value 55.800603
## iter 100 value 55.781788
## final value 55.781788
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2313.274089
## iter 20 value 2124.265810
## iter 30 value 1964.077988
## iter 40 value 1273.507032
## iter 50 value 181.258273
## iter 60 value 139.224825
## iter 70 value 138.062872
## iter 80 value 137.975841
```

```
## iter 90 value 137.909754
## iter 100 value 137.900840
## final value 137.900840
## stopped after 100 iterations
## trying - n_cores
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.007489
## iter 20 value 2104.693639
## iter 30 value 2012.311782
## iter 40 value 1185.366898
## iter 50 value 162.186404
## iter 60 value 72.077334
## iter 70 value 65.775733
## iter 80 value 64.408857
## iter 90 value 64.263256
## iter 100 value 64.256912
## final value 64.256912
## stopped after 100 iterations
## trying - pc
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.134320
## iter 20 value 2100.344087
## iter 30 value 1953.121247
## iter 40 value 1176.311481
## iter 50 value 159.014880
## iter 60 value 68.152564
## iter 70 value 61.619324
## iter 80 value 60.005253
## iter 90 value 59.814223
## iter 100 value 59.795315
## final value 59.795315
## stopped after 100 iterations
## trying - px_height
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2239.392348
## iter 20 value 2109.150256
## iter 30 value 1958.548307
## iter 40 value 1200.353216
## iter 50 value 395.863937
## iter 60 value 381.396425
## iter 70 value 378.256742
## iter 80 value 378.196573
## iter 90 value 378.159300
## iter 100 value 378.151198
## final value 378.151198
## stopped after 100 iterations
## trying - px_width
```



```
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2289.979948
## iter 20 value 2063.581689
## iter 30 value 1889.958091
## iter 40 value 1199.371831
## iter 50 value 382.695487
## iter 60 value 372.475897
## iter 70 value 370.564068
## iter 80 value 370.449481
## iter 90 value 370.405472
## iter 100 value 370.399312
## final value 370.399312
## stopped after 100 iterations
## trying - ram
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2738.563637
## iter 20 value 2709.564250
## iter 30 value 2697.647816
## iter 40 value 2659.507872
## final value 2657.416751
## converged
## trying - sc_h
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.224418
## iter 20 value 2111.254395
## iter 30 value 1998.069180
## iter 40 value 1210.921810
## iter 50 value 144.693347
## iter 60 value 66.366150
## iter 70 value 61.661163
## iter 80 value 60.740810
## iter 90 value 60.660579
## iter 100 value 60.651671
## final value 60.651671
## stopped after 100 iterations
## trying - talk_time
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.207047
## iter 20 value 2102.007555
## iter 30 value 1952.495688
## iter 40 value 1124.457210
## iter 50 value 168.904803
## iter 60 value 64.849574
## iter 70 value 57.176979
## iter 80 value 55.498088
## iter 90 value 55.320358
```

```
## iter 100 value 55.311442
## final value 55.311442
## stopped after 100 iterations
## trying - wifi
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2278.965168
## iter 20 value 2094.953867
## iter 30 value 2005.414967
## iter 40 value 1370.346259
## iter 50 value 161.352777
## iter 60 value 71.333832
## iter 70 value 65.745283
## iter 80 value 64.854074
## iter 90 value 64.760844
## iter 100 value 64.750269
## final value 64.750269
## stopped after 100 iterations
## trying + clock_speed
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.960069
## iter 20 value 2093.851944
## iter 30 value 2033.214310
## iter 40 value 1399.600861
## iter 50 value 615.467433
## iter 60 value 84.369195
## iter 70 value 60.359028
## iter 80 value 54.907240
## iter 90 value 54.214982
## iter 100 value 54.114900
## final value 54.114900
## stopped after 100 iterations
## trying + fc
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.924995
## iter 20 value 2095.105188
## iter 30 value 2017.318716
## iter 40 value 1568.800538
## iter 50 value 761.641320
## iter 60 value 88.953953
## iter 70 value 61.913262
## iter 80 value 54.694570
## iter 90 value 53.724032
## iter 100 value 53.492055
## final value 53.492055
## stopped after 100 iterations
## trying + four_g
## # weights: 68 (48 variable)
```

```
## initial value 2772.588722
## iter 10 value 2278.964335
## iter 20 value 2094.735269
## iter 30 value 2013.013659
## iter 40 value 1424.289754
## iter 50 value 697.740673
## iter 60 value 76.849359
## iter 70 value 58.753267
## iter 80 value 54.390419
## iter 90 value 53.604043
## iter 100 value 53.420624
## final value 53.420624
## stopped after 100 iterations
## trying + sc_w
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.919662
## iter 20 value 2092.870129
## iter 30 value 2045.166144
## iter 40 value 1547.458862
## iter 50 value 742.273987
## iter 60 value 79.392897
## iter 70 value 58.811685
## iter 80 value 54.875617
## iter 90 value 53.996638
## iter 100 value 53.777895
## final value 53.777895
## stopped after 100 iterations
## trying + three_g
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.963658
## iter 20 value 2094.623765
## iter 30 value 2019.127432
## iter 40 value 1308.374605
## iter 50 value 570.960754
## iter 60 value 77.150201
## iter 70 value 59.558228
## iter 80 value 54.975355
## iter 90 value 54.364374
## iter 100 value 54.211293
## final value 54.211293
## stopped after 100 iterations
## trying + touch_screen
## # weights: 68 (48 variable)
## initial value 2772.588722
## iter 10 value 2278.964110
## iter 20 value 2094.665281
## iter 30 value 2015.492078
## iter 40 value 1463.627293
```

```

## iter 50 value 588.964693
## iter 60 value 77.864233
## iter 70 value 59.756294
## iter 80 value 54.507754
## iter 90 value 53.332599
## iter 100 value 53.154779
## final value 53.154779
## stopped after 100 iterations
##           Df      AIC
## - talk_time    42  194.6229
## - m_dep        42  195.5636
## - blue         42  197.3885
## <none>         45  198.6919
## - dual_sim     42  200.1934
## + +touch_screen 48  202.3096
## + +four_g      48  202.8412
## + +fc          48  202.9841
## + +sc_w        48  203.5558
## - pc           42  203.5906
## + +clock_speed 48  204.2298
## + +three_g     48  204.4226
## - sc_h         42  205.3033
## - n_cores      42  212.5138
## - wifi         42  213.5005
## - int_memory   42  226.6494
## - mobile_wt    42  359.8017
## - px_width     42  824.7986
## - px_height    42  840.3024
## - battery_power 42 1646.9973
## - ram          42 5398.8335
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.207047
## iter 20 value 2102.007555
## iter 30 value 1952.495688
## iter 40 value 1124.457210
## iter 50 value 168.904803
## iter 60 value 64.849574
## iter 70 value 57.176979
## iter 80 value 55.498088
## iter 90 value 55.320358
## iter 100 value 55.311442
## final value 55.311442
## stopped after 100 iterations
##
## Step: AIC=194.62
## price_range ~ battery_power + blue + dual_sim + int_memory +
##             m_dep + mobile_wt + n_cores + pc + px_height + px_width +
##             ram + sc_h + wifi
##

```

```
## trying - battery_power
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2313.644747
## iter 20 value 2110.184407
## iter 30 value 1711.158132
## iter 40 value 1139.200485
## iter 50 value 785.973650
## iter 60 value 783.560279
## iter 70 value 783.313814
## final value 783.313800
## converged
## trying - blue
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207540
## iter 20 value 2102.124465
## iter 30 value 1943.318378
## iter 40 value 776.372274
## iter 50 value 96.393407
## iter 60 value 63.341053
## iter 70 value 58.414160
## iter 80 value 57.608962
## iter 90 value 57.589264
## iter 100 value 57.544951
## final value 57.544951
## stopped after 100 iterations
## trying - dual_sim
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207661
## iter 20 value 2102.221470
## iter 30 value 1945.897318
## iter 40 value 1003.071239
## iter 50 value 100.488127
## iter 60 value 63.078368
## iter 70 value 59.778633
## iter 80 value 59.036850
## iter 90 value 59.016822
## iter 100 value 58.962985
## final value 58.962985
## stopped after 100 iterations
## trying - int_memory
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2280.807112
## iter 20 value 2091.828773
## iter 30 value 1684.694447
## iter 40 value 749.791597
## iter 50 value 98.772871
```

```
## iter 60 value 74.866622
## iter 70 value 72.876380
## iter 80 value 72.671672
## iter 90 value 72.656132
## iter 100 value 72.644961
## final value 72.644961
## stopped after 100 iterations
## trying - m_dep
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207579
## iter 20 value 2102.182096
## iter 30 value 1922.303186
## iter 40 value 1079.431112
## iter 50 value 108.194319
## iter 60 value 62.757711
## iter 70 value 58.055206
## iter 80 value 56.847280
## iter 90 value 56.833797
## iter 100 value 56.716477
## final value 56.716477
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2313.414559
## iter 20 value 2156.243750
## iter 30 value 1765.922837
## iter 40 value 829.034229
## iter 50 value 153.199908
## iter 60 value 141.750557
## iter 70 value 141.261726
## iter 80 value 141.072545
## iter 90 value 141.012633
## iter 100 value 140.969289
## final value 140.969289
## stopped after 100 iterations
## trying - n_cores
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.249806
## iter 20 value 2103.383779
## iter 30 value 1717.267665
## iter 40 value 747.869014
## iter 50 value 89.188068
## iter 60 value 69.497764
## iter 70 value 66.038810
## iter 80 value 65.699893
## iter 90 value 65.693080
## iter 100 value 65.675224
```

```
## final value 65.675224
## stopped after 100 iterations
## trying - pc
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.376646
## iter 20 value 2096.473293
## iter 30 value 1696.895345
## iter 40 value 786.103622
## iter 50 value 90.873017
## iter 60 value 65.430708
## iter 70 value 61.581877
## iter 80 value 60.944467
## iter 90 value 60.914449
## iter 100 value 60.862255
## final value 60.862255
## stopped after 100 iterations
## trying - px_height
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2240.680239
## iter 20 value 2121.347334
## iter 30 value 1726.019860
## iter 40 value 938.445871
## iter 50 value 382.300985
## iter 60 value 379.951056
## iter 70 value 378.495464
## iter 80 value 378.477926
## iter 90 value 378.476520
## iter 100 value 378.475184
## final value 378.475184
## stopped after 100 iterations
## trying - px_width
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2290.389933
## iter 20 value 2074.951251
## iter 30 value 1679.396376
## iter 40 value 976.261700
## iter 50 value 375.558019
## iter 60 value 373.586285
## iter 70 value 372.209025
## iter 80 value 372.182081
## iter 90 value 372.178394
## iter 100 value 372.174426
## final value 372.174426
## stopped after 100 iterations
## trying - ram
## # weights: 56 (39 variable)
## initial value 2772.588722
```

```
## iter 10 value 2738.622408
## iter 20 value 2711.837969
## iter 30 value 2676.264931
## iter 40 value 2660.353850
## final value 2659.569430
## converged
## trying - sc_h
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.466703
## iter 20 value 2119.816911
## iter 30 value 1699.616010
## iter 40 value 781.613040
## iter 50 value 89.787463
## iter 60 value 65.122105
## iter 70 value 61.836934
## iter 80 value 61.368071
## iter 90 value 61.345800
## iter 100 value 61.319769
## final value 61.319769
## stopped after 100 iterations
## trying - wifi
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207489
## iter 20 value 2102.135848
## iter 30 value 1943.749256
## iter 40 value 987.842036
## iter 50 value 95.309229
## iter 60 value 68.092692
## iter 70 value 65.787222
## iter 80 value 65.372323
## iter 90 value 65.336560
## iter 100 value 65.304667
## final value 65.304667
## stopped after 100 iterations
## trying + clock_speed
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.202391
## iter 20 value 2100.799370
## iter 30 value 2010.927626
## iter 40 value 1332.651587
## iter 50 value 322.195282
## iter 60 value 65.861393
## iter 70 value 57.824521
## iter 80 value 55.427246
## iter 90 value 55.151492
## iter 100 value 55.111316
## final value 55.111316
```



```
## stopped after 100 iterations
## trying + fc
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.167335
## iter 20 value 2102.336521
## iter 30 value 2015.833272
## iter 40 value 1439.356984
## iter 50 value 346.808256
## iter 60 value 67.018180
## iter 70 value 57.437268
## iter 80 value 55.021064
## iter 90 value 54.597260
## iter 100 value 54.575504
## final value 54.575504
## stopped after 100 iterations
## trying + four_g
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.206656
## iter 20 value 2101.886481
## iter 30 value 1961.510603
## iter 40 value 1171.081881
## iter 50 value 359.422246
## iter 60 value 66.467804
## iter 70 value 57.196852
## iter 80 value 54.841910
## iter 90 value 54.425063
## iter 100 value 54.378715
## final value 54.378715
## stopped after 100 iterations
## trying + sc_w
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.162012
## iter 20 value 2100.309442
## iter 30 value 2015.687491
## iter 40 value 1423.195166
## iter 50 value 334.139861
## iter 60 value 65.590317
## iter 70 value 57.384762
## iter 80 value 55.123304
## iter 90 value 54.577990
## iter 100 value 54.551643
## final value 54.551643
## stopped after 100 iterations
## trying + talk_time
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2278.964727
```

```

## iter 20 value 2094.844168
## iter 30 value 2009.755584
## iter 40 value 1316.411733
## iter 50 value 317.053973
## iter 60 value 69.322601
## iter 70 value 57.851297
## iter 80 value 54.836378
## iter 90 value 54.408176
## iter 100 value 54.345927
## final value 54.345927
## stopped after 100 iterations
## trying + three_g
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.205980
## iter 20 value 2101.751856
## iter 30 value 1958.363024
## iter 40 value 1245.636861
## iter 50 value 321.237437
## iter 60 value 67.216774
## iter 70 value 57.982012
## iter 80 value 55.492852
## iter 90 value 55.068245
## iter 100 value 55.024286
## final value 55.024286
## stopped after 100 iterations
## trying + touch_screen
## # weights: 64 (45 variable)
## initial value 2772.588722
## iter 10 value 2279.206430
## iter 20 value 2101.766206
## iter 30 value 1967.780618
## iter 40 value 1214.945462
## iter 50 value 520.170994
## iter 60 value 73.190965
## iter 70 value 59.336190
## iter 80 value 55.255988
## iter 90 value 54.642368
## iter 100 value 54.598887
## final value 54.598887
## stopped after 100 iterations
##
##           Df      AIC
## - m_dep    39  191.4330
## - blue     39  193.0899
## <none>      42  194.6229
## - dual_sim  39  195.9260
## + +talk_time 45  198.6919
## + +four_g   45  198.7574
## + +sc_w     45  199.1033
## + +fc       45  199.1510

```

```

## + +touch_screen 45 199.1978
## - pc 39 199.7245
## + +three_g 45 200.0486
## + +clock_speed 45 200.2226
## - sc_h 39 200.6395
## - wifi 39 208.6093
## - n_cores 39 209.3504
## - int_memory 39 223.2899
## - mobile_wt 39 359.9386
## - px_width 39 822.3489
## - px_height 39 834.9504
## - battery_power 39 1644.6276
## - ram 39 5397.1389
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207579
## iter 20 value 2102.182096
## iter 30 value 1922.303186
## iter 40 value 1079.431112
## iter 50 value 108.194319
## iter 60 value 62.757711
## iter 70 value 58.055206
## iter 80 value 56.847280
## iter 90 value 56.833797
## iter 100 value 56.716477
## final value 56.716477
## stopped after 100 iterations
##
## Step: AIC=191.43
## price_range ~ battery_power + blue + dual_sim + int_memory +
## mobile_wt + n_cores + pc + px_height + px_width + ram + sc_h +
## wifi
##
## trying - battery_power
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2313.644861
## iter 20 value 2110.791314
## iter 30 value 1694.170645
## iter 40 value 977.254312
## iter 50 value 786.221963
## iter 60 value 785.497534
## final value 785.445337
## converged
## trying - blue
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.208072
## iter 20 value 2102.299054
## iter 30 value 1918.061326

```

```
## iter 40 value 623.904162
## iter 50 value 75.079279
## iter 60 value 62.125438
## iter 70 value 58.963701
## iter 80 value 58.763958
## iter 90 value 58.735820
## iter 100 value 58.681238
## final value 58.681238
## stopped after 100 iterations
## trying - dual_sim
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.208193
## iter 20 value 2102.395817
## iter 30 value 1885.043796
## iter 40 value 615.841595
## iter 50 value 73.909643
## iter 60 value 62.941481
## iter 70 value 59.897988
## iter 80 value 59.583293
## iter 90 value 59.533722
## iter 100 value 59.460553
## final value 59.460553
## stopped after 100 iterations
## trying - int_memory
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2280.807644
## iter 20 value 2092.243333
## iter 30 value 1572.268072
## iter 40 value 636.116926
## iter 50 value 83.368646
## iter 60 value 76.338438
## iter 70 value 74.837756
## iter 80 value 74.709664
## iter 90 value 74.693492
## iter 100 value 74.650875
## final value 74.650875
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2313.414872
## iter 20 value 2157.168628
## iter 30 value 1712.935264
## iter 40 value 695.696057
## iter 50 value 146.417283
## iter 60 value 141.842712
## iter 70 value 141.650668
## iter 80 value 141.600831
```

```
## iter 90 value 141.587040
## iter 100 value 141.548292
## final value 141.548292
## stopped after 100 iterations
## trying - n_cores
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.250338
## iter 20 value 2103.520363
## iter 30 value 1769.403987
## iter 40 value 678.932505
## iter 50 value 78.889401
## iter 60 value 69.516917
## iter 70 value 66.964918
## iter 80 value 66.802467
## iter 90 value 66.761882
## iter 100 value 66.706267
## final value 66.706267
## stopped after 100 iterations
## trying - pc
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.377178
## iter 20 value 2096.649617
## iter 30 value 1642.886182
## iter 40 value 629.751642
## iter 50 value 75.700423
## iter 60 value 65.398437
## iter 70 value 62.678494
## iter 80 value 62.435847
## iter 90 value 62.388228
## iter 100 value 62.273532
## final value 62.273532
## stopped after 100 iterations
## trying - px_height
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2240.682873
## iter 20 value 2122.053971
## iter 30 value 1470.918325
## iter 40 value 873.812355
## iter 50 value 385.405033
## iter 60 value 382.744640
## iter 70 value 382.045874
## iter 80 value 382.042585
## iter 90 value 382.042020
## iter 100 value 382.039831
## final value 382.039831
## stopped after 100 iterations
## trying - px_width
```

```
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2290.390499
## iter 20 value 2075.586701
## iter 30 value 1731.111461
## iter 40 value 762.292976
## iter 50 value 373.779096
## iter 60 value 372.855076
## iter 70 value 372.256853
## iter 80 value 372.249964
## iter 90 value 372.248252
## iter 100 value 372.235777
## final value 372.235777
## stopped after 100 iterations
## trying - ram
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2738.622702
## iter 20 value 2712.190162
## iter 30 value 2671.827635
## iter 40 value 2661.605396
## final value 2661.605245
## converged
## trying - sc_h
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.467235
## iter 20 value 2119.975472
## iter 30 value 1646.290809
## iter 40 value 576.778423
## iter 50 value 78.212637
## iter 60 value 64.828653
## iter 70 value 62.544431
## iter 80 value 62.359757
## iter 90 value 62.336209
## iter 100 value 62.282222
## final value 62.282222
## stopped after 100 iterations
## trying - wifi
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.208021
## iter 20 value 2102.310207
## iter 30 value 1915.957211
## iter 40 value 716.745782
## iter 50 value 78.803424
## iter 60 value 68.169375
## iter 70 value 66.187165
## iter 80 value 65.943991
## iter 90 value 65.893995
```

```
## iter 100 value 65.823400
## final value 65.823400
## stopped after 100 iterations
## trying + clock_speed
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.202923
## iter 20 value 2100.974670
## iter 30 value 2009.806701
## iter 40 value 1263.163150
## iter 50 value 203.923021
## iter 60 value 66.029524
## iter 70 value 57.821754
## iter 80 value 56.306279
## iter 90 value 56.128093
## iter 100 value 56.112719
## final value 56.112719
## stopped after 100 iterations
## trying + fc
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.167867
## iter 20 value 2102.513794
## iter 30 value 2015.402602
## iter 40 value 1337.088016
## iter 50 value 252.969890
## iter 60 value 68.922136
## iter 70 value 57.501488
## iter 80 value 55.789267
## iter 90 value 55.604293
## iter 100 value 55.585507
## final value 55.585507
## stopped after 100 iterations
## trying + four_g
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.207188
## iter 20 value 2102.061079
## iter 30 value 1926.813232
## iter 40 value 1259.711135
## iter 50 value 206.066084
## iter 60 value 67.090116
## iter 70 value 57.766415
## iter 80 value 56.234833
## iter 90 value 56.070772
## iter 100 value 56.052218
## final value 56.052218
## stopped after 100 iterations
## trying + m_dep
## # weights: 60 (42 variable)
```

```
## initial value 2772.588722
## iter 10 value 2279.207047
## iter 20 value 2102.007555
## iter 30 value 1952.495694
## iter 40 value 1124.457218
## iter 50 value 168.904917
## iter 60 value 64.849570
## iter 70 value 57.176979
## iter 80 value 55.498088
## iter 90 value 55.320359
## iter 100 value 55.311442
## final value 55.311442
## stopped after 100 iterations
## trying + sc_w
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.162544
## iter 20 value 2100.482320
## iter 30 value 2017.700674
## iter 40 value 1329.652652
## iter 50 value 191.126969
## iter 60 value 65.486719
## iter 70 value 57.684920
## iter 80 value 56.145467
## iter 90 value 55.879150
## iter 100 value 55.863644
## final value 55.863644
## stopped after 100 iterations
## trying + talk_time
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2278.965259
## iter 20 value 2094.972963
## iter 30 value 2009.922182
## iter 40 value 1331.199543
## iter 50 value 220.014381
## iter 60 value 66.148049
## iter 70 value 57.466916
## iter 80 value 56.013385
## iter 90 value 55.800602
## iter 100 value 55.781788
## final value 55.781788
## stopped after 100 iterations
## trying + three_g
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.206512
## iter 20 value 2101.926449
## iter 30 value 1933.404494
## iter 40 value 1325.120868
```



```
## iter 50 value 225.277490
## iter 60 value 65.282665
## iter 70 value 58.190586
## iter 80 value 56.796983
## iter 90 value 56.620011
## iter 100 value 56.603845
## final value 56.603845
## stopped after 100 iterations
## trying + touch_screen
## # weights: 60 (42 variable)
## initial value 2772.588722
## iter 10 value 2279.206962
## iter 20 value 2101.940899
## iter 30 value 1933.349214
## iter 40 value 1194.685778
## iter 50 value 182.313819
## iter 60 value 65.171860
## iter 70 value 57.256244
## iter 80 value 55.866740
## iter 90 value 55.672022
## iter 100 value 55.658644
## final value 55.658644
## stopped after 100 iterations
##           Df      AIC
## - blue      36  189.3625
## - dual_sim   36  190.9211
## <none>      39  191.4330
## + +m_dep     42  194.6229
## + +fc        42  195.1710
## + +touch_screen 42  195.3173
## + +talk_time 42  195.5636
## + +sc_w      42  195.7273
## + +four_g    42  196.1044
## + +clock_speed 42  196.2254
## - pc         36  196.5471
## - sc_h       36  196.5644
## + +three_g   42  197.2077
## - wifi       36  203.6468
## - n_cores    36  205.4125
## - int_memory 36  221.3018
## - mobile_wt  36  355.0966
## - px_width   36  816.4716
## - px_height  36  836.0797
## - battery_power 36 1642.8907
## - ram        36 5395.2105
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.208072
## iter 20 value 2102.299054
## iter 30 value 1918.061326
```

```
## iter 40 value 623.904162
## iter 50 value 75.079279
## iter 60 value 62.125438
## iter 70 value 58.963701
## iter 80 value 58.763958
## iter 90 value 58.735820
## iter 100 value 58.681238
## final value 58.681238
## stopped after 100 iterations
##
## Step: AIC=189.36
## price_range ~ battery_power + dual_sim + int_memory + mobile_wt +
## n_cores + pc + px_height + px_width + ram + sc_h + wifi
##
## trying - battery_power
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2313.645186
## iter 20 value 2111.220712
## iter 30 value 1539.530968
## iter 40 value 795.754851
## iter 50 value 786.416065
## iter 60 value 785.944182
## final value 785.939081
## converged
## trying - dual_sim
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2279.208685
## iter 20 value 2102.512943
## iter 30 value 1863.608680
## iter 40 value 285.141156
## iter 50 value 72.837163
## iter 60 value 63.510959
## iter 70 value 62.018644
## iter 80 value 61.961911
## iter 90 value 61.844668
## iter 100 value 61.722592
## final value 61.722592
## stopped after 100 iterations
## trying - int_memory
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2280.808139
## iter 20 value 2092.545924
## iter 30 value 1717.713037
## iter 40 value 262.118924
## iter 50 value 80.536993
## iter 60 value 76.126733
## iter 70 value 75.533072
```

```
## iter 80 value 75.517458
## iter 90 value 75.494943
## iter 100 value 75.420377
## final value 75.420377
## stopped after 100 iterations
## trying - mobile_wt
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2313.415153
## iter 20 value 2157.734476
## iter 30 value 1715.125035
## iter 40 value 309.856868
## iter 50 value 144.054818
## iter 60 value 142.268632
## iter 70 value 142.130118
## iter 80 value 142.117028
## iter 90 value 142.096074
## iter 100 value 140.708318
## final value 140.708318
## stopped after 100 iterations
## trying - n_cores
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2279.250830
## iter 20 value 2103.614835
## iter 30 value 1706.322596
## iter 40 value 255.507178
## iter 50 value 78.190337
## iter 60 value 69.021053
## iter 70 value 68.247108
## iter 80 value 68.196131
## iter 90 value 68.140470
## iter 100 value 68.081581
## final value 68.081581
## stopped after 100 iterations
## trying - pc
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2279.377670
## iter 20 value 2096.762462
## iter 30 value 1714.950919
## iter 40 value 260.268674
## iter 50 value 75.472493
## iter 60 value 65.548183
## iter 70 value 64.432493
## iter 80 value 64.373126
## iter 90 value 64.275230
## iter 100 value 64.119994
## final value 64.119994
## stopped after 100 iterations
```

```
## trying - px_height
## # weights:  48 (33 variable)
## initial  value 2772.588722
## iter   10 value 2240.685462
## iter   20 value 2122.522621
## iter   30 value 1537.068316
## iter   40 value 449.015456
## iter   50 value 387.137529
## iter   60 value 383.966488
## iter   70 value 383.856107
## iter   80 value 383.849438
## iter   90 value 383.846987
## iter  100 value 383.845653
## final   value 383.845653
## stopped after 100 iterations
## trying - px_width
## # weights:  48 (33 variable)
## initial  value 2772.588722
## iter   10 value 2290.391316
## iter   20 value 2076.010162
## iter   30 value 1490.778136
## iter   40 value 428.599090
## iter   50 value 376.260572
## iter   60 value 374.396937
## iter   70 value 374.190998
## iter   80 value 374.186824
## iter   90 value 374.185407
## iter  100 value 374.150895
## final   value 374.150895
## stopped after 100 iterations
## trying - ram
## # weights:  48 (33 variable)
## initial  value 2772.588722
## iter   10 value 2738.622663
## iter   20 value 2712.235793
## iter   30 value 2680.275421
## final   value 2662.506837
## converged
## trying - sc_h
## # weights:  48 (33 variable)
## initial  value 2772.588722
## iter   10 value 2279.467727
## iter   20 value 2120.086965
## iter   30 value 1780.294464
## iter   40 value 288.704537
## iter   50 value 72.224406
## iter   60 value 64.936113
## iter   70 value 64.277218
## iter   80 value 64.226929
## iter   90 value 64.155751
```

```
## iter 100 value 64.085178
## final value 64.085178
## stopped after 100 iterations
## trying - wifi
## # weights: 48 (33 variable)
## initial value 2772.588722
## iter 10 value 2279.208513
## iter 20 value 2102.427099
## iter 30 value 1883.223813
## iter 40 value 268.769766
## iter 50 value 76.369783
## iter 60 value 68.671955
## iter 70 value 67.941286
## iter 80 value 67.889001
## iter 90 value 67.821311
## iter 100 value 67.746168
## final value 67.746168
## stopped after 100 iterations
## trying + blue
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207579
## iter 20 value 2102.182096
## iter 30 value 1922.303188
## iter 40 value 1079.430099
## iter 50 value 108.194268
## iter 60 value 62.757715
## iter 70 value 58.055206
## iter 80 value 56.847281
## iter 90 value 56.833798
## iter 100 value 56.716479
## final value 56.716479
## stopped after 100 iterations
## trying + clock_speed
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.203416
## iter 20 value 2101.091013
## iter 30 value 2010.918492
## iter 40 value 1070.049166
## iter 50 value 107.869585
## iter 60 value 63.948424
## iter 70 value 59.425746
## iter 80 value 58.631142
## iter 90 value 58.615192
## iter 100 value 58.535217
## final value 58.535217
## stopped after 100 iterations
## trying + fc
## # weights: 56 (39 variable)
```

```
## initial value 2772.588722
## iter 10 value 2279.168360
## iter 20 value 2102.630901
## iter 30 value 2009.410220
## iter 40 value 1177.428663
## iter 50 value 102.128658
## iter 60 value 63.079532
## iter 70 value 58.113430
## iter 80 value 57.483784
## iter 90 value 57.462739
## iter 100 value 57.419247
## final value 57.419247
## stopped after 100 iterations
## trying + four_g
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207680
## iter 20 value 2102.178029
## iter 30 value 1924.659794
## iter 40 value 1106.069047
## iter 50 value 102.196902
## iter 60 value 62.564729
## iter 70 value 59.030610
## iter 80 value 58.355827
## iter 90 value 58.330797
## iter 100 value 58.274678
## final value 58.274678
## stopped after 100 iterations
## trying + m_dep
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207540
## iter 20 value 2102.124465
## iter 30 value 1943.318384
## iter 40 value 776.372203
## iter 50 value 96.393412
## iter 60 value 63.341054
## iter 70 value 58.414159
## iter 80 value 57.608962
## iter 90 value 57.589264
## iter 100 value 57.544950
## final value 57.544950
## stopped after 100 iterations
## trying + sc_w
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.163036
## iter 20 value 2100.597087
## iter 30 value 2013.110444
## iter 40 value 1150.685488
```

```
## iter 50 value 101.353150
## iter 60 value 62.781553
## iter 70 value 58.672946
## iter 80 value 57.819967
## iter 90 value 57.790754
## iter 100 value 57.679927
## final value 57.679927
## stopped after 100 iterations
## trying + talk_time
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2278.965751
## iter 20 value 2095.062058
## iter 30 value 2004.469746
## iter 40 value 1152.787813
## iter 50 value 99.739378
## iter 60 value 62.708435
## iter 70 value 58.616068
## iter 80 value 57.948720
## iter 90 value 57.924227
## iter 100 value 57.861199
## final value 57.861199
## stopped after 100 iterations
## trying + three_g
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207004
## iter 20 value 2102.043498
## iter 30 value 1922.946224
## iter 40 value 1000.300733
## iter 50 value 99.700941
## iter 60 value 63.513724
## iter 70 value 59.342991
## iter 80 value 58.780123
## iter 90 value 58.758887
## iter 100 value 58.717184
## final value 58.717184
## stopped after 100 iterations
## trying + touch_screen
## # weights: 56 (39 variable)
## initial value 2772.588722
## iter 10 value 2279.207455
## iter 20 value 2102.057858
## iter 30 value 1919.676013
## iter 40 value 1002.699162
## iter 50 value 101.368365
## iter 60 value 62.518740
## iter 70 value 58.439013
## iter 80 value 57.774264
## iter 90 value 57.752806
```

```

## iter 100 value 57.688044
## final value 57.688044
## stopped after 100 iterations
##           Df          AIC
## <none>      36  189.3625
## - dual_sim  33  189.4452
## + +blue     39  191.4330
## + +fc       39  192.8385
## + +m_dep    39  193.0899
## + +sc_w     39  193.3599
## + +touch_screen 39  193.3761
## + +talk_time 39  193.7224
## - sc_h      33  194.1704
## - pc        33  194.2400
## + +four_g   39  194.5494
## + +clock_speed 39  195.0704
## + +three_g  39  195.4344
## - wifi      33  201.4923
## - n_cores   33  202.1632
## - int_memory 33  216.8408
## - mobile_wt 33  347.4166
## - px_width  33  814.3018
## - px_height 33  833.6913
## - battery_power 33 1637.8782
## - ram       33 5391.0137

summary(mobile_back)

## Call:
## multinom(formula = price_range ~ battery_power + dual_sim + int_memory +
##   mobile_wt + n_cores + pc + px_height + px_width + ram + sc_h +
##   wifi, data = mobile)
##
## Coefficients:
##   (Intercept) battery_power  dual_sim int_memory  mobile_wt  n_cores
## 1  -236.0779    0.05938811 -0.7560520 0.04694022 -0.1276754 0.6340881
## 2  -506.1893    0.10806514 -2.1862323 0.11868043 -0.2112339 1.1360100
## 3  -929.8309    0.16654270 -0.4107822 0.24606883 -0.3822686 1.5606123
##           pc  px_height  px_width      ram      sc_h      wifi
## 1 -0.03447719 0.03531989 0.03442956 0.09739154 -0.2152274 -1.302895
## 2  0.16332124 0.06307451 0.06296642 0.17444872 -0.2199244 -3.438932
## 3  0.22273345 0.10161993 0.09803998 0.27174098  0.1636086 -6.725673
##
## Std. Errors:
##   (Intercept) battery_power  dual_sim int_memory  mobile_wt  n_cores
## 1 0.002637454  0.001374587 0.2877205 0.02405268 0.01594404 0.2119649
## 2 0.002794578  0.001555151 0.3593155 0.03247293 0.01913479 0.2728758
## 3 0.001515596  0.001854085 0.1418278 0.04247721 0.02436218 0.3757548
##           pc  px_height  px_width      ram      sc_h      wifi
## 1 0.09399781 0.001458721 0.001551879 0.001550765 0.1317862 0.3156846

```



```
## 2 0.11249974 0.001867631 0.001870435 0.001748421 0.1617408 0.3424589
## 3 0.13474588 0.002200766 0.002348736 0.001991876 0.2038021 0.1027030
##
## Residual Deviance: 117.3625
## AIC: 189.3625
```

Here, I fit the multinomial logistic regression model with the best variables:

```
mobile_best = multinom(formula = price_range ~ battery_power + dual_sim +
int_memory + mobile_wt + n_cores + pc + px_height + px_width + ram + sc_h +
wifi, data = mobile)
```

```
## # weights: 52 (36 variable)
## initial value 2772.588722
## iter 10 value 2279.208072
## iter 20 value 2102.299054
## iter 30 value 1918.061326
## iter 40 value 623.904162
## iter 50 value 75.079279
## iter 60 value 62.125438
## iter 70 value 58.963701
## iter 80 value 58.763958
## iter 90 value 58.735820
## iter 100 value 58.681238
## final value 58.681238
## stopped after 100 iterations
```

Let's perform in-sample prediction. As you can see from the output, the model has done a good job at classifying the price range in the training dataset, with an accuracy of 98.81%:

```
#in-sample prediction with the best model
pred_resp <- predict(mobile_best, newdata= mobile_train, type="class")
table(mobile_train$price_range, pred_resp)

##      pred_resp
##      0      1      2      3
## 0 390      1      0      0
## 1      1 390      4      0
## 2      0      4 398      4
## 3      0      0      5 403

tab = table(mobile_train$price_range, pred_resp)
round((sum(diag(tab))/sum(tab))*100,2)

## [1] 98.81
```

Now let's perform out-of-sample prediction. As you can see here, the model also does a good job at classifying on the test set because the classification for 0/0, 1/1, 2/2, and 3/3 (predicted values to actual) are quite correct, while the chances of misclassifying (0/1, 1/0, 2/3, etc) are very small. Therefore, the model is stable and we can make good use of it:

```
# Predicting the class for test dataset
pred_test <- predict(mobile_best, newdata = mobile_test, "class")
# Building classification table
tab <- table(mobile_test$price_range, pred_test)
tab
```

```
##      pred_test
##          0    1    2    3
## 0 108      1    0    0
## 1   1 103      1    0
## 2   0   0  93      1
## 3   0   0   1  91
```