Naive-Bayes

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Naive-Bayes

```
dataset = read.csv("Social_Network_Ads.csv")
dataset = dataset[,3:5]
```

Dividir dataset en conjunto de entranmiento y conjunto de test

```
library(caTools)
```

```
## Warning: package 'caTools' was built under R version 4.0.5
```

```
set.seed(123)
split = sample.split(dataset$Purchased, SplitRatio = 0.75)
```

```
training_set = subset(dataset, split == TRUE)
training_set
```

```
##     Age EstimatedSalary Purchased
## 1    19           19000         0
## 3    26           43000         0
## 6    27           58000         0
## 7    27           84000         0
## 8    32          150000         1
## 10   35           65000         0
## 11   26           80000         0
## 13   20           86000         0
## 14   32           18000         0
## 15   18           82000         0
## 16   29           80000         0
## 17   47           25000         1
## 21   45           22000         1
## 23   48           41000         1
## 24   45           22000         1
## 25   46           23000         1
## 26   47           20000         1
## 27   49           28000         1
## 28   47           30000         1
## 30   31           18000         0
## 31   31           74000         0
## 33   21           16000         0
## 36   35           27000         0
## 37   33           28000         0
```

```
## 39   26        72000      0
## 40   27        31000      0
## 41   27        17000      0
## 42   33        51000      0
## 43   35       108000      0
## 44   30        15000      0
## 47   25        79000      0
## 49   30       135000      1
## 50   31        89000      0
## 51   24        32000      0
## 53   29        83000      0
## 54   35        23000      0
## 55   27        58000      0
## 56   24        55000      0
## 57   23        48000      0
## 58   28        79000      0
## 59   22        18000      0
## 60   32       117000      0
## 61   27        20000      0
## 62   25        87000      0
## 63   23        66000      0
## 64   32       120000      1
## 65   59        83000      0
## 67   24        19000      0
## 68   23        82000      0
## 70   31        68000      0
## 71   25        80000      0
## 72   24        27000      0
## 73   20        23000      0
## 76   34       112000      1
## 77   18        52000      0
## 78   22        27000      0
## 79   28        87000      0
## 80   26        17000      0
## 81   30        80000      0
## 83   20        49000      0
## 88   28        85000      0
## 90   35        50000      0
## 91   22        81000      0
## 92   30       116000      0
## 93   26        15000      0
## 94   29        28000      0
## 95   29        83000      0
## 96   35        44000      0
## 97   35        25000      0
## 98   28       123000      1
## 99   35        73000      0
## 100  28        37000      0
## 101  27        88000      0
## 102  28        59000      0
## 105  19        21000      0
## 106  21        72000      0
## 110  38        80000      0
## 111  39        71000      0
```

```
## 112  37          71000        0
## 113  38          61000        0
## 114  37          55000        0
## 115  42          80000        0
## 116  40          57000        0
## 118  36          52000        0
## 119  40          59000        0
## 120  41          59000        0
## 121  36          75000        0
## 122  37          72000        0
## 123  40          75000        0
## 125  41          51000        0
## 128  26          32000        0
## 129  30          17000        0
## 130  26          84000        0
## 132  33          31000        0
## 133  30          87000        0
## 135  28          55000        0
## 136  23          63000        0
## 137  20          82000        0
## 138  30         107000        1
## 140  19          25000        0
## 141  19          85000        0
## 142  18          68000        0
## 143  35          59000        0
## 144  30          89000        0
## 145  34          25000        0
## 146  24          89000        0
## 147  27          96000        1
## 149  29          61000        0
## 150  20          74000        0
## 151  26          15000        0
## 152  41          45000        0
## 153  31          76000        0
## 155  40          47000        0
## 157  46          59000        0
## 158  29          75000        0
## 160  32         135000        1
## 161  32         100000        1
## 164  35          38000        0
## 165  33          69000        0
## 166  18          86000        0
## 167  22          55000        0
## 168  35          71000        0
## 169  29         148000        1
## 171  21          88000        0
## 172  34         115000        0
## 173  26         118000        0
## 174  34          43000        0
## 177  35          47000        0
## 178  25          22000        0
## 179  24          23000        0
## 180  31          34000        0
## 181  26          16000        0
```

```
## 182  31          71000          0
## 183  32         117000          1
## 184  33          43000          0
## 185  33          60000          0
## 186  31          66000          0
## 187  20          82000          0
## 188  33          41000          0
## 189  35          72000          0
## 190  28          32000          0
## 191  24          84000          0
## 192  19          26000          0
## 194  19          70000          0
## 195  28          89000          0
## 196  34          43000          0
## 197  30          79000          0
## 198  20          36000          0
## 201  35          39000          0
## 202  49          74000          0
## 203  39         134000          1
## 204  41          71000          0
## 205  58         101000          1
## 206  47          47000          0
## 207  55         130000          1
## 209  40         142000          1
## 210  46          22000          0
## 211  48          96000          1
## 212  52         150000          1
## 214  35          58000          0
## 215  47          43000          0
## 216  60         108000          1
## 217  49          65000          0
## 218  40          78000          0
## 219  46          96000          0
## 220  59         143000          1
## 221  41          80000          0
## 222  35          91000          1
## 223  37         144000          1
## 225  35          60000          0
## 227  36         126000          1
## 231  35         147000          1
## 232  39          42000          0
## 233  40         107000          1
## 235  38         112000          0
## 238  37          80000          0
## 240  53         143000          1
## 242  38          59000          0
## 243  50          88000          1
## 244  56         104000          1
## 245  41          72000          0
## 246  51         146000          1
## 247  35          50000          0
## 248  57         122000          1
## 249  41          52000          0
## 250  35          97000          1
```

```
## 251  44     39000    0
## 252  37     52000    0
## 253  48    134000    1
## 254  37    146000    1
## 256  52     90000    1
## 257  41     72000    0
## 258  40     57000    0
## 259  58     95000    1
## 260  45    131000    1
## 261  35     77000    0
## 262  36    144000    1
## 263  55    125000    1
## 267  40     75000    0
## 268  37     74000    0
## 269  47    144000    1
## 270  40     61000    0
## 271  43    133000    0
## 272  59     76000    1
## 275  57     26000    1
## 276  57     74000    1
## 277  38     71000    0
## 278  49     88000    1
## 279  52     38000    1
## 280  50     36000    1
## 282  35     61000    0
## 283  37     70000    1
## 284  52     21000    1
## 285  48    141000    0
## 287  37     62000    0
## 288  48    138000    1
## 289  41     79000    0
## 290  37     78000    1
## 291  39    134000    1
## 293  55     39000    1
## 294  37     77000    0
## 295  35     57000    0
## 296  36     63000    0
## 297  42     73000    1
## 298  43    112000    1
## 300  46    117000    1
## 301  58     38000    1
## 303  37    137000    1
## 304  37     79000    1
## 306  42     54000    0
## 308  47    113000    1
## 309  36    125000    1
## 311  42     70000    0
## 312  39     96000    1
## 313  38     50000    0
## 314  49    141000    1
## 315  39     79000    0
## 317  54    104000    1
## 318  35     55000    0
## 319  45     32000    1
```

```
## 320  36             60000          0
## 321  52            138000          1
## 322  53             82000          1
## 323  41             52000          0
## 325  48            131000          1
## 327  41             72000          0
## 328  42             75000          0
## 329  36            118000          1
## 330  47            107000          1
## 331  38             51000          0
## 333  42             65000          0
## 334  40             65000          0
## 335  57             60000          1
## 336  36             54000          0
## 337  58            144000          1
## 338  35             79000          0
## 340  39            122000          1
## 342  35             75000          0
## 344  47             51000          1
## 345  47            105000          1
## 346  41             63000          0
## 348  54            108000          1
## 349  39             77000          0
## 350  38             61000          0
## 351  38            113000          1
## 352  37             75000          0
## 354  37             57000          0
## 355  36             99000          1
## 356  60             34000          1
## 357  54             70000          1
## 358  41             72000          0
## 359  40             71000          1
## 360  42             54000          0
## 361  43            129000          1
## 362  53             34000          1
## 365  42            104000          1
## 366  59             29000          1
## 370  54             26000          1
## 371  60             46000          1
## 374  59            130000          1
## 375  37             80000          0
## 376  46             32000          1
## 377  46             74000          0
## 378  42             53000          0
## 379  41             87000          1
## 381  42             64000          0
## 382  48             33000          1
## 384  49             28000          1
## 385  57             33000          1
## 386  56             60000          1
## 387  49             39000          1
## 388  39             71000          0
## 390  48             35000          1
## 391  48             33000          1
```

```
## 393  45           45000         1
## 394  60           42000         1
## 396  46           41000         1
## 397  51           23000         1
## 398  50           20000         1
## 399  36           33000         0
```

```
testing_set = subset(dataset, split == FALSE)
testing_set
```

```
##     Age EstimatedSalary Purchased
## 2    35           20000         0
## 4    27           57000         0
## 5    19           76000         0
## 9    25           33000         0
## 12   26           52000         0
## 18   45           26000         1
## 19   46           28000         1
## 20   48           29000         1
## 22   47           49000         1
## 29   29           43000         0
## 32   27          137000         1
## 34   28           44000         0
## 35   27           90000         0
## 38   30           49000         0
## 45   28           84000         0
## 46   23           20000         0
## 48   27           54000         0
## 52   18           44000         0
## 66   24           58000         0
## 69   22           63000         0
## 74   33          113000         0
## 75   32           18000         0
## 82   39           42000         0
## 84   35           88000         0
## 85   30           62000         0
## 86   31          118000         1
## 87   24           55000         0
## 89   26           81000         0
## 103  32           86000         0
## 104  33          149000         1
## 107  26           35000         0
## 108  27           89000         0
## 109  26           86000         0
## 117  35           75000         0
## 124  35           53000         0
## 126  39           61000         0
## 127  42           65000         0
## 131  31           58000         0
## 134  21           68000         0
## 139  28           59000         0
## 148  41           30000         0
## 154  36           50000         0
## 156  31           15000         0
## 159  26           30000         0
```

```
## 162  25          90000          0
## 163  37          33000          0
## 170  29          47000          0
## 175  34          72000          0
## 176  23          28000          0
## 193  29          43000          0
## 199  26          80000          0
## 200  35          22000          0
## 208  52         114000          0
## 213  59          42000          0
## 224  60         102000          1
## 226  37          53000          0
## 228  56         133000          1
## 229  40          72000          0
## 230  42          80000          1
## 234  49          86000          1
## 236  46          79000          1
## 237  40          57000          0
## 239  46          82000          0
## 241  42         149000          1
## 255  50          44000          0
## 264  35          72000          0
## 265  48          90000          1
## 266  42         108000          1
## 273  60          42000          1
## 274  39         106000          1
## 281  59          88000          1
## 286  37          93000          1
## 292  49          89000          1
## 299  45          79000          0
## 302  48          74000          1
## 305  40          60000          0
## 307  51         134000          0
## 310  38          50000          0
## 316  39          75000          1
## 324  48          30000          1
## 326  41          60000          0
## 332  48         119000          1
## 339  38          55000          0
## 341  53         104000          1
## 343  38          65000          0
## 347  53          72000          1
## 353  42          90000          1
## 363  47          50000          1
## 364  42          79000          0
## 367  58          47000          1
## 368  46          88000          1
## 369  38          71000          0
## 372  60          83000          1
## 373  39          73000          0
## 380  58          23000          1
## 383  44         139000          1
## 389  47          34000          1
## 392  47          23000          1
```

```
## 395  39            59000          0
## 400  49            36000          1
```

Escalado de datos

Standardisation

$$x_{stand} = \frac{x - mean(x)}{sd(x)}$$

```
training_set[,1:2] = scale(training_set[,1:2])
training_set
```

```
##              Age EstimatedSalary Purchased
## 1   -1.76554750     -1.47334137         0
## 3   -1.09629664     -0.78837605         0
## 6   -1.00068938     -0.36027273         0
## 7   -1.00068938      0.38177303         0
## 8   -0.52265305      2.26542765         1
## 10  -0.23583125     -0.16049118         0
## 11  -1.09629664      0.26761214         0
## 13  -1.66994024      0.43885347         0
## 14  -0.52265305     -1.50188159         0
## 15  -1.86115477      0.32469259         0
## 16  -0.80947485      0.26761214         0
## 17   0.91145593     -1.30210004         1
## 21   0.72024140     -1.38772071         1
## 23   1.00706320     -0.84545650         1
## 24   0.72024140     -1.38772071         1
## 25   0.81584866     -1.35918049         1
## 26   0.91145593     -1.44480115         1
## 27   1.10267046     -1.21647938         1
## 28   0.91145593     -1.15939893         1
## 30  -0.61826032     -1.50188159         0
## 31  -0.61826032      0.09637081         0
## 33  -1.57433297     -1.55896204         0
## 36  -0.23583125     -1.24501960         0
## 37  -0.42704579     -1.21647938         0
## 39  -1.09629664      0.03929037         0
## 40  -1.00068938     -1.13085871         0
## 41  -1.00068938     -1.53042182         0
## 42  -0.42704579     -0.56005428         0
## 43  -0.23583125      1.06673835         0
## 44  -0.71386758     -1.58750226         0
## 47  -1.19190391      0.23907192         0
## 49  -0.71386758      1.83732433         1
## 50  -0.61826032      0.52447414         0
## 51  -1.28751117     -1.10231849         0
## 53  -0.80947485      0.35323281         0
## 54  -0.23583125     -1.35918049         0
## 55  -1.00068938     -0.36027273         0
## 56  -1.28751117     -0.44589340         0
## 57  -1.38311844     -0.64567495         0
## 58  -0.90508211      0.23907192         0
## 59  -1.47872570     -1.50188159         0
## 60  -0.52265305      1.32360034         0
```

```
## 61  -1.00068938     -1.44480115          0
## 62  -1.19190391      0.46739370          0
## 63  -1.38311844     -0.13195096          0
## 64  -0.52265305      1.40922101          1
## 65   2.05874311      0.35323281          0
## 67  -1.28751117     -1.47334137          0
## 68  -1.38311844      0.32469259          0
## 70  -0.61826032     -0.07487051          0
## 71  -1.19190391      0.26761214          0
## 72  -1.28751117     -1.24501960          0
## 73  -1.66994024     -1.35918049          0
## 76  -0.33143852      1.18089923          1
## 77  -1.86115477     -0.53151406          0
## 78  -1.47872570     -1.24501960          0
## 79  -0.90508211      0.46739370          0
## 80  -1.09629664     -1.53042182          0
## 81  -0.71386758      0.26761214          0
## 83  -1.66994024     -0.61713472          0
## 88  -0.90508211      0.41031325          0
## 90  -0.23583125     -0.58859450          0
## 91  -1.47872570      0.29615237          0
## 92  -0.71386758      1.29506012          0
## 93  -1.09629664     -1.58750226          0
## 94  -0.80947485     -1.21647938          0
## 95  -0.80947485      0.35323281          0
## 96  -0.23583125     -0.75983583          0
## 97  -0.23583125     -1.30210004          0
## 98  -0.90508211      1.49484167          1
## 99  -0.23583125      0.06783059          0
## 100 -0.90508211     -0.95961738          0
## 101 -1.00068938      0.49593392          0
## 102 -0.90508211     -0.33173251          0
## 105 -1.76554750     -1.41626093          0
## 106 -1.57433297      0.03929037          0
## 110  0.05099054      0.26761214          0
## 111  0.14659781      0.01075015          0
## 112 -0.04461672      0.01075015          0
## 113  0.05099054     -0.27465207          0
## 114 -0.04461672     -0.44589340          0
## 115  0.43341960      0.26761214          0
## 116  0.24220507     -0.38881295          0
## 118 -0.14022399     -0.53151406          0
## 119  0.24220507     -0.33173251          0
## 120  0.33781234     -0.33173251          0
## 121 -0.14022399      0.12491104          0
## 122 -0.04461672      0.03929037          0
## 123  0.24220507      0.12491104          0
## 125  0.33781234     -0.56005428          0
## 128 -1.09629664     -1.10231849          0
## 129 -0.71386758     -1.53042182          0
## 130 -1.09629664      0.38177303          0
## 132 -0.42704579     -1.13085871          0
## 133 -0.71386758      0.46739370          0
## 135 -0.90508211     -0.44589340          0
```

```
## 136 -1.38311844     -0.21757162          0
## 137 -1.66994024      0.32469259          0
## 138 -0.71386758      1.03819813          1
## 140 -1.76554750     -1.30210004          0
## 141 -1.76554750      0.41031325          0
## 142 -1.86115477     -0.07487051          0
## 143 -0.23583125     -0.33173251          0
## 144 -0.71386758      0.52447414          0
## 145 -0.33143852     -1.30210004          0
## 146 -1.28751117      0.52447414          0
## 147 -1.00068938      0.72425569          1
## 149 -0.80947485     -0.27465207          0
## 150 -1.66994024      0.09637081          0
## 151 -1.09629664     -1.58750226          0
## 152  0.33781234     -0.73129561          0
## 153 -0.61826032      0.15345126          0
## 155  0.24220507     -0.67421517          0
## 157  0.81584866     -0.33173251          0
## 158 -0.80947485      0.12491104          0
## 160 -0.52265305      1.83732433          1
## 161 -0.52265305      0.83841658          1
## 164 -0.23583125     -0.93107716          0
## 165 -0.42704579     -0.04633029          0
## 166 -1.86115477      0.43885347          0
## 167 -1.47872570     -0.44589340          0
## 168 -0.23583125      0.01075015          0
## 169 -0.80947485      2.20834721          1
## 171 -1.57433297      0.49593392          0
## 172 -0.33143852      1.26651990          0
## 173 -1.09629664      1.35214056          0
## 174 -0.33143852     -0.78837605          0
## 177 -0.23583125     -0.67421517          0
## 178 -1.19190391     -1.38772071          0
## 179 -1.28751117     -1.35918049          0
## 180 -0.61826032     -1.04523805          0
## 181 -1.09629664     -1.55896204          0
## 182 -0.61826032      0.01075015          0
## 183 -0.52265305      1.32360034          1
## 184 -0.42704579     -0.78837605          0
## 185 -0.42704579     -0.30319229          0
## 186 -0.61826032     -0.13195096          0
## 187 -1.66994024      0.32469259          0
## 188 -0.42704579     -0.84545650          0
## 189 -0.23583125      0.03929037          0
## 190 -0.90508211     -1.10231849          0
## 191 -1.28751117      0.38177303          0
## 192 -1.76554750     -1.27355982          0
## 194 -1.76554750     -0.01779007          0
## 195 -0.90508211      0.52447414          0
## 196 -0.33143852     -0.78837605          0
## 197 -0.71386758      0.23907192          0
## 198 -1.66994024     -0.98815761          0
## 201 -0.23583125     -0.90253694          0
## 202  1.10267046      0.09637081          0
```

```
## 203  0.14659781      1.80878411          1
## 204  0.33781234      0.01075015          0
## 205  1.96313585      0.86695680          1
## 206  0.91145593     -0.67421517          0
## 207  1.67631405      1.69462322          1
## 209  0.24220507      2.03710588          1
## 210  0.81584866     -1.38772071          0
## 211  1.00706320      0.72425569          1
## 212  1.38949226      2.26542765          1
## 214 -0.23583125     -0.36027273          0
## 215  0.91145593     -0.78837605          0
## 216  2.15435038      1.06673835          1
## 217  1.10267046     -0.16049118          0
## 218  0.24220507      0.21053170          0
## 219  0.81584866      0.72425569          0
## 220  2.05874311      2.06564610          1
## 221  0.33781234      0.26761214          0
## 222 -0.23583125      0.58155458          1
## 223 -0.04461672      2.09418633          1
## 225 -0.23583125     -0.30319229          0
## 227 -0.14022399      1.58046234          1
## 231 -0.23583125      2.17980699          1
## 232  0.14659781     -0.81691628          0
## 233  0.24220507      1.03819813          1
## 235  0.05099054      1.18089923          0
## 238 -0.04461672      0.26761214          0
## 240  1.48509952      2.06564610          1
## 242  0.05099054     -0.33173251          0
## 243  1.19827773      0.49593392          1
## 244  1.77192132      0.95257746          1
## 245  0.33781234      0.03929037          0
## 246  1.29388499      2.15126677          1
## 247 -0.23583125     -0.58859450          0
## 248  1.86752858      1.46630145          1
## 249  0.33781234     -0.53151406          0
## 250 -0.23583125      0.75279591          1
## 251  0.62463413     -0.90253694          0
## 252 -0.04461672     -0.53151406          0
## 253  1.00706320      1.80878411          1
## 254 -0.04461672      2.15126677          1
## 256  1.38949226      0.55301436          1
## 257  0.33781234      0.03929037          0
## 258  0.24220507     -0.38881295          0
## 259  1.96313585      0.69571547          1
## 260  0.72024140      1.72316344          1
## 261 -0.23583125      0.18199148          0
## 262 -0.14022399      2.09418633          1
## 263  1.67631405      1.55192212          1
## 267  0.24220507      0.12491104          0
## 268 -0.04461672      0.09637081          0
## 269  0.91145593      2.09418633          1
## 270  0.24220507     -0.27465207          0
## 271  0.52902687      1.78024389          0
## 272  2.05874311      0.15345126          1
```

```
## 275  1.86752858     -1.27355982          1
## 276  1.86752858      0.09637081          1
## 277  0.05099054      0.01075015          0
## 278  1.10267046      0.49593392          1
## 279  1.38949226     -0.93107716          1
## 280  1.19827773     -0.98815761          1
## 282 -0.23583125     -0.27465207          0
## 283 -0.04461672     -0.01779007          1
## 284  1.38949226     -1.41626093          1
## 285  1.00706320      2.00856566          0
## 287 -0.04461672     -0.24611184          0
## 288  1.00706320      1.92294500          1
## 289  0.33781234      0.23907192          0
## 290 -0.04461672      0.21053170          1
## 291  0.14659781      1.80878411          1
## 293  1.67631405     -0.90253694          1
## 294 -0.04461672      0.18199148          0
## 295 -0.23583125     -0.38881295          0
## 296 -0.14022399     -0.21757162          0
## 297  0.43341960      0.06783059          1
## 298  0.52902687      1.18089923          1
## 300  0.81584866      1.32360034          1
## 301  1.96313585     -0.93107716          1
## 303 -0.04461672      1.89440477          1
## 304 -0.04461672      0.23907192          1
## 306  0.43341960     -0.47443362          0
## 308  0.91145593      1.20943946          1
## 309 -0.14022399      1.55192212          1
## 311  0.43341960     -0.01779007          0
## 312  0.14659781      0.72425569          1
## 313  0.05099054     -0.58859450          0
## 314  1.10267046      2.00856566          1
## 315  0.14659781      0.23907192          0
## 317  1.58070679      0.95257746          1
## 318 -0.23583125     -0.44589340          0
## 319  0.72024140     -1.10231849          1
## 320 -0.14022399     -0.30319229          0
## 321  1.38949226      1.92294500          1
## 322  1.48509952      0.32469259          1
## 323  0.33781234     -0.53151406          0
## 325  1.00706320      1.72316344          1
## 327  0.33781234      0.03929037          0
## 328  0.43341960      0.12491104          0
## 329 -0.14022399      1.35214056          1
## 330  0.91145593      1.03819813          1
## 331  0.05099054     -0.56005428          0
## 333  0.43341960     -0.16049118          0
## 334  0.24220507     -0.16049118          0
## 335  1.86752858     -0.30319229          1
## 336 -0.14022399     -0.47443362          0
## 337  1.96313585      2.09418633          1
## 338 -0.23583125      0.23907192          0
## 340  0.14659781      1.46630145          1
## 342 -0.23583125      0.12491104          0
```

```
## 344  0.91145593      -0.56005428         1
## 345  0.91145593       0.98111768         1
## 346  0.33781234      -0.21757162         0
## 348  1.58070679       1.06673835         1
## 349  0.14659781       0.18199148         0
## 350  0.05099054      -0.27465207         0
## 351  0.05099054       1.20943946         1
## 352 -0.04461672       0.12491104         0
## 354 -0.04461672      -0.38881295         0
## 355 -0.14022399       0.80987635         1
## 356  2.15435038      -1.04523805         1
## 357  1.58070679      -0.01779007         1
## 358  0.33781234       0.03929037         0
## 359  0.24220507       0.01075015         1
## 360  0.43341960      -0.47443362         0
## 361  0.52902687       1.66608300         1
## 362  1.48509952      -1.04523805         1
## 365  0.43341960       0.95257746         1
## 366  2.05874311      -1.18793916         1
## 370  1.58070679      -1.27355982         1
## 371  2.15435038      -0.70275539         1
## 374  2.05874311       1.69462322         1
## 375 -0.04461672       0.26761214         0
## 376  0.81584866      -1.10231849         1
## 377  0.81584866       0.09637081         0
## 378  0.43341960      -0.50297384         0
## 379  0.33781234       0.46739370         1
## 381  0.43341960      -0.18903140         0
## 382  1.00706320      -1.07377827         1
## 384  1.10267046      -1.21647938         1
## 385  1.86752858      -1.07377827         1
## 386  1.77192132      -0.30319229         1
## 387  1.10267046      -0.90253694         1
## 388  0.14659781       0.01075015         0
## 390  1.00706320      -1.01669783         1
## 391  1.00706320      -1.07377827         1
## 393  0.72024140      -0.73129561         1
## 394  2.15435038      -0.81691628         1
## 396  0.81584866      -0.84545650         1
## 397  1.29388499      -1.35918049         1
## 398  1.19827773      -1.44480115         1
## 399 -0.14022399      -1.07377827         0
```

```r
testing_set[,1:2] = scale(testing_set[,1:2])
testing_set
```

```
##              Age EstimatedSalary Purchased
## 2   -0.30419063     -1.51354339         0
## 4   -1.05994374     -0.32456026         0
## 5   -1.81569686      0.28599864         0
## 9   -1.24888202     -1.09579256         0
## 12  -1.15441288     -0.48523366         0
## 18   0.64050076     -1.32073531         1
## 19   0.73496990     -1.25646596         1
## 20   0.92390818     -1.22433128         1
```

```
## 22   0.82943904     -0.58163769          1
## 29  -0.87100546     -0.77444577          0
## 32  -1.05994374      2.24621408          1
## 34  -0.96547460     -0.74231109          0
## 35  -1.05994374      0.73588415          0
## 38  -0.77653633     -0.58163769          0
## 45  -0.96547460      0.54307608          0
## 46  -1.43782030     -1.51354339          0
## 48  -1.05994374     -0.42096430          0
## 52  -1.91016600     -0.74231109          0
## 66  -1.34335116     -0.29242558          0
## 69  -1.53228944     -0.13175218          0
## 74  -0.49312891      1.47498177          0
## 75  -0.58759805     -1.57781275          0
## 82   0.07368593     -0.80658045          0
## 84  -0.30419063      0.67161480          0
## 85  -0.77653633     -0.16388686          0
## 86  -0.68206719      1.63565517          1
## 87  -1.34335116     -0.38882962          0
## 89  -1.15441288      0.44667204          0
## 103 -0.58759805      0.60734544          0
## 104 -0.49312891      2.63183023          1
## 107 -1.15441288     -1.03152320          0
## 108 -1.05994374      0.70374947          0
## 109 -1.15441288      0.60734544          0
## 117 -0.30419063      0.25386397          0
## 124 -0.30419063     -0.45309898          0
## 126  0.07368593     -0.19602154          0
## 127  0.35709335     -0.06748283          0
## 131 -0.68206719     -0.29242558          0
## 134 -1.62675858      0.02892121          0
## 139 -0.96547460     -0.26029090          0
## 148  0.26262421     -1.19219660          0
## 154 -0.20972149     -0.54950301          0
## 156 -0.68206719     -1.67421679          0
## 159 -1.15441288     -1.19219660          0
## 162 -1.24888202      0.73588415          0
## 163 -0.11525235     -1.09579256          0
## 170 -0.87100546     -0.64590705          0
## 175 -0.39865977      0.15745993          0
## 176 -1.43782030     -1.25646596          0
## 193 -0.87100546     -0.77444577          0
## 199 -1.15441288      0.41453736          0
## 200 -0.30419063     -1.44927403          0
## 208  1.30178474      1.50711645          0
## 213  1.96306872     -0.80658045          0
## 224  2.05753786      1.12150030          1
## 226 -0.11525235     -0.45309898          0
## 228  1.67966130      2.11767536          1
## 229  0.16815507      0.15745993          0
## 230  0.35709335      0.41453736          1
## 234  1.01837732      0.60734544          1
## 236  0.73496990      0.38240268          1
## 237  0.16815507     -0.32456026          0
```

```
## 239  0.73496990      0.47880672         0
## 241  0.35709335      2.63183023         1
## 255  1.11284646     -0.74231109         0
## 264 -0.30419063      0.15745993         0
## 265  0.92390818      0.73588415         1
## 266  0.35709335      1.31430838         1
## 273  2.05753786     -0.80658045         1
## 274  0.07368593      1.25003902         1
## 281  1.96306872      0.67161480         1
## 286 -0.11525235      0.83228819         1
## 292  1.01837732      0.70374947         1
## 299  0.64050076      0.38240268         0
## 302  0.92390818      0.22172929         1
## 305  0.16815507     -0.22815622         0
## 307  1.20731560      2.14981004         0
## 310 -0.02078321     -0.54950301         0
## 316  0.07368593      0.25386397         1
## 324  0.92390818     -1.19219660         1
## 326  0.26262421     -0.22815622         0
## 332  0.92390818      1.66778985         1
## 339 -0.02078321     -0.38882962         0
## 341  1.39625388      1.18576966         1
## 343 -0.02078321     -0.06748283         0
## 347  1.39625388      0.15745993         1
## 353  0.35709335      0.73588415         1
## 363  0.82943904     -0.54950301         1
## 364  0.35709335      0.38240268         0
## 367  1.86859958     -0.64590705         1
## 368  0.73496990      0.67161480         1
## 369 -0.02078321      0.12532525         0
## 372  2.05753786      0.51094140         1
## 373  0.07368593      0.18959461         0
## 380  1.86859958     -1.41713935         1
## 383  0.54603163      2.31048343         1
## 389  0.82943904     -1.06365788         1
## 392  0.82943904     -1.41713935         1
## 395  0.07368593     -0.26029090         0
## 400  1.01837732     -0.99938852         1
```

Ajustar el modelo de Regresión Logística con el conjunto de entrenamiento y hacer las predicciones con el conjunto testing

```
library(e1071)
```

```
## Warning: package 'e1071' was built under R version 4.0.5
```

```
classifier = naiveBayes(formula = Purchased ~.,
                 data = training_set)
```

```
y_pred = predict(classifier,
                 newdata = testing_set[, -3])
y_pred
```

```
##   [1] 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0
```

```
##  [38] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 0 1 1 0 1 1 1 0 1 1 1 1 1 0 1 1
##  [75] 1 0 1 0 0 1 0 1 0 1 0 1 1 0 0 1 1 0 1 0 1 1 1 1 0 1
## Levels: 0 1
```

Comparar uno a uno los resultados predichos con los esperados no es una buena técnica por lo que se construye la matriz de confusión

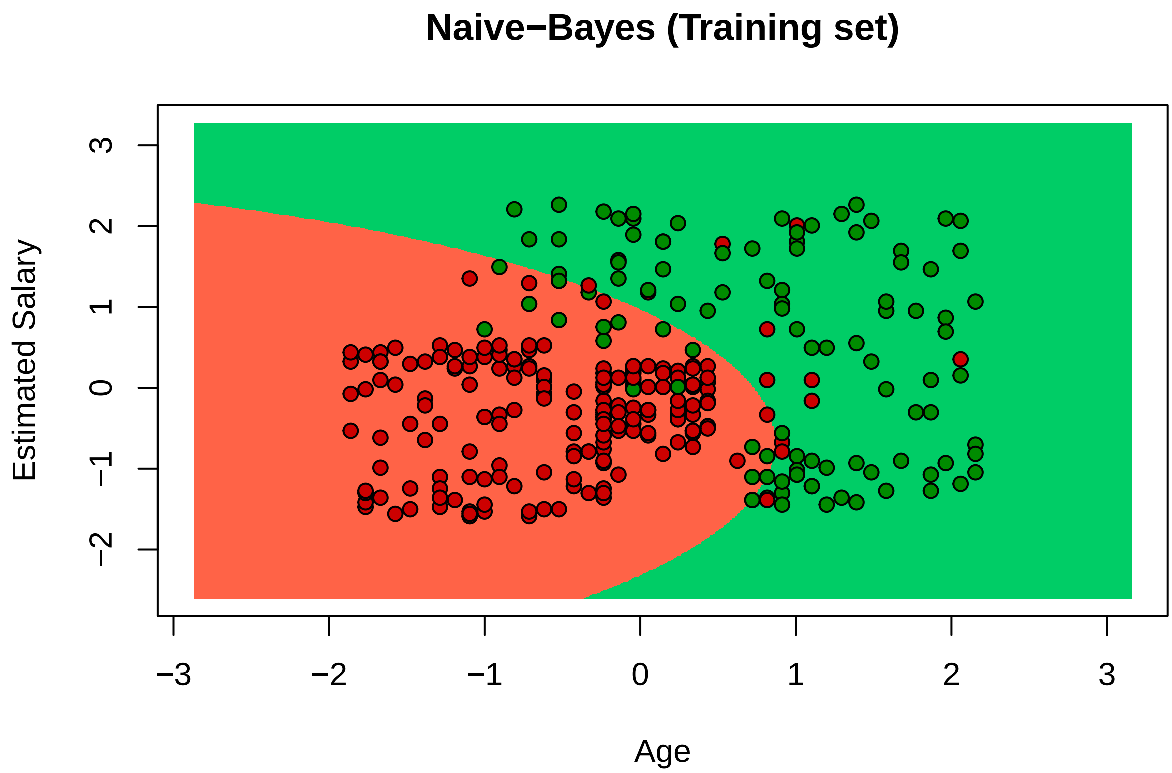
```r
cm = table(testing_set[, 3], y_pred)
cm
```

```
##    y_pred
##      0  1
##   0 57  7
##   1  7 29
```

La diagonal principal es la cantidad de datos que son predichos correctamente.La diagonal secundaria son los fallos.

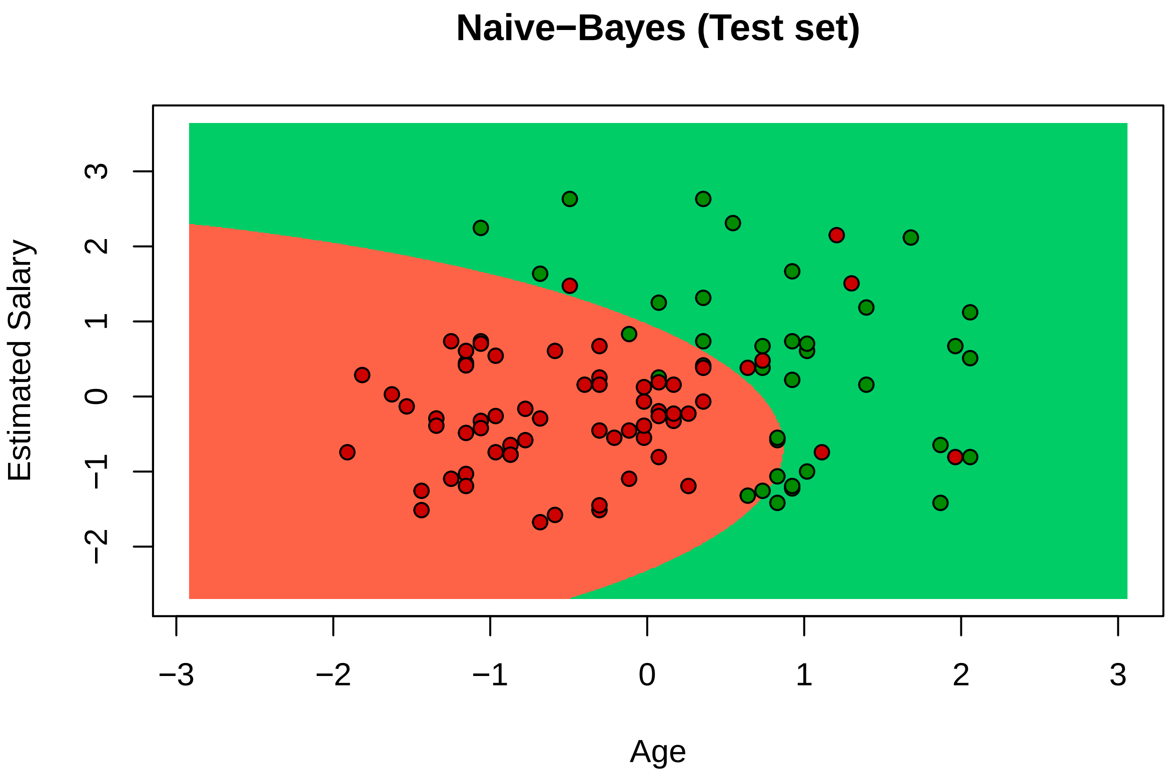
Visualización del conjunto de entranmiento

```r
library(ElemStatLearn)
set = training_set
X1 = seq(min(set[, 1]) - 1, max(set[, 1]) + 1, by = 0.01)
X2 = seq(min(set[, 2]) - 1, max(set[, 2]) + 1, by = 0.01)
grid_set = expand.grid(X1, X2)
colnames(grid_set) = c('Age', 'EstimatedSalary')
y_grid = predict(classifier,
                 newdata = grid_set)
plot(set[, -3],
     main = 'Naive-Bayes (Training set)',
     xlab = 'Age', ylab = 'Estimated Salary',
     xlim = range(X1), ylim = range(X2))
contour(X1, X2, matrix(as.numeric(y_grid), length(X1), length(X2)), add = TRUE)
points(grid_set, pch = '.', col = ifelse(y_grid == 1, 'springgreen3', 'tomato'))
points(set, pch = 21, bg = ifelse(set[, 3] == 1, 'green4', 'red3'))
```



Visualising the Test set results

```
library(ElemStatLearn)
set = testing_set
X1 = seq(min(set[, 1]) - 1, max(set[, 1]) + 1, by = 0.01)
X2 = seq(min(set[, 2]) - 1, max(set[, 2]) + 1, by = 0.01)
grid_set = expand.grid(X1, X2)
colnames(grid_set) = c('Age', 'EstimatedSalary')
y_grid = predict(classifier,
                 newdata = grid_set)
plot(set[, -3],
     main = 'Naive-Bayes (Test set)',
     xlab = 'Age', ylab = 'Estimated Salary',
     xlim = range(X1), ylim = range(X2))
contour(X1, X2, matrix(as.numeric(y_grid), length(X1), length(X2)), add = TRUE)
points(grid_set, pch = '.', col = ifelse(y_grid == 1, 'springgreen3', 'tomato'))
points(set, pch = 21, bg = ifelse(set[, 3] == 1, 'green4', 'red3'))
```



Naive−Bayes (Test set)
Estimated Salary
Age
−3
−2
−1
0
1
2
3