Visualización de datos

Gráficas con ggplot

Agosto 2017

```r
if (!require('Rcpp')) install.packages('Rcpp'); library('Rcpp')
if (!require('naniar')) install.packages('naniar'); library('naniar')
if (!require('ggplot2')) install.packages('ggplot2'); library('ggplot2')
if (!require('scales')) install.packages('scales'); library('scales')
if (!require('forcats')) install.packages('forcats'); library('forcats')
if (!require('GGally')) install.packages('GGally'); library('GGally')
if (!require('mi')) install.packages('mi'); library('mi')
if (!require('extracat')) install.packages('extracat'); library('extracat')
if (!require('data.table')) install.packages('data.table'); library('data.table')
if (!require('dplyr')) install.packages('dplyr'); library('dplyr')
if (!require('maps')) install.packages('maps'); library('maps')
if (!require('ggalt')) install.packages('ggalt'); library('ggalt')
if (!require('ggExtra')) install.packages('ggExtra'); library('ggExtra')
```

```r
options(scipen=999)
theme_set(theme_bw())
```

```r
data <- read.csv("data/train.csv", header=T, dec=".", sep=",")
dim(data)
```

```
## [1] 1460   81
```

```r
head(data)
```

```
##   Id MSSubClass MSZoning LotFrontage LotArea Street Alley LotShape
## 1  1         60       RL          65    8450   Pave  <NA>      Reg
## 2  2         20       RL          80    9600   Pave  <NA>      Reg
## 3  3         60       RL          68   11250   Pave  <NA>      IR1
## 4  4         70       RL          60    9550   Pave  <NA>      IR1
## 5  5         60       RL          84   14260   Pave  <NA>      IR1
## 6  6         50       RL          85   14115   Pave  <NA>      IR1
##   LandContour Utilities LotConfig LandSlope Neighborhood Condition1
## 1         Lvl    AllPub    Inside       Gtl      CollgCr       Norm
## 2         Lvl    AllPub       FR2       Gtl      Veenker      Feedr
## 3         Lvl    AllPub    Inside       Gtl      CollgCr       Norm
## 4         Lvl    AllPub    Corner       Gtl      Crawfor       Norm
## 5         Lvl    AllPub       FR2       Gtl      NoRidge       Norm
## 6         Lvl    AllPub    Inside       Gtl      Mitchel       Norm
##   Condition2 BldgType HouseStyle OverallQual OverallCond YearBuilt
## 1       Norm     1Fam     2Story           7           5      2003
## 2       Norm     1Fam     1Story           6           8      1976
## 3       Norm     1Fam     2Story           7           5      2001
## 4       Norm     1Fam     2Story           7           5      1915
## 5       Norm     1Fam     2Story           8           5      2000
## 6       Norm     1Fam     1.5Fin           5           5      1993
##   YearRemodAdd RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType
## 1         2003     Gable  CompShg     VinylSd     VinylSd    BrkFace
## 2         1976     Gable  CompShg     MetalSd     MetalSd       None
## 3         2002     Gable  CompShg     VinylSd     VinylSd    BrkFace
## 4         1970     Gable  CompShg     Wd Sdng     Wd Shng       None
## 5         2000     Gable  CompShg     VinylSd     VinylSd    BrkFace
## 6         1995     Gable  CompShg     VinylSd     VinylSd       None
##   MasVnrArea ExterQual ExterCond Foundation BsmtQual BsmtCond BsmtExposure
## 1        196        Gd        TA      PConc       Gd       TA           No
## 2          0        TA        TA     CBlock       Gd       TA           Gd
## 3        162        Gd        TA      PConc       Gd       TA           Mn
## 4          0        TA        TA     BrkTil       TA       Gd           No
## 5        350        Gd        TA      PConc       Gd       TA           Av
## 6          0        TA        TA       Wood       Gd       TA           No
##   BsmtFinType1 BsmtFinSF1 BsmtFinType2 BsmtFinSF2 BsmtUnfSF TotalBsmtSF
## 1          GLQ        706          Unf          0       150         856
## 2          ALQ        978          Unf          0       284        1262
## 3          GLQ        486          Unf          0       434         920
## 4          ALQ        216          Unf          0       540         756
## 5          GLQ        655          Unf          0       490        1145
## 6          GLQ        732          Unf          0        64         796
##   Heating HeatingQC CentralAir Electrical X1stFlrSF X2ndFlrSF LowQualFinSF
## 1    GasA        Ex          Y      SBrkr       856       854            0
## 2    GasA        Ex          Y      SBrkr      1262         0            0
## 3    GasA        Ex          Y      SBrkr       920       866            0
## 4    GasA        Gd          Y      SBrkr       961       756            0
## 5    GasA        Ex          Y      SBrkr      1145      1053            0
## 6    GasA        Ex          Y      SBrkr       796       566            0
##   GrLivArea BsmtFullBath BsmtHalfBath FullBath HalfBath BedroomAbvGr
## 1      1710            1            0        2        1            3
## 2      1262            0            1        2        0            3
## 3      1786            1            0        2        1            3
## 4      1717            1            0        1        0            3
## 5      2198            1            0        2        1            4
## 6      1362            1            0        1        1            1
##   KitchenAbvGr KitchenQual TotRmsAbvGrd Functional Fireplaces FireplaceQu
## 1            1          Gd            8        Typ          0        <NA>
## 2            1          TA            6        Typ          1          TA
## 3            1          Gd            6        Typ          1          TA
## 4            1          Gd            7        Typ          1          Gd
## 5            1          Gd            9        Typ          1          TA
## 6            1          TA            5        Typ          0        <NA>
##   GarageType GarageYrBlt GarageFinish GarageCars GarageArea GarageQual
## 1     Attchd        2003          RFn          2        548         TA
## 2     Attchd        1976          RFn          2        460         TA
## 3     Attchd        2001          RFn          2        608         TA
## 4     Detchd        1998          Unf          3        642         TA
## 5     Attchd        2000          RFn          3        836         TA
## 6     Attchd        1993          Unf          2        480         TA
##   GarageCond PavedDrive WoodDeckSF OpenPorchSF EnclosedPorch X3SsnPorch
## 1         TA          Y          0          61             0          0
## 2         TA          Y        298           0             0          0
## 3         TA          Y          0          42             0          0
## 4         TA          Y          0          35           272          0
## 5         TA          Y        192          84             0          0
## 6         TA          Y         40          30             0        320
##   ScreenPorch PoolArea PoolQC Fence MiscFeature MiscVal MoSold YrSold
## 1           0        0   <NA>  <NA>        <NA>       0      2   2008
## 2           0        0   <NA>  <NA>        <NA>       0      5   2007
## 3           0        0   <NA>  <NA>        <NA>       0      9   2008
## 4           0        0   <NA>  <NA>        <NA>       0      2   2006
## 5           0        0   <NA>  <NA>        <NA>       0     12   2008
## 6           0        0   <NA> MnPrv        Shed     700     10   2009
##   SaleType SaleCondition SalePrice
## 1       WD        Normal    208500
## 2       WD        Normal    181500
## 3       WD        Normal    223500
## 4       WD       Abnorml    140000
## 5       WD        Normal    250000
## 6       WD        Normal    143000
```

```r
summary(data)
```

```
##        Id           MSSubClass       MSZoning     LotFrontage
##  Min.   :   1.0   Min.   : 20.0   C (all):  10   Min.   : 21.00
##  1st Qu.: 365.8   1st Qu.: 20.0   FV     :  65   1st Qu.: 59.00
##  Median : 730.5   Median : 50.0   RH     :  16   Median : 69.00
##  Mean   : 730.5   Mean   : 56.9   RL     :1151   Mean   : 70.05
##  3rd Qu.:1095.2   3rd Qu.: 70.0   RM     : 218   3rd Qu.: 80.00
##  Max.   :1460.0   Max.   :190.0                  Max.   :313.00
##                                                  NA's   :259
##     LotArea        Street      Alley      LotShape  LandContour
##  Min.   :  1300   Grvl:   6   Grvl:  50   IR1:484   Bnk:  63
##  1st Qu.:  7554   Pave:1454   Pave:  41   IR2: 41   HLS:  50
##  Median :  9478               NA's:1369   IR3: 10   Low:  36
##  Mean   : 10517                           Reg:925   Lvl:1311
##  3rd Qu.: 11602
##  Max.   :215245
##
##   Utilities      LotConfig    LandSlope   Neighborhood   Condition1
##  AllPub:1459   Corner : 263   Gtl:1382   NAmes  :225   Norm   :1260
##  NoSeWa:   1   CulDSac:  94   Mod:  65   CollgCr:150   Feedr  :  81
##                FR2    :  47   Sev:  13   OldTown:113   Artery :  48
##                FR3    :   4              Edwards:100   RRAn   :  26
##                Inside :1052              Somerst: 86   PosN   :  19
##                                          Gilbert: 79   RRAe   :  11
##                                          (Other):707   (Other):  15
##    Condition2     BldgType      HouseStyle    OverallQual
##  Norm   :1445   1Fam  :1220   1Story :726   Min.   : 1.000
##  Feedr  :   6   2fmCon:  31   2Story :445   1st Qu.: 5.000
##  Artery :   2   Duplex:  52   1.5Fin :154   Median : 6.000
##  PosN   :   2   Twnhs :  43   SLvl   : 65   Mean   : 6.099
##  RRNn   :   2   TwnhsE: 114   SFoyer : 37   3rd Qu.: 7.000
##  PosA   :   1                 1.5Unf : 14   Max.   :10.000
##  (Other):   2                 (Other): 19
##   OverallCond      YearBuilt     YearRemodAdd    RoofStyle
##  Min.   :1.000   Min.   :1872   Min.   :1950   Flat   :  13
##  1st Qu.:5.000   1st Qu.:1954   1st Qu.:1967   Gable  :1141
##  Median :5.000   Median :1973   Median :1994   Gambrel:  11
##  Mean   :5.575   Mean   :1971   Mean   :1985   Hip    : 286
##  3rd Qu.:6.000   3rd Qu.:2000   3rd Qu.:2004   Mansard:   7
##  Max.   :9.000   Max.   :2010   Max.   :2010   Shed   :   2
##
```

```
##     RoofMatl     Exterior1st   Exterior2nd    MasVnrType    MasVnrArea
##  CompShg:1434   VinylSd:515   VinylSd:504   BrkCmn : 15   Min.   :   0.0
##  Tar&Grv:  11   HdBoard:222   MetalSd:214   BrkFace:445   1st Qu.:   0.0
##  WdShngl:   6   MetalSd:220   HdBoard:207   None   :864   Median :   0.0
##  WdShake:   5   Wd Sdng:206   Wd Sdng:197   Stone  :128   Mean   : 103.7
##  ClyTile:   1   Plywood:108   Plywood:142   NA's   :  8   3rd Qu.: 166.0
##  Membran:   1   CemntBd: 61   CmentBd: 60                 Max.   :1600.0
##  (Other):   2   (Other):128   (Other):136                 NA's   :8
##  ExterQual ExterCond  Foundation  BsmtQual   BsmtCond    BsmtExposure
##  Ex: 52    Ex:   3   BrkTil:146   Ex  :121   Fa  :  45   Av  :221
##  Fa: 14    Fa:  28   CBlock:634   Fa  : 35   Gd  :  65   Gd  :134
##  Gd:488    Gd: 146   PConc :647   Gd  :618   Po  :   2   Mn  :114
##  TA:906    Po:   1   Slab  : 24   TA  :649   TA  :1311   No  :953
##            TA:1282   Stone :  6   NA's: 37   NA's:  37   NA's: 38
##                      Wood  :  3
##
##  BsmtFinType1   BsmtFinSF1     BsmtFinType2   BsmtFinSF2
##  ALQ :220     Min.   :   0.0   ALQ :  19    Min.   :   0.00
##  BLQ :148     1st Qu.:   0.0   BLQ :  33    1st Qu.:   0.00
##  GLQ :418     Median : 383.5   GLQ :  14    Median :   0.00
##  LwQ : 74     Mean   : 443.6   LwQ :  46    Mean   :  46.55
##  Rec :133     3rd Qu.: 712.2   Rec :  54    3rd Qu.:   0.00
##  Unf :430     Max.   :5644.0   Unf :1256    Max.   :1474.00
##  NA's: 37                      NA's:  38
##    BsmtUnfSF       TotalBsmtSF      Heating     HeatingQC CentralAir
##  Min.   :   0.0   Min.   :   0.0   Floor:   1   Ex:741    N:  95
##  1st Qu.: 223.0   1st Qu.: 795.8   GasA :1428   Fa: 49    Y:1365
##  Median : 477.5   Median : 991.5   GasW :  18   Gd:241
##  Mean   : 567.2   Mean   :1057.4   Grav :   7   Po:  1
##  3rd Qu.: 808.0   3rd Qu.:1298.2   OthW :   2   TA:428
##  Max.   :2336.0   Max.   :6110.0   Wall :   4
##
##  Electrical     X1stFlrSF      X2ndFlrSF     LowQualFinSF
##  FuseA:  94   Min.   : 334   Min.   :   0   Min.   :  0.000
##  FuseF:  27   1st Qu.: 882   1st Qu.:   0   1st Qu.:  0.000
##  FuseP:   3   Median :1087   Median :   0   Median :  0.000
##  Mix  :   1   Mean   :1163   Mean   : 347   Mean   :  5.845
##  SBrkr:1334   3rd Qu.:1391   3rd Qu.: 728   3rd Qu.:  0.000
##  NA's :   1   Max.   :4692   Max.   :2065   Max.   :572.000
##
##    GrLivArea     BsmtFullBath     BsmtHalfBath        FullBath
##  Min.   : 334   Min.   :0.0000   Min.   :0.00000   Min.   :0.000
##  1st Qu.:1130   1st Qu.:0.0000   1st Qu.:0.00000   1st Qu.:1.000
##  Median :1464   Median :0.0000   Median :0.00000   Median :2.000
##  Mean   :1515   Mean   :0.4253   Mean   :0.05753   Mean   :1.565
##  3rd Qu.:1777   3rd Qu.:1.0000   3rd Qu.:0.00000   3rd Qu.:2.000
##  Max.   :5642   Max.   :3.0000   Max.   :2.00000   Max.   :3.000
##
##     HalfBath       BedroomAbvGr    KitchenAbvGr   KitchenQual
##  Min.   :0.0000   Min.   :0.000   Min.   :0.000   Ex:100
##  1st Qu.:0.0000   1st Qu.:2.000   1st Qu.:1.000   Fa: 39
##  Median :0.0000   Median :3.000   Median :1.000   Gd:586
##  Mean   :0.3829   Mean   :2.866   Mean   :1.047   TA:735
##  3rd Qu.:1.0000   3rd Qu.:3.000   3rd Qu.:1.000
##  Max.   :2.0000   Max.   :8.000   Max.   :3.000
##
##   TotRmsAbvGrd    Functional    Fireplaces    FireplaceQu   GarageType
##  Min.   : 2.000   Maj1:  14   Min.   :0.000   Ex  : 24    2Types :  6
##  1st Qu.: 5.000   Maj2:   5   1st Qu.:0.000   Fa  : 33    Attchd :870
##  Median : 6.000   Min1:  31   Median :1.000   Gd  :380    Basment: 19
##  Mean   : 6.518   Min2:  34   Mean   :0.613   Po  : 20    BuiltIn: 88
##  3rd Qu.: 7.000   Mod :  15   3rd Qu.:1.000   TA  :313    CarPort:  9
##  Max.   :14.000   Sev :   1   Max.   :3.000   NA's:690    Detchd :387
##                   Typ :1360                               NA's   : 81
##   GarageYrBlt   GarageFinish   GarageCars      GarageArea     GarageQual
##  Min.   :1900   Fin :352     Min.   :0.000   Min.   :   0.0   Ex  :   3
##  1st Qu.:1961   RFn :422     1st Qu.:1.000   1st Qu.: 334.5   Fa  :  48
##  Median :1980   Unf :605     Median :2.000   Median : 480.0   Gd  :  14
##  Mean   :1979   NA's: 81     Mean   :1.767   Mean   : 473.0   Po  :   3
##  3rd Qu.:2002                3rd Qu.:2.000   3rd Qu.: 576.0   TA  :1311
##  Max.   :2010                Max.   :4.000   Max.   :1418.0   NA's:  81
##  NA's   :81
##  GarageCond  PavedDrive   WoodDeckSF      OpenPorchSF     EnclosedPorch
##  Ex  :   2   N:  90     Min.   :  0.00   Min.   :  0.00   Min.   :  0.00
##  Fa  :  35   P:  30     1st Qu.:  0.00   1st Qu.:  0.00   1st Qu.:  0.00
##  Gd  :   9   Y:1340     Median :  0.00   Median : 25.00   Median :  0.00
##  Po  :   7              Mean   : 94.24   Mean   : 46.66   Mean   : 21.95
##  TA  :1326              3rd Qu.:168.00   3rd Qu.: 68.00   3rd Qu.:  0.00
##  NA's:  81              Max.   :857.00   Max.   :547.00   Max.   :552.00
##
##    X3SsnPorch      ScreenPorch        PoolArea        PoolQC
##  Min.   :  0.00   Min.   :  0.00   Min.   :  0.000   Ex  :   2
##  1st Qu.:  0.00   1st Qu.:  0.00   1st Qu.:  0.000   Fa  :   2
##  Median :  0.00   Median :  0.00   Median :  0.000   Gd  :   3
##  Mean   :  3.41   Mean   : 15.06   Mean   :  2.759   NA's:1453
##  3rd Qu.:  0.00   3rd Qu.:  0.00   3rd Qu.:  0.000
##  Max.   :508.00   Max.   :480.00   Max.   :738.000
##
##    Fence      MiscFeature    MiscVal             MoSold
##  GdPrv:  59   Gar2:   2   Min.   :    0.00   Min.   : 1.000
##  GdWo :  54   Othr:   2   1st Qu.:    0.00   1st Qu.: 5.000
##  MnPrv: 157   Shed:  49   Median :    0.00   Median : 6.000
##  MnWw :  11   TenC:   1   Mean   :   43.49   Mean   : 6.322
##  NA's :1179   NA's:1406   3rd Qu.:    0.00   3rd Qu.: 8.000
##                           Max.   :15500.00   Max.   :12.000
##
##      YrSold        SaleType    SaleCondition    SalePrice
##  Min.   :2006   WD     :1267   Abnorml: 101   Min.   : 34900
##  1st Qu.:2007   New    : 122   AdjLand:   4   1st Qu.:129975
##  Median :2008   COD    :  43   Alloca :  12   Median :163000
##  Mean   :2008   ConLD  :   9   Family :  20   Mean   :180921
##  3rd Qu.:2009   ConLI  :   5   Normal :1198   3rd Qu.:214000
##  Max.   :2010   ConLw  :   5   Partial: 125   Max.   :755000
##                 (Other):   9
```

```
str(data)
```

```
## 'data.frame':    1460 obs. of  81 variables:
##  $ Id           : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ MSSubClass   : int  60 20 60 70 60 50 20 60 50 190 ...
##  $ MSZoning     : Factor w/ 5 levels "C (all)","FV",..: 4 4 4 4 4 4 4 4 5 4 ...
##  $ LotFrontage  : int  65 80 68 60 84 85 75 NA 51 50 ...
##  $ LotArea      : int  8450 9600 11250 9550 14260 14115 10084 10382 6120 7420 ...
##  $ Street       : Factor w/ 2 levels "Grvl","Pave": 2 2 2 2 2 2 2 2 2 2 ...
##  $ Alley        : Factor w/ 2 levels "Grvl","Pave": NA NA NA NA NA NA NA NA NA NA ...
##  $ LotShape     : Factor w/ 4 levels "IR1","IR2","IR3",..: 4 4 1 1 1 1 4 1 4 4 ...
##  $ LandContour  : Factor w/ 4 levels "Bnk","HLS","Low",..: 4 4 4 4 4 4 4 4 4 4 ...
##  $ Utilities    : Factor w/ 2 levels "AllPub","NoSeWa": 1 1 1 1 1 1 1 1 1 1 ...
##  $ LotConfig    : Factor w/ 5 levels "Corner","CulDSac",..: 5 3 5 1 3 5 5 1 5 1 ...
##  $ LandSlope    : Factor w/ 3 levels "Gtl","Mod","Sev": 1 1 1 1 1 1 1 1 1 1 ...
##  $ Neighborhood : Factor w/ 25 levels "Blmngtn","Blueste",..: 6 25 6 7 14 12 21 17 18 4 ...
##  $ Condition1   : Factor w/ 9 levels "Artery","Feedr",..: 3 2 3 3 3 3 3 5 1 1 ...
##  $ Condition2   : Factor w/ 8 levels "Artery","Feedr",..: 3 3 3 3 3 3 3 3 3 1 ...
##  $ BldgType     : Factor w/ 5 levels "1Fam","2fmCon",..: 1 1 1 1 1 1 1 1 1 2 ...
##  $ HouseStyle   : Factor w/ 8 levels "1.5Fin","1.5Unf",..: 6 3 6 6 6 1 3 6 1 2 ...
##  $ OverallQual  : int  7 6 7 7 8 5 8 7 7 5 ...
##  $ OverallCond  : int  5 8 5 5 5 5 5 6 5 6 ...
##  $ YearBuilt    : int  2003 1976 2001 1915 2000 1993 2004 1973 1931 1939 ...
##  $ YearRemodAdd : int  2003 1976 2002 1970 2000 1995 2005 1973 1950 1950 ...
##  $ RoofStyle    : Factor w/ 6 levels "Flat","Gable",..: 2 2 2 2 2 2 2 2 2 2 ...
##  $ RoofMatl     : Factor w/ 8 levels "ClyTile","CompShg",..: 2 2 2 2 2 2 2 2 2 2 ...
##  $ Exterior1st  : Factor w/ 15 levels "AsbShng","AsphShn",..: 13 9 13 14 13 13 13 7 4 9 ...
##  $ Exterior2nd  : Factor w/ 16 levels "AsbShng","AsphShn",..: 14 9 14 16 14 14 14 7 16 9 ...
##  $ MasVnrType   : Factor w/ 4 levels "BrkCmn","BrkFace",..: 2 3 2 3 2 3 4 4 3 3 ...
##  $ MasVnrArea   : int  196 0 162 0 350 0 186 240 0 0 ...
##  $ ExterQual    : Factor w/ 4 levels "Ex","Fa","Gd",..: 3 4 3 4 3 4 3 4 4 4 ...
##  $ ExterCond    : Factor w/ 5 levels "Ex","Fa","Gd",..: 5 5 5 5 5 5 5 5 5 5 ...
##  $ Foundation   : Factor w/ 6 levels "BrkTil","CBlock",..: 3 2 3 1 3 6 3 2 1 1 ...
##  $ BsmtQual     : Factor w/ 4 levels "Ex","Fa","Gd",..: 3 3 3 4 3 3 1 3 4 4 ...
##  $ BsmtCond     : Factor w/ 4 levels "Fa","Gd","Po",..: 4 4 4 2 4 4 4 4 4 4 ...
##  $ BsmtExposure : Factor w/ 4 levels "Av","Gd","Mn",..: 4 2 3 4 1 4 1 3 4 4 ...
##  $ BsmtFinType1 : Factor w/ 6 levels "ALQ","BLQ","GLQ",..: 3 1 3 1 3 3 3 1 6 3 ...
##  $ BsmtFinSF1   : int  706 978 486 216 655 732 1369 859 0 851 ...
##  $ BsmtFinType2 : Factor w/ 6 levels "ALQ","BLQ","GLQ",..: 6 6 6 6 6 6 6 2 6 6 ...
##  $ BsmtFinSF2   : int  0 0 0 0 0 0 0 32 0 0 ...
##  $ BsmtUnfSF    : int  150 284 434 540 490 64 317 216 952 140 ...
##  $ TotalBsmtSF  : int  856 1262 920 756 1145 796 1686 1107 952 991 ...
##  $ Heating      : Factor w/ 6 levels "Floor","GasA",..: 2 2 2 2 2 2 2 2 2 2 ...
##  $ HeatingQC    : Factor w/ 5 levels "Ex","Fa","Gd",..: 1 1 1 3 1 1 1 1 3 1 ...
##  $ CentralAir   : Factor w/ 2 levels "N","Y": 2 2 2 2 2 2 2 2 2 2 ...
##  $ Electrical   : Factor w/ 5 levels "FuseA","FuseF",..: 5 5 5 5 5 5 5 5 2 5 ...
##  $ X1stFlrSF    : int  856 1262 920 961 1145 796 1694 1107 1022 1077 ...
##  $ X2ndFlrSF    : int  854 0 866 756 1053 566 0 983 752 0 ...
##  $ LowQualFinSF : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ GrLivArea    : int  1710 1262 1786 1717 2198 1362 1694 2090 1774 1077 ...
##  $ BsmtFullBath : int  1 0 1 1 1 1 1 1 0 1 ...
##  $ BsmtHalfBath : int  0 1 0 0 0 0 0 0 0 0 ...
##  $ FullBath     : int  2 2 2 1 2 1 2 2 2 1 ...
##  $ HalfBath     : int  1 0 1 0 1 1 0 1 0 0 ...
##  $ BedroomAbvGr : int  3 3 3 3 4 1 3 3 2 2 ...
##  $ KitchenAbvGr : int  1 1 1 1 1 1 1 1 2 2 ...
##  $ KitchenQual  : Factor w/ 4 levels "Ex","Fa","Gd",..: 3 4 3 3 3 4 3 4 4 4 ...
##  $ TotRmsAbvGrd : int  8 6 6 7 9 5 7 7 8 5 ...
##  $ Functional   : Factor w/ 7 levels "Maj1","Maj2",..: 7 7 7 7 7 7 7 7 3 7 ...
##  $ Fireplaces   : int  0 1 1 1 1 0 1 2 2 2 ...
##  $ FireplaceQu  : Factor w/ 5 levels "Ex","Fa","Gd",..: NA 5 5 3 5 NA 3 5 5 5 ...
##  $ GarageType   : Factor w/ 6 levels "2Types","Attchd",..: 2 2 2 6 2 2 2 2 6 2 ...
##  $ GarageYrBlt  : int  2003 1976 2001 1998 2000 1993 2004 1973 1931 1939 ...
##  $ GarageFinish : Factor w/ 3 levels "Fin","RFn","Unf": 2 2 2 3 2 3 2 2 3 2 ...
##  $ GarageCars   : int  2 2 2 3 3 2 2 2 2 1 ...
##  $ GarageArea   : int  548 460 608 642 836 480 636 484 468 205 ...
##  $ GarageQual   : Factor w/ 5 levels "Ex","Fa","Gd",..: 5 5 5 5 5 5 5 5 2 3 ...
##  $ GarageCond   : Factor w/ 5 levels "Ex","Fa","Gd",..: 5 5 5 5 5 5 5 5 5 5 ...
##  $ PavedDrive   : Factor w/ 3 levels "N","P","Y": 3 3 3 3 3 3 3 3 3 3 ...
##  $ WoodDeckSF   : int  0 298 0 0 192 40 255 235 90 0 ...
##  $ OpenPorchSF  : int  61 0 42 35 84 30 57 204 0 4 ...
##  $ EnclosedPorch: int  0 0 0 272 0 0 0 228 205 0 ...
##  $ X3SsnPorch   : int  0 0 0 0 0 320 0 0 0 0 ...
##  $ ScreenPorch  : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ PoolArea     : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ PoolQC       : Factor w/ 3 levels "Ex","Fa","Gd": NA NA NA NA NA NA NA NA NA NA ...
##  $ Fence        : Factor w/ 4 levels "GdPrv","GdWo",..: NA NA NA NA NA 3 NA NA NA NA ...
##  $ MiscFeature  : Factor w/ 4 levels "Gar2","Othr",..: NA NA NA NA NA 3 NA 3 NA NA ...
##  $ MiscVal      : int  0 0 0 0 0 700 0 350 0 0 ...
##  $ MoSold       : int  2 5 9 2 12 10 8 11 4 1 ...
##  $ YrSold       : int  2008 2007 2008 2006 2008 2009 2007 2009 2008 2008 ...
##  $ SaleType     : Factor w/ 9 levels "COD","Con","ConLD",..: 9 9 9 9 9 9 9 9 9 9 ...
##  $ SaleCondition: Factor w/ 6 levels "Abnorml","AdjLand",..: 5 5 5 1 5 5 5 5 1 5 ...
##  $ SalePrice    : int  208500 181500 223500 140000 250000 143000 307000 200000 129900 118000 ...
```

```
cat_var <- names(data)[which(sapply(data, is.character))]
cat_car <- c(cat_var, 'BedroomAbvGr', 'HalfBath', ' KitchenAbvGr','BsmtFullBath', 'BsmtHalfBath', 'MSSu
numeric_var <- names(data)[which(sapply(data, is.numeric))]

#colSums(sapply(data, is.na))
#colSums(sapply(data[,cat_var, .SDcols = cat_var], is.na))
#colSums(sapply(data[,.SD, .SDcols = numeric_var], is.na))
```

```
library(data.table)
train <- fread("data/train.csv", header=T, dec=".", sep=",")
cat_var <- names(train)[unlist(lapply(train, is.character))]
cat_var
```

```
##  [1] "MSZoning"      "Street"        "Alley"         "LotShape"
##  [5] "LandContour"   "Utilities"     "LotConfig"     "LandSlope"
##  [9] "Neighborhood"  "Condition1"    "Condition2"    "BldgType"
## [13] "HouseStyle"    "RoofStyle"     "RoofMatl"      "Exterior1st"
## [17] "Exterior2nd"   "MasVnrType"    "ExterQual"     "ExterCond"
## [21] "Foundation"    "BsmtQual"      "BsmtCond"      "BsmtExposure"
## [25] "BsmtFinType1"  "BsmtFinType2"  "Heating"       "HeatingQC"
## [29] "CentralAir"    "Electrical"    "KitchenQual"   "Functional"
## [33] "FireplaceQu"   "GarageType"    "GarageFinish"  "GarageQual"
## [37] "GarageCond"    "PavedDrive"    "PoolQC"        "Fence"
## [41] "MiscFeature"   "SaleType"      "SaleCondition"
```

```
numeric_var <- names(train)[which(sapply(train, is.numeric))]
numeric_var
```

```
##  [1] "Id"            "MSSubClass"    "LotFrontage"   "LotArea"
##  [5] "OverallQual"   "OverallCond"   "YearBuilt"     "YearRemodAdd"
##  [9] "MasVnrArea"    "BsmtFinSF1"    "BsmtFinSF2"    "BsmtUnfSF"
## [13] "TotalBsmtSF"   "1stFlrSF"      "2ndFlrSF"      "LowQualFinSF"
## [17] "GrLivArea"     "BsmtFullBath"  "BsmtHalfBath"  "FullBath"
## [21] "HalfBath"      "BedroomAbvGr"  "KitchenAbvGr"  "TotRmsAbvGrd"
## [25] "Fireplaces"    "GarageYrBlt"   "GarageCars"    "GarageArea"
## [29] "WoodDeckSF"    "OpenPorchSF"   "EnclosedPorch" "3SsnPorch"
## [33] "ScreenPorch"   "PoolArea"      "MiscVal"       "MoSold"
## [37] "YrSold"        "SalePrice"
```

```
train[, lapply(.SD, function(x) sum(is.na(x))), .SDcols = cat_var]
```

```
##    MSZoning Street Alley LotShape LandContour Utilities LotConfig
## 1:        0      0  1369        0           0         0         0
##    LandSlope Neighborhood Condition1 Condition2 BldgType HouseStyle
## 1:         0            0          0          0        0          0
##    RoofStyle RoofMatl Exterior1st Exterior2nd MasVnrType ExterQual
## 1:         0        0           0           0          8         0
##    ExterCond Foundation BsmtQual BsmtCond BsmtExposure BsmtFinType1
## 1:         0          0       37       37           38           37
##    BsmtFinType2 Heating HeatingQC CentralAir Electrical KitchenQual
## 1:           38       0         0          0          1           0
##    Functional FireplaceQu GarageType GarageFinish GarageQual GarageCond
## 1:          0         690         81           81         81         81
##    PavedDrive PoolQC Fence MiscFeature SaleType SaleCondition
## 1:          0   1453  1179        1406        0             0
```

```
train[, lapply(.SD, function(x) sum(is.na(x))), .SDcols = numeric_var]
```

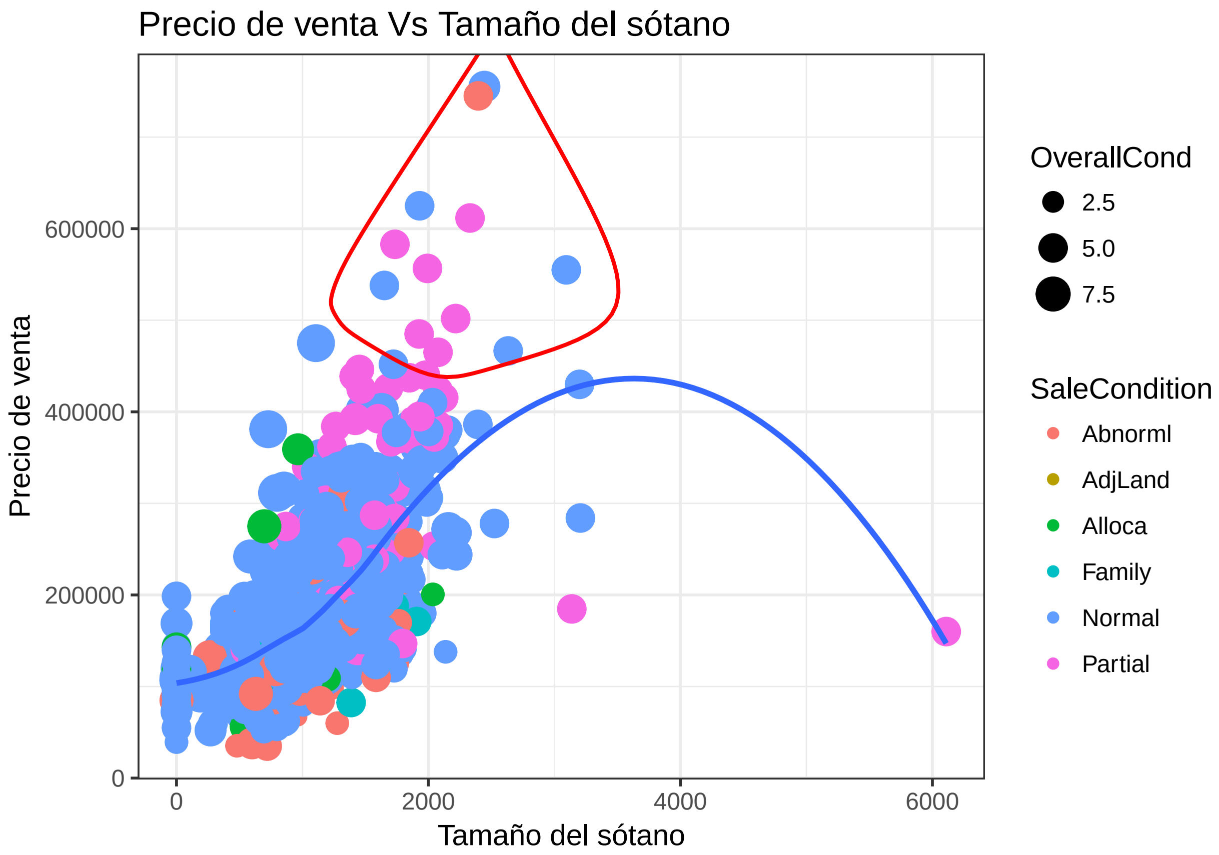
```
##    Id MSSubClass LotFrontage LotArea OverallQual OverallCond YearBuilt
## 1:  0          0         259       0           0           0         0
##    YearRemodAdd MasVnrArea BsmtFinSF1 BsmtFinSF2 BsmtUnfSF TotalBsmtSF
## 1:            0          8          0          0         0           0
##    1stFlrSF 2ndFlrSF LowQualFinSF GrLivArea BsmtFullBath BsmtHalfBath
## 1:        0        0            0         0            0            0
##    FullBath HalfBath BedroomAbvGr KitchenAbvGr TotRmsAbvGrd Fireplaces
## 1:        0        0            0            0            0          0
##    GarageYrBlt GarageCars GarageArea WoodDeckSF OpenPorchSF EnclosedPorch
## 1:          81          0          0          0           0             0
##    3SsnPorch ScreenPorch PoolArea MiscVal MoSold YrSold SalePrice
## 1:         0           0        0       0      0      0         0
```

```
luxury <- data %>%
filter(SalePrice > 500000)
```

```
gg <- ggplot(data, aes( x=TotalBsmtSF, y=SalePrice)) +
  geom_point(aes(col=SaleCondition, size=OverallCond)) +
  geom_smooth(method="loess", se=F) +
  geom_encircle(aes(x=TotalBsmtSF, y=SalePrice),
                data=luxury,
                color="red",
                size=2,
                expand=0.08) +
  labs(y="Precio de venta",
       x="Tamaño del sótano",
       title="Precio de venta Vs Tamaño del sótano")
```

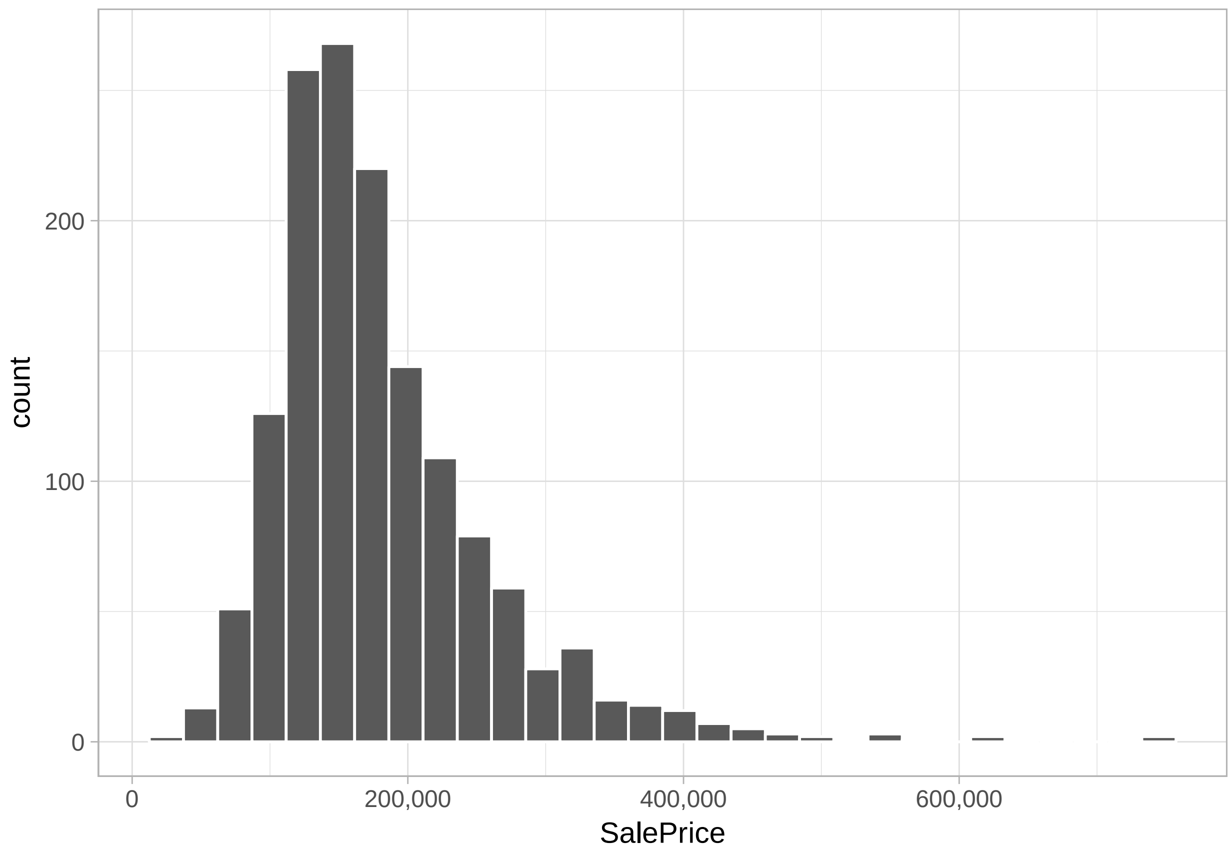
```
plot(gg)
```

```
## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0xf

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0xd

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0xf

## Warning in grid.Call(L_stringMetric, as.graphicsAnnot(x$label)): font
## metrics unknown for character 0xd
```

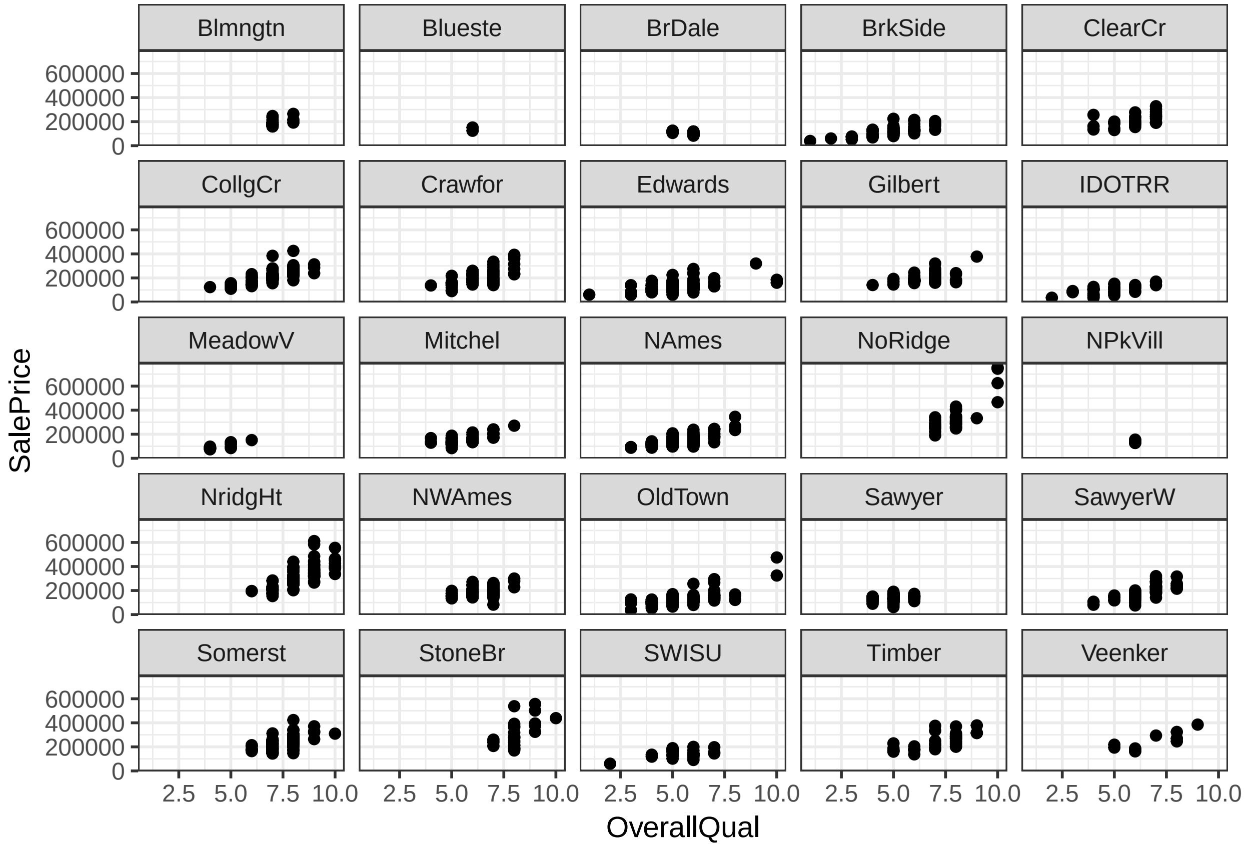


```
ggplot(data, aes(x=SalePrice)) + geom_histogram(col = 'white') + theme_light() +scale_x_continuous(labe
```

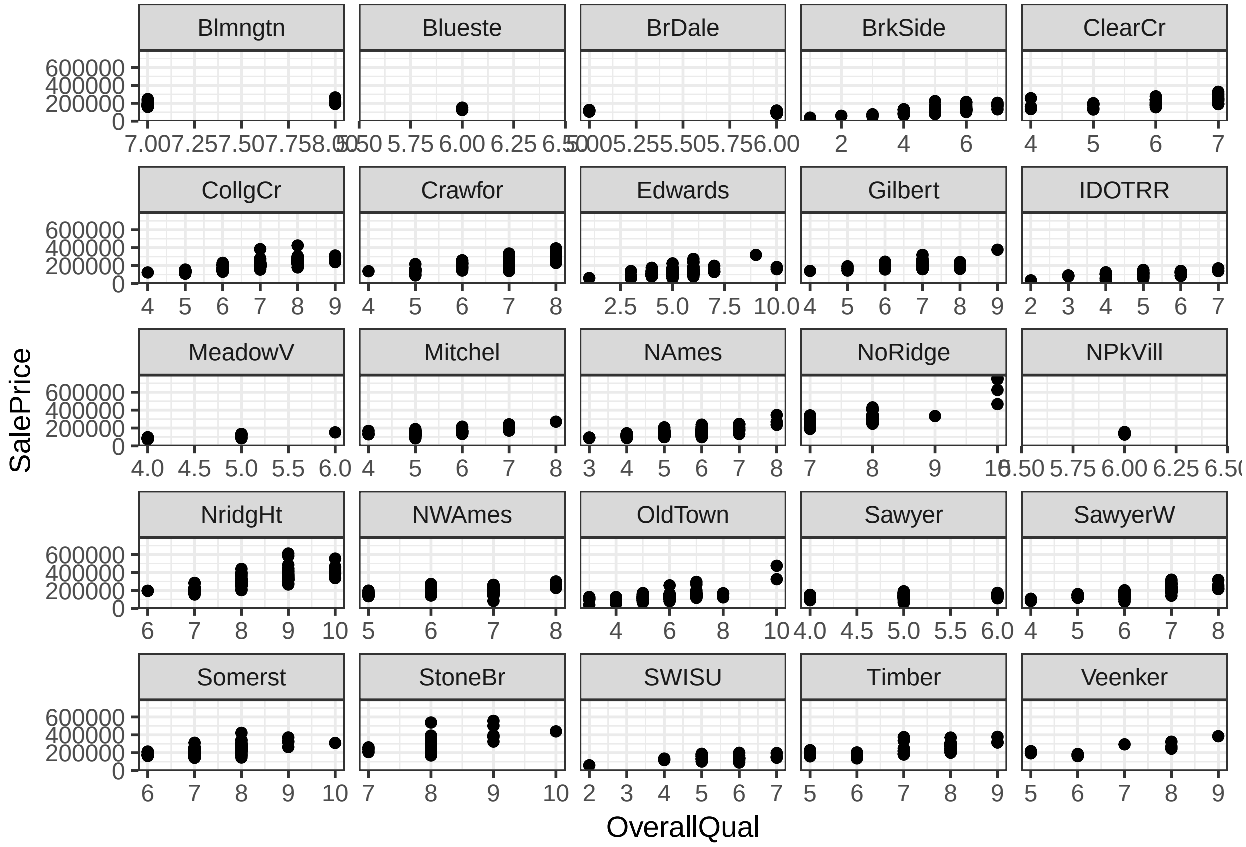
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



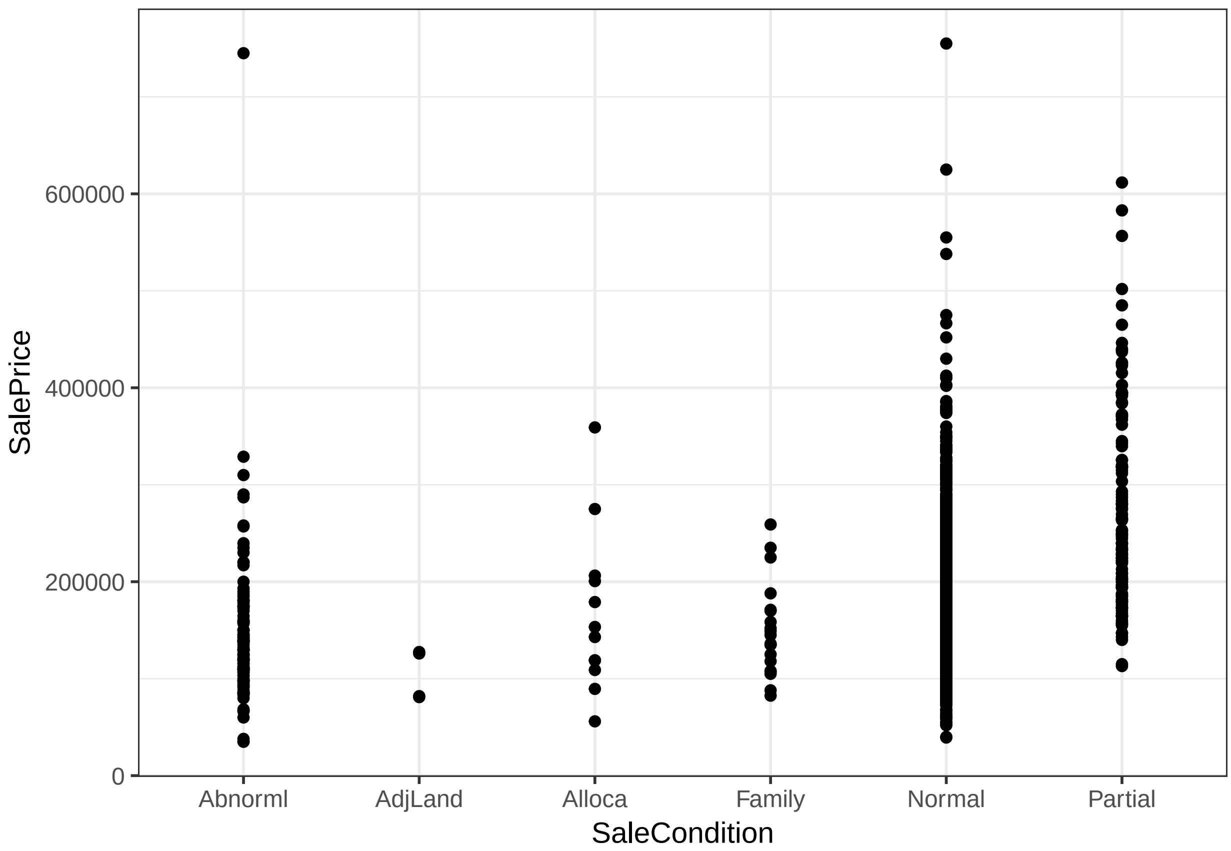
```r
ggplot(data, aes(x=OverallQual, y=SalePrice)) +
geom_point() +
facet_wrap('Neighborhood')
```



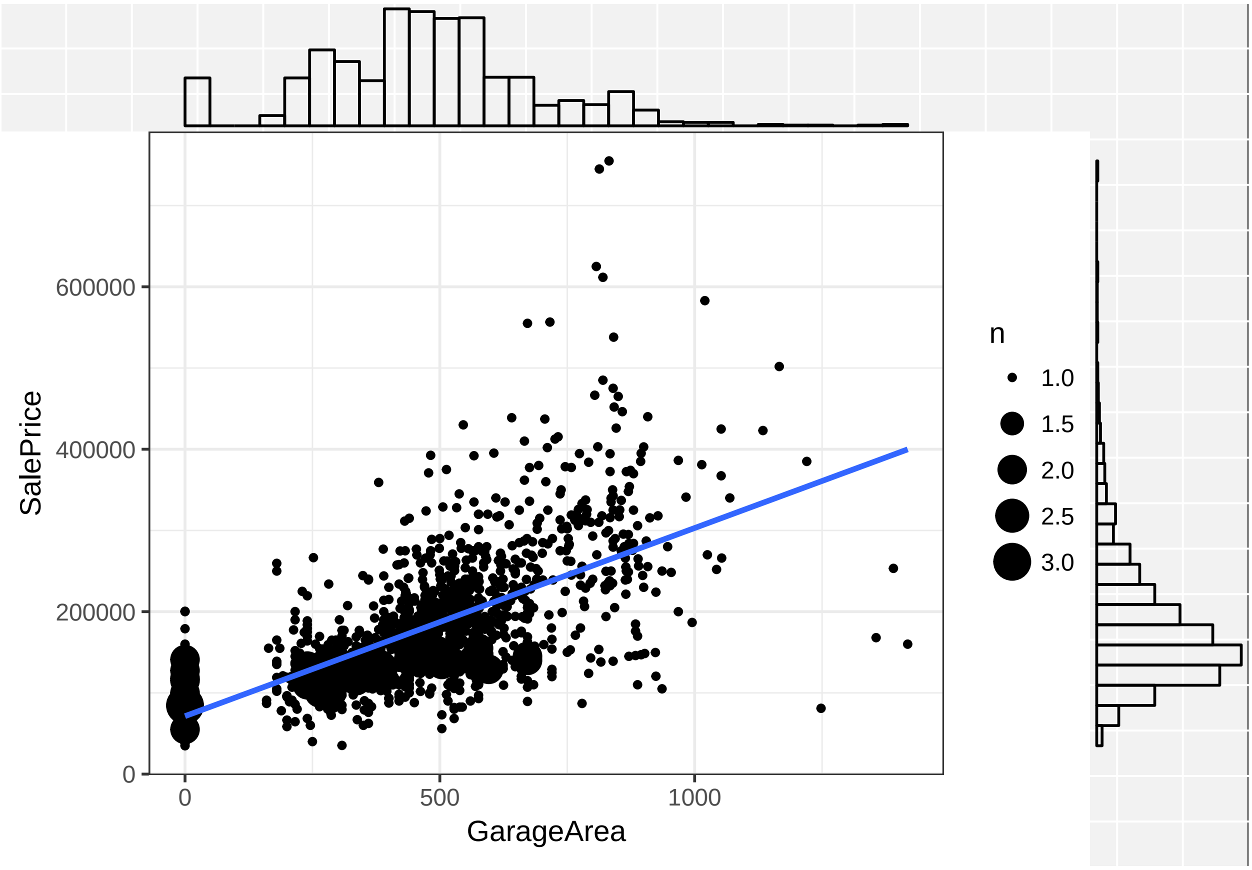
```
ggplot(data, aes(x=OverallQual, y=SalePrice)) +
geom_point() +
facet_wrap('Neighborhood', scales='free_x')
```



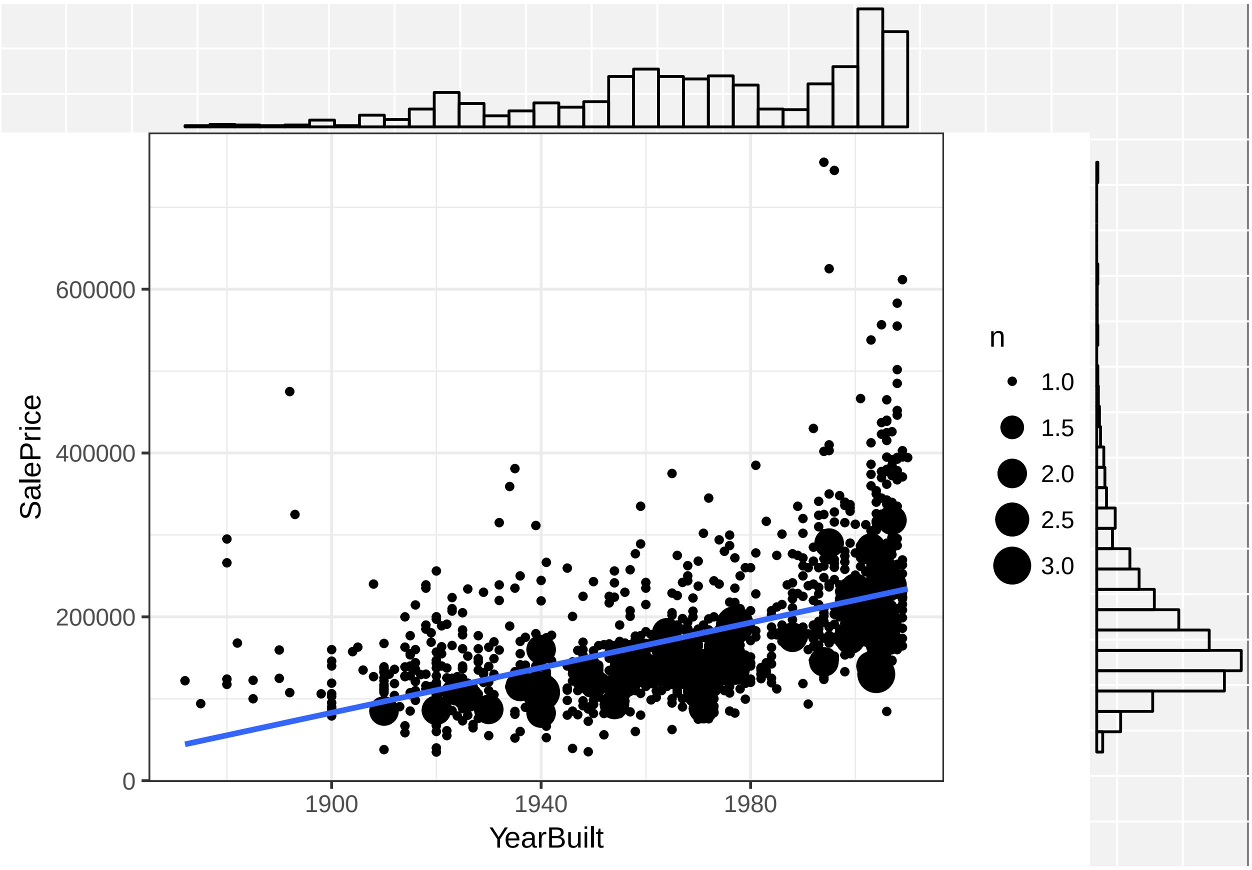
```
ggplot(data, aes(x=SaleCondition, y=SalePrice)) +
geom_point()
```



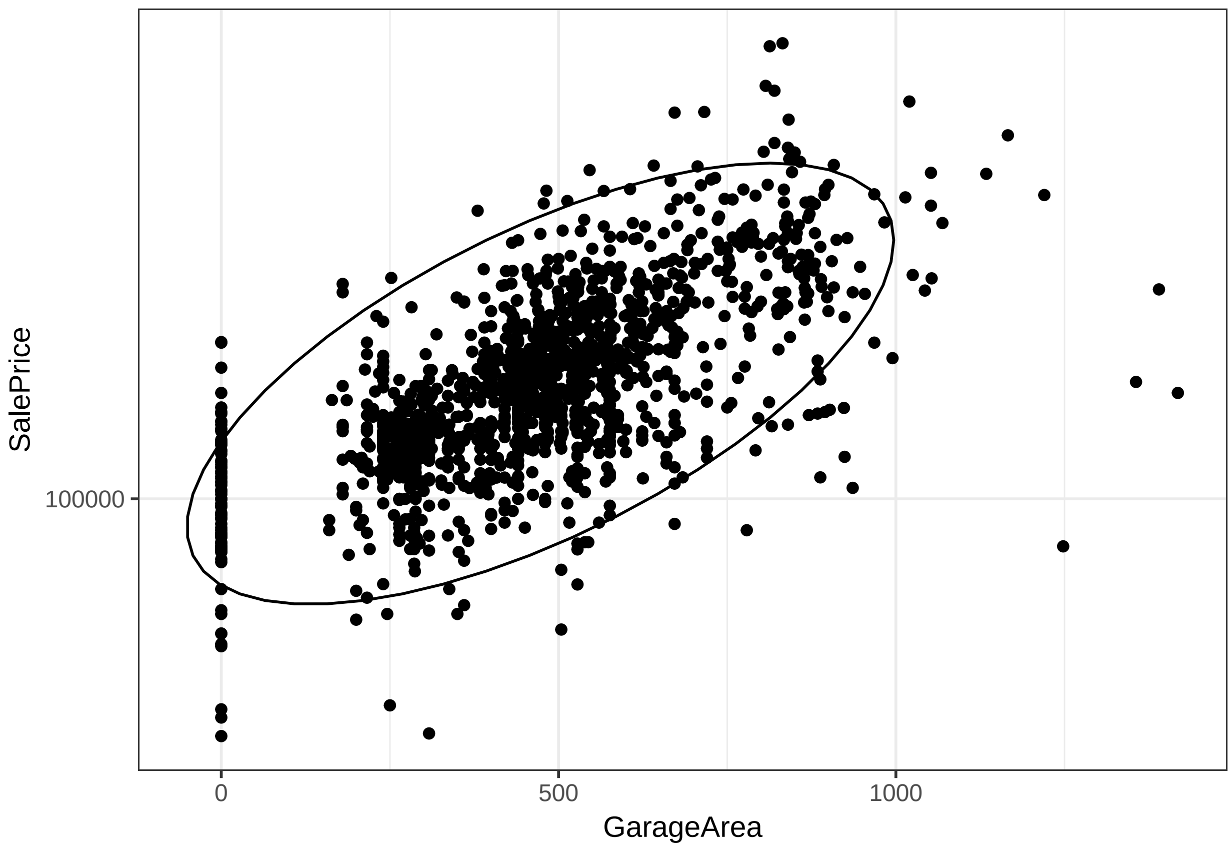
```
g <- ggplot(data, aes(GarageArea, SalePrice)) +
  geom_count() +
  geom_smooth(method="lm", se=F)

g2<-ggMarginal(g, type = "histogram", fill="transparent")
plot(g2)
```



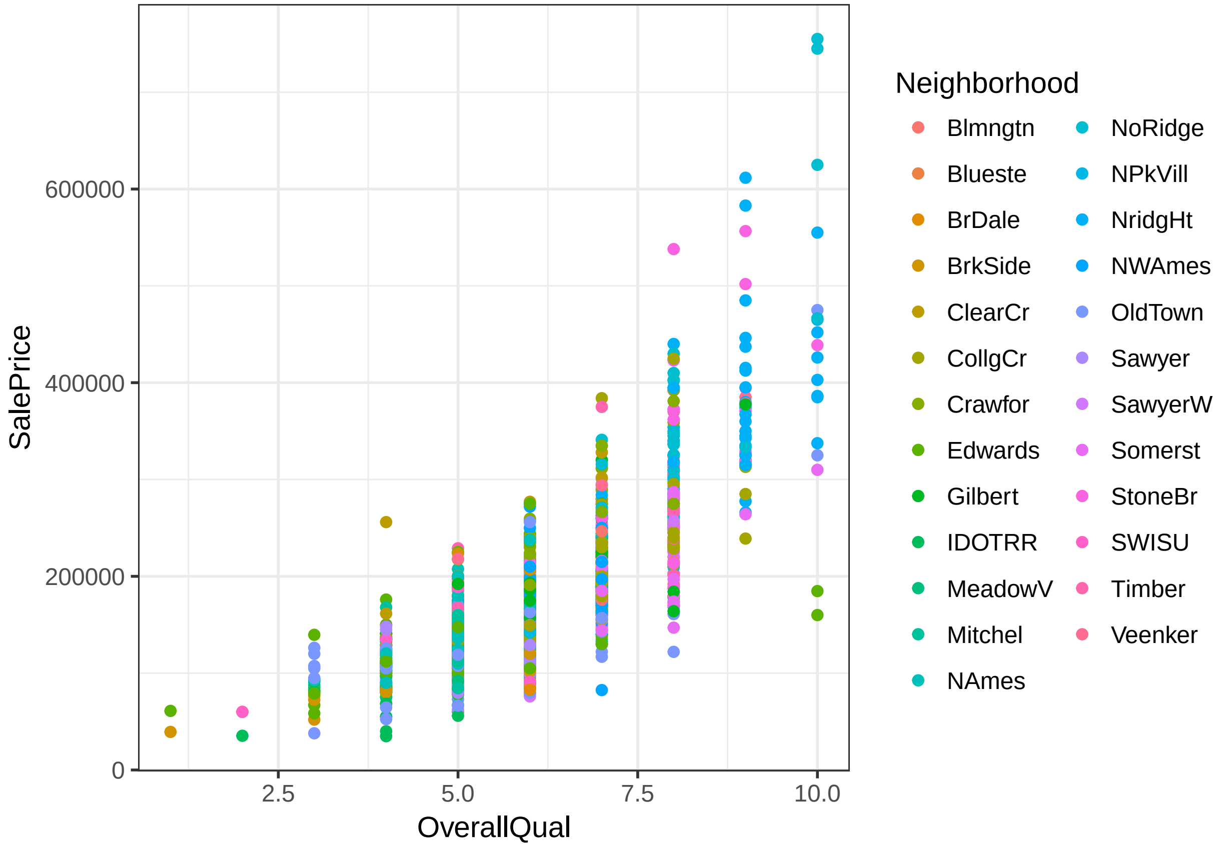
```
g <- ggplot(data, aes(YearBuilt, SalePrice)) +
  geom_count() +
  geom_smooth(method="lm", se=F)

g2<-ggMarginal(g, type = "histogram", fill="transparent")
plot(g2)
```



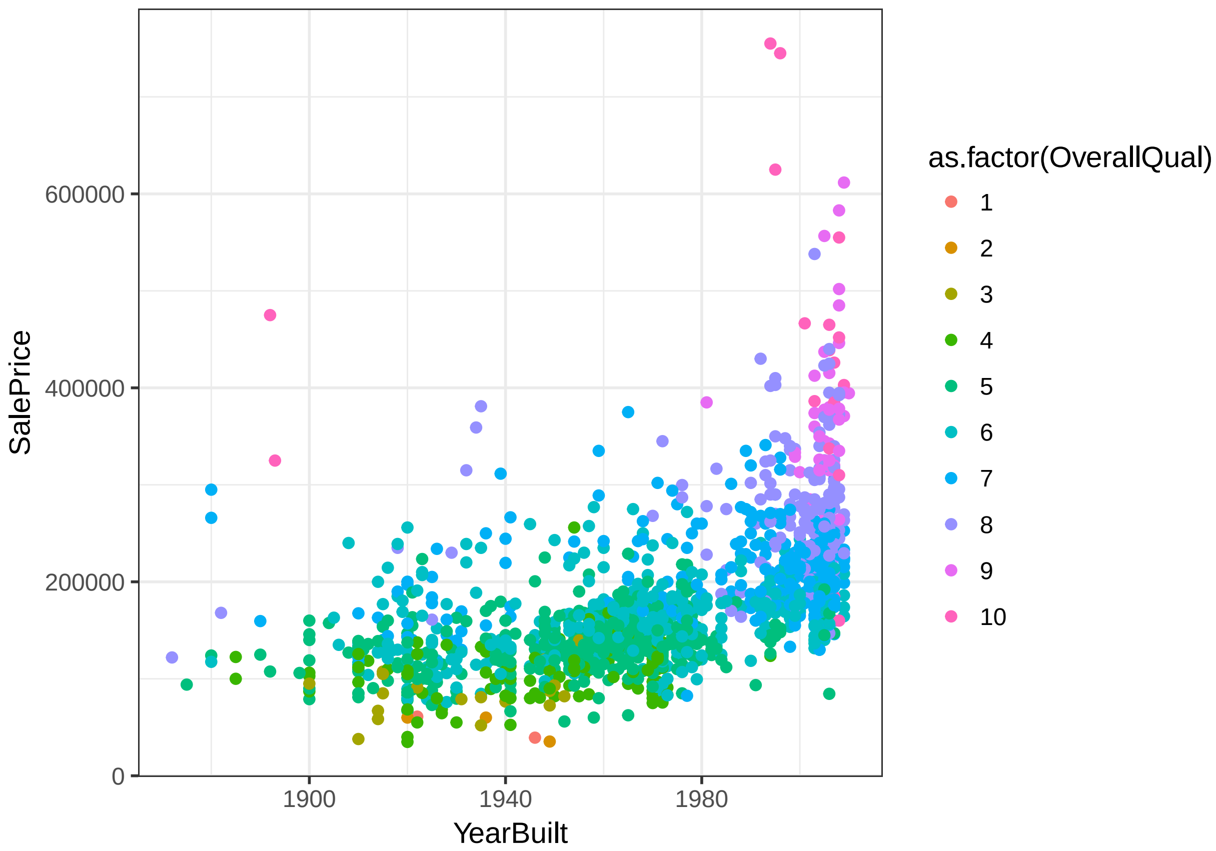
```r
ggplot(data, aes(x=GarageArea, y=SalePrice)) +
geom_point() +
scale_y_log10() +
stat_ellipse(type='norm')
```



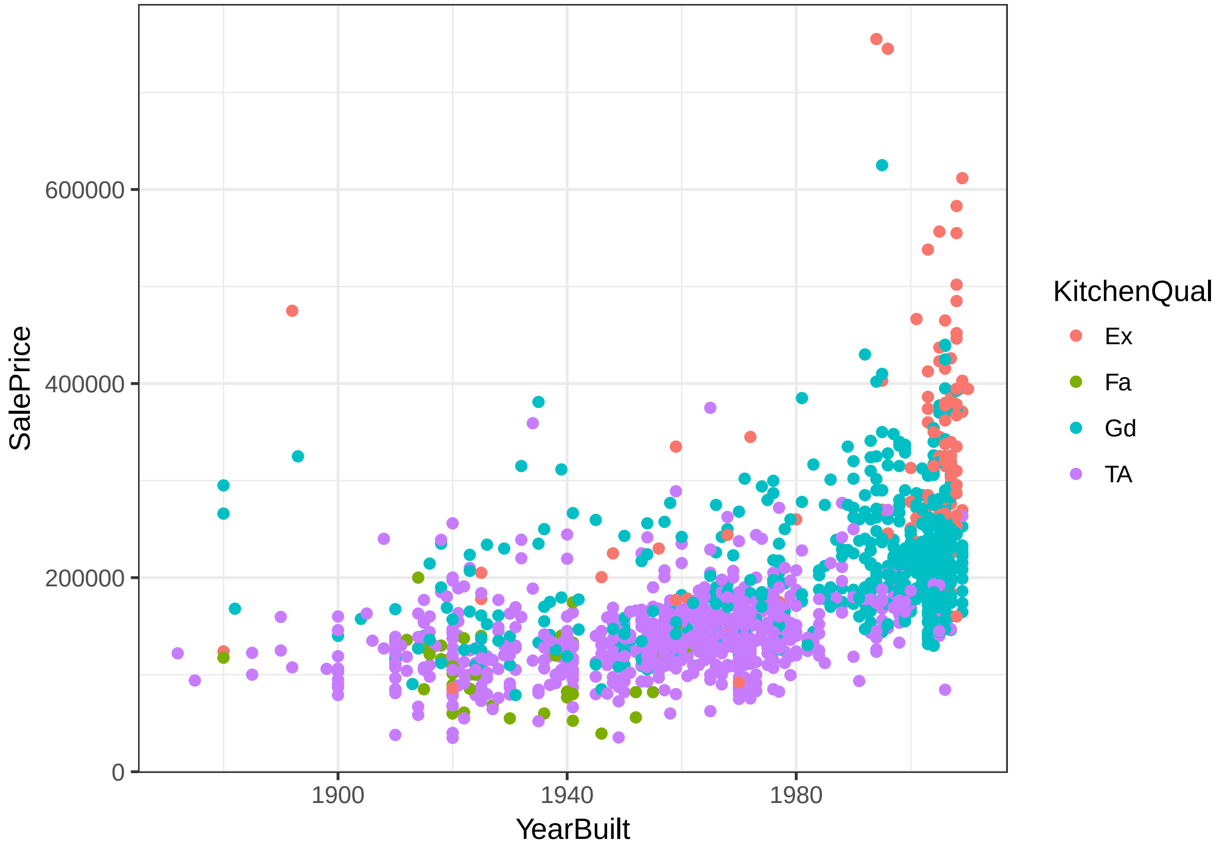
```r
ggplot(data, aes(x=OverallQual, y=SalePrice, colour=Neighborhood)) + geom_point()
```



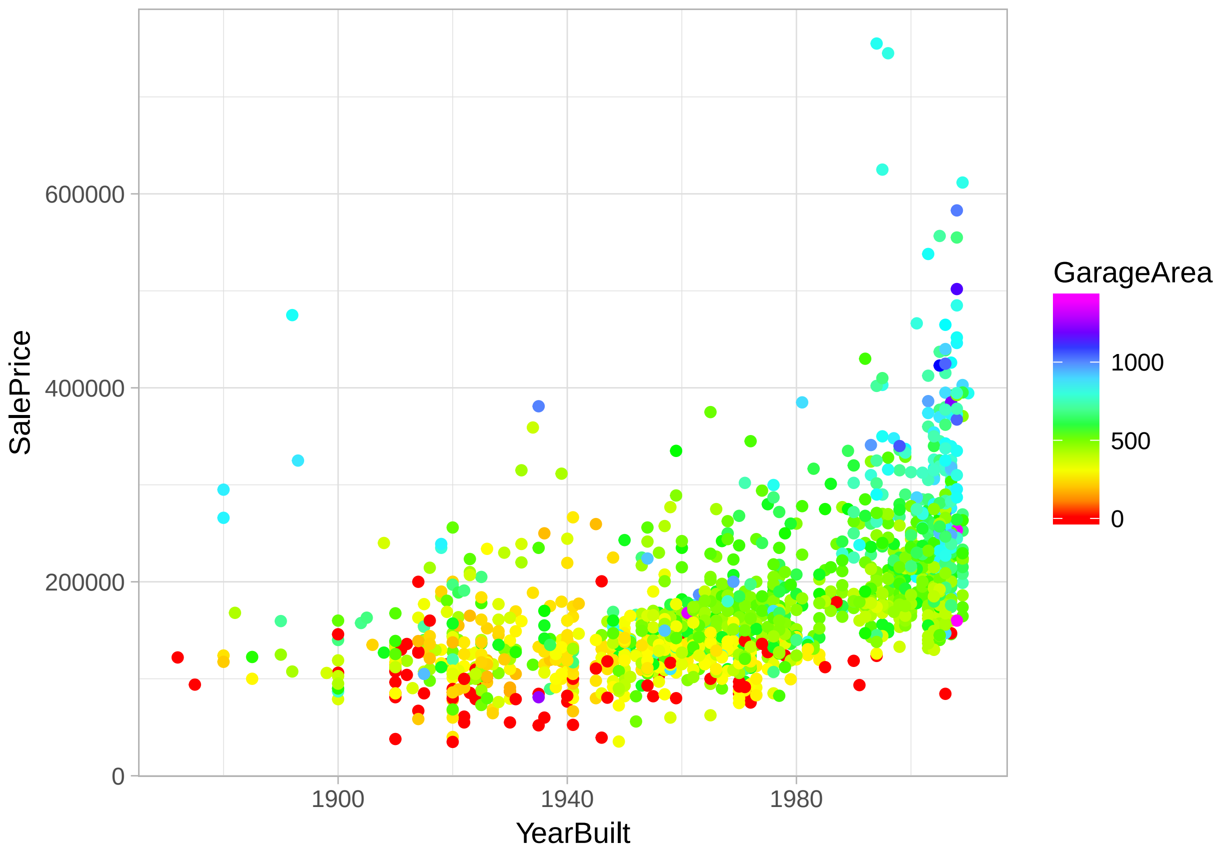
```r
ggplot(data, aes(x=YearBuilt, y=SalePrice, colour=as.factor(OverallQual))) + geom_point()
```



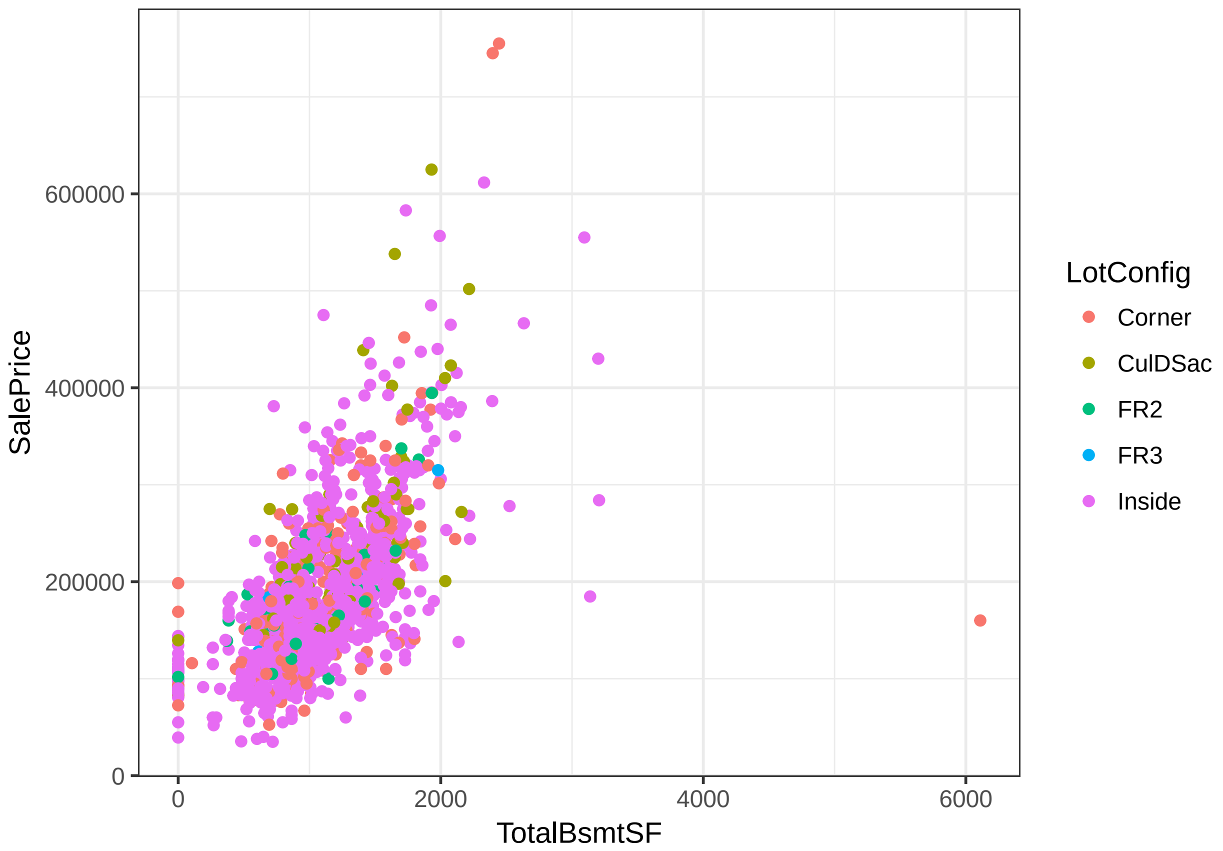
```
ggplot(data, aes(x=YearBuilt, y=SalePrice, colour=KitchenQual)) + geom_point()
```



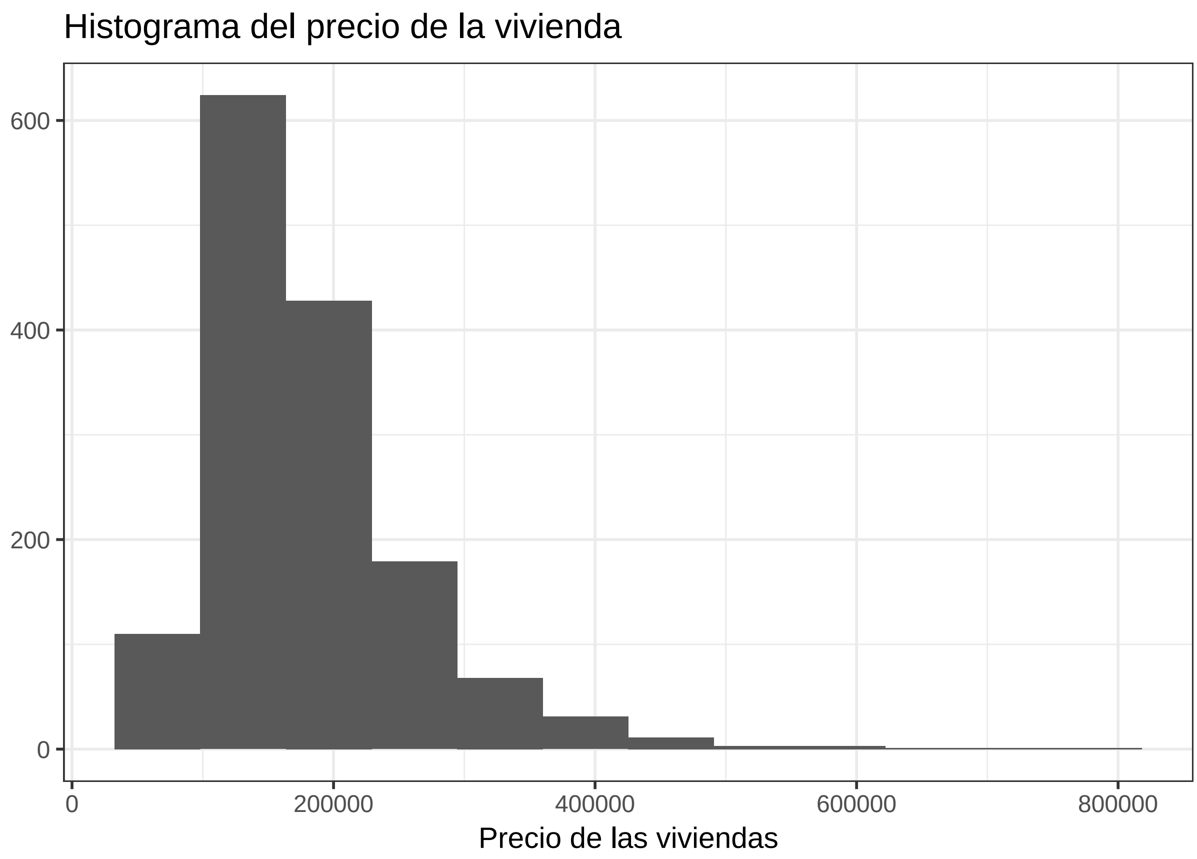
```
ggplot(data, aes(x=YearBuilt, y=SalePrice, colour=GarageArea)) + geom_point() +
theme_light() + scale_colour_gradientn(colours=rainbow(6))
```



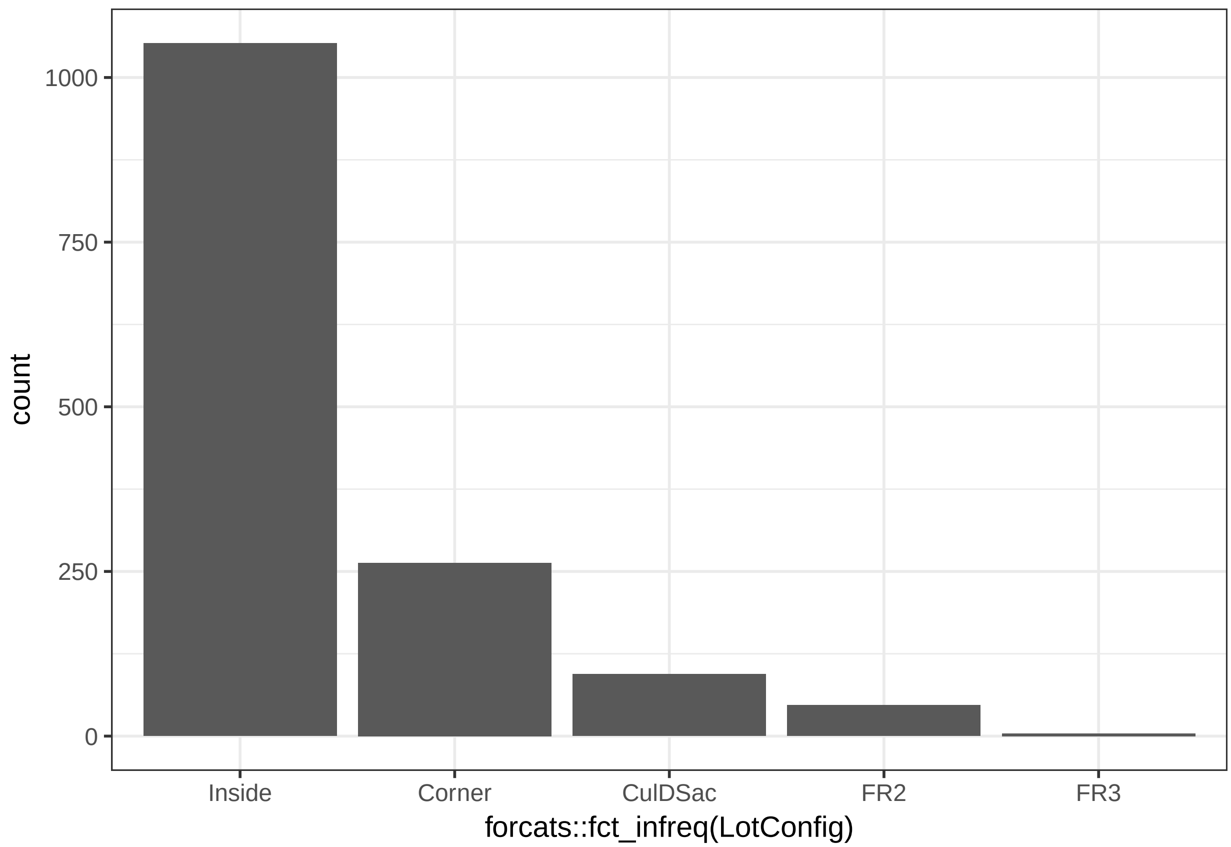
```
ggplot(data, aes(x=TotalBsmtSF, y=SalePrice, color=LotConfig)) + geom_point()
```



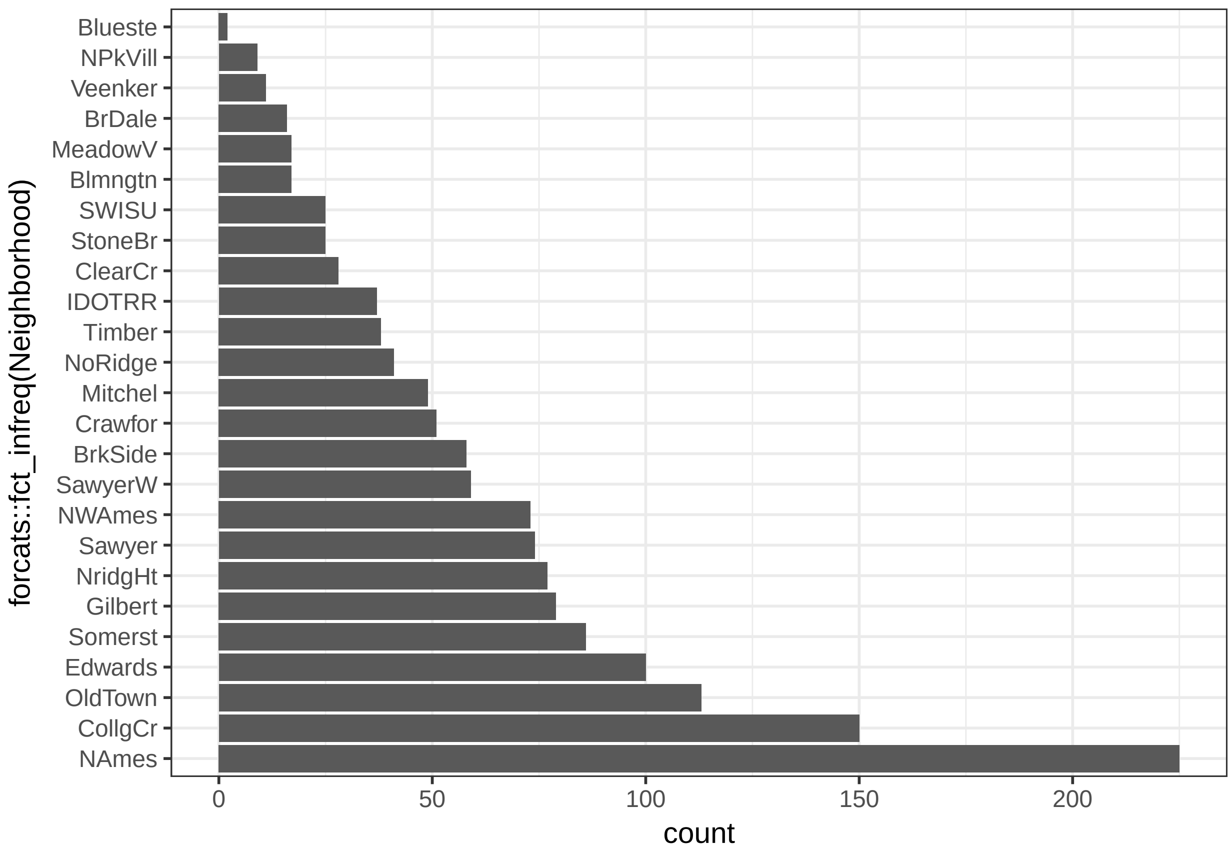
```
ggplot(data, aes(SalePrice)) +
geom_histogram(bins=nclass.Sturges(data$SalePrice)) +
xlab('Precio de las viviendas') +
ylab('') +
ggtitle('Histograma del precio de la vivienda')
```



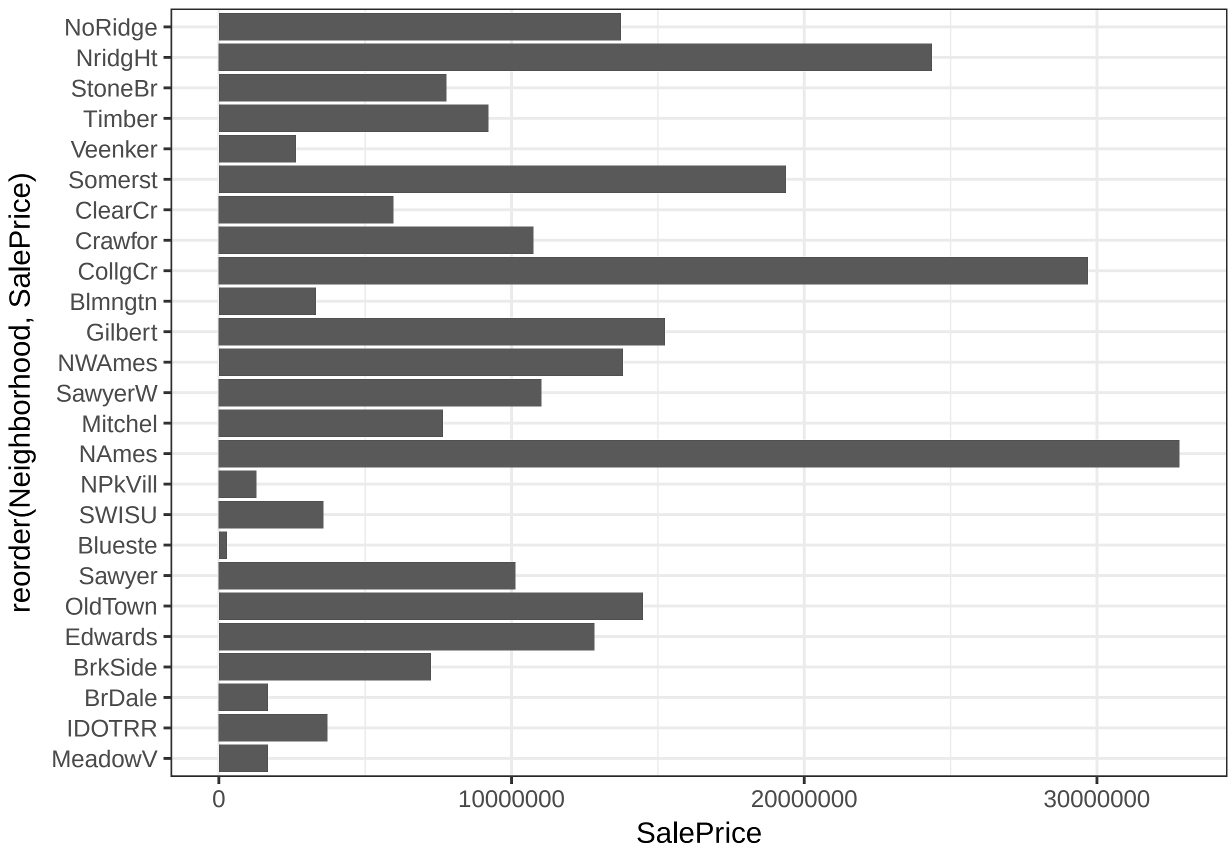
```
ggplot(data, aes(forcats::fct_infreq(LotConfig))) + geom_bar()
```



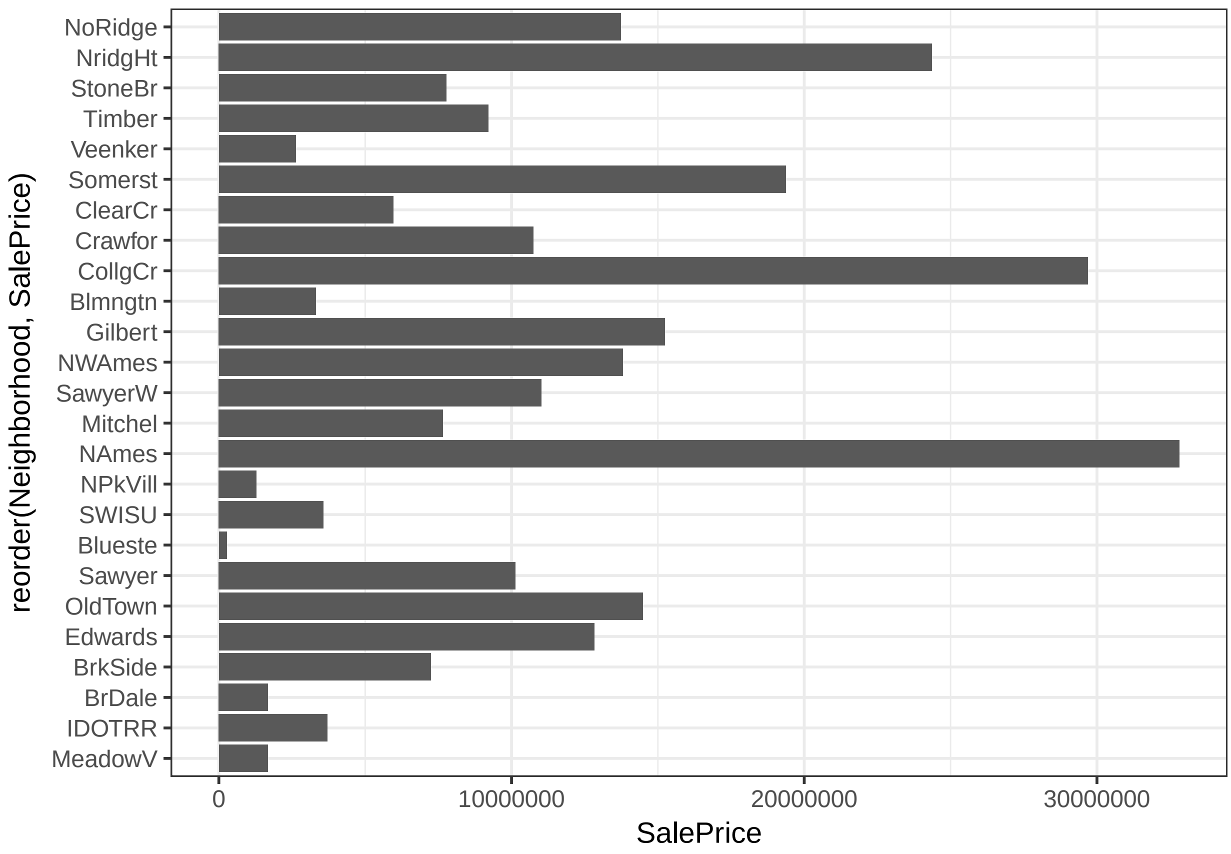
```r
ggplot(data, aes(forcats::fct_infreq(Neighborhood))) + geom_bar() + coord_flip()
```



```
ggplot(data,
aes(reorder(Neighborhood, SalePrice), SalePrice)) +
geom_bar(stat='identity') + coord_flip()
```

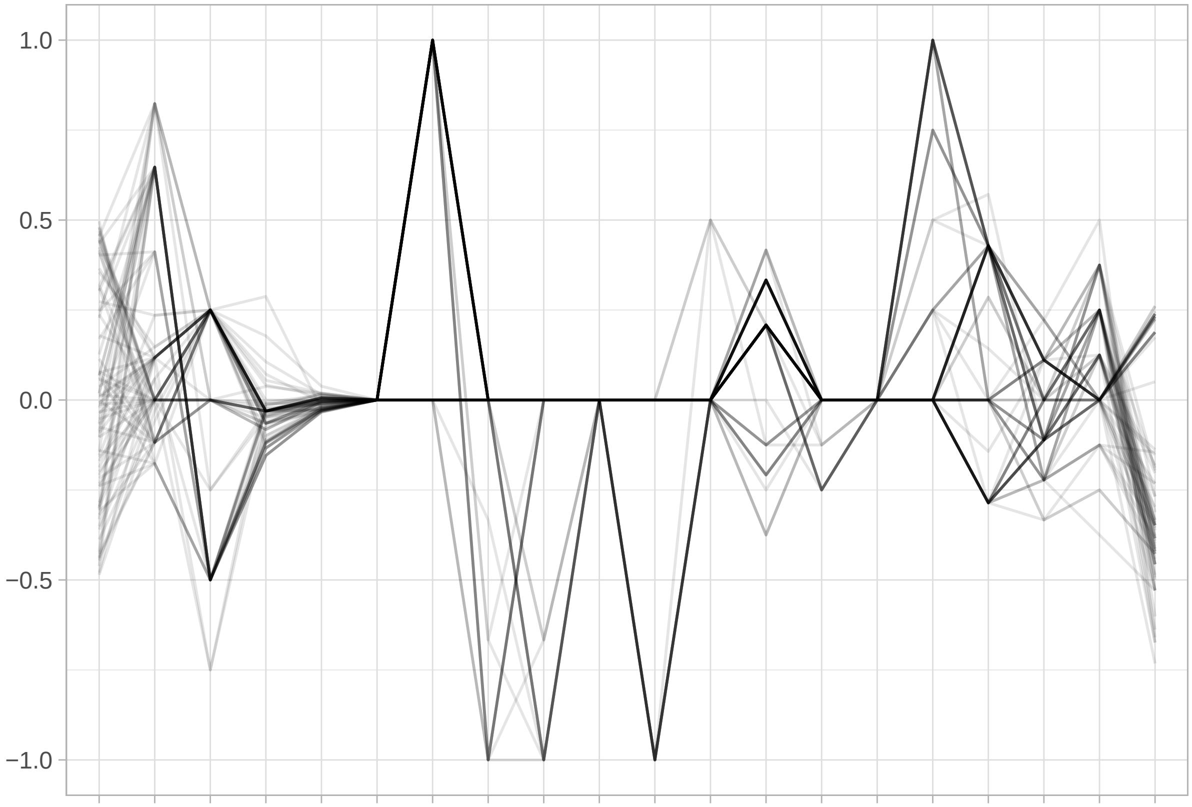


```
ggplot(data,
aes(reorder(Neighborhood, SalePrice), SalePrice)) +
geom_bar(stat='identity') + coord_flip()
```

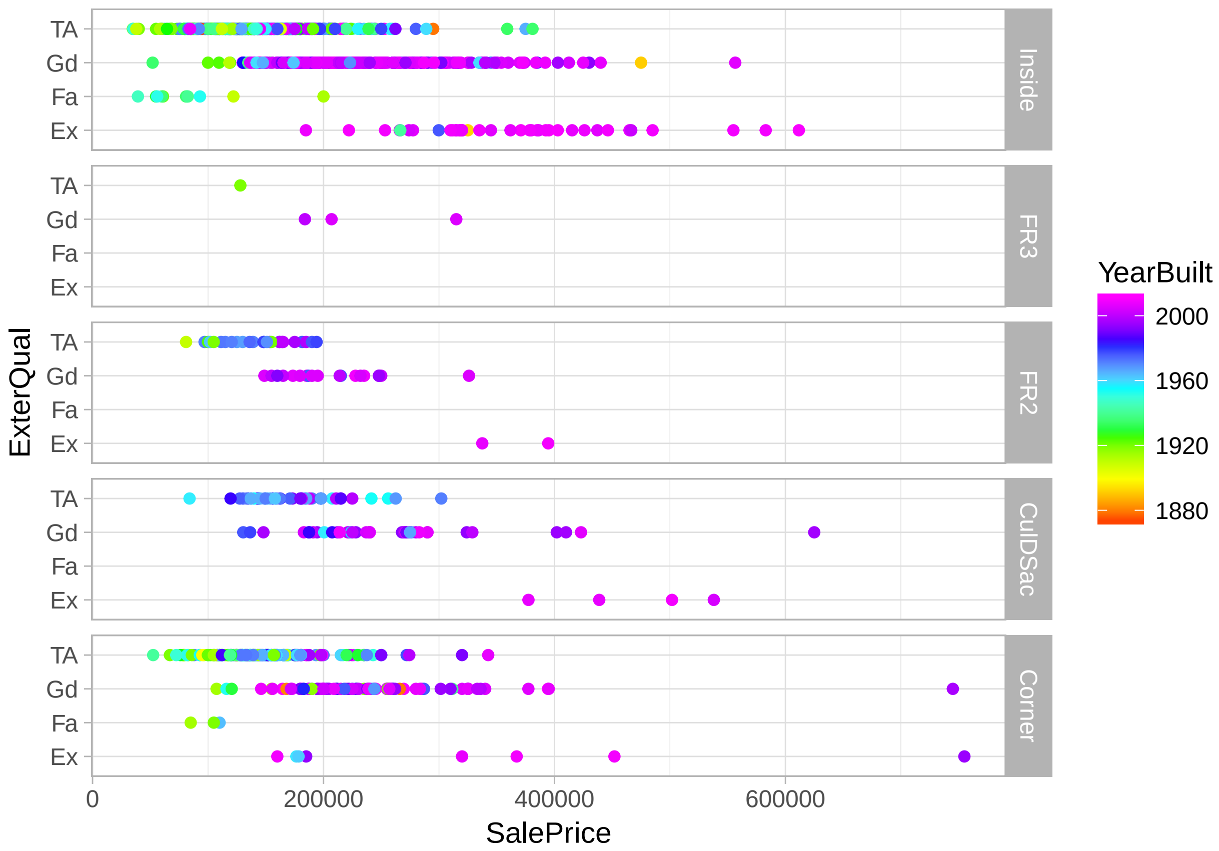


```
#ggpairs(data, aes(color=SalePrice), columns=2:7,
#upper=list(continuous='points'),
#diag=list(continuous='blankDiag'),
#axisLabels='internal')
```

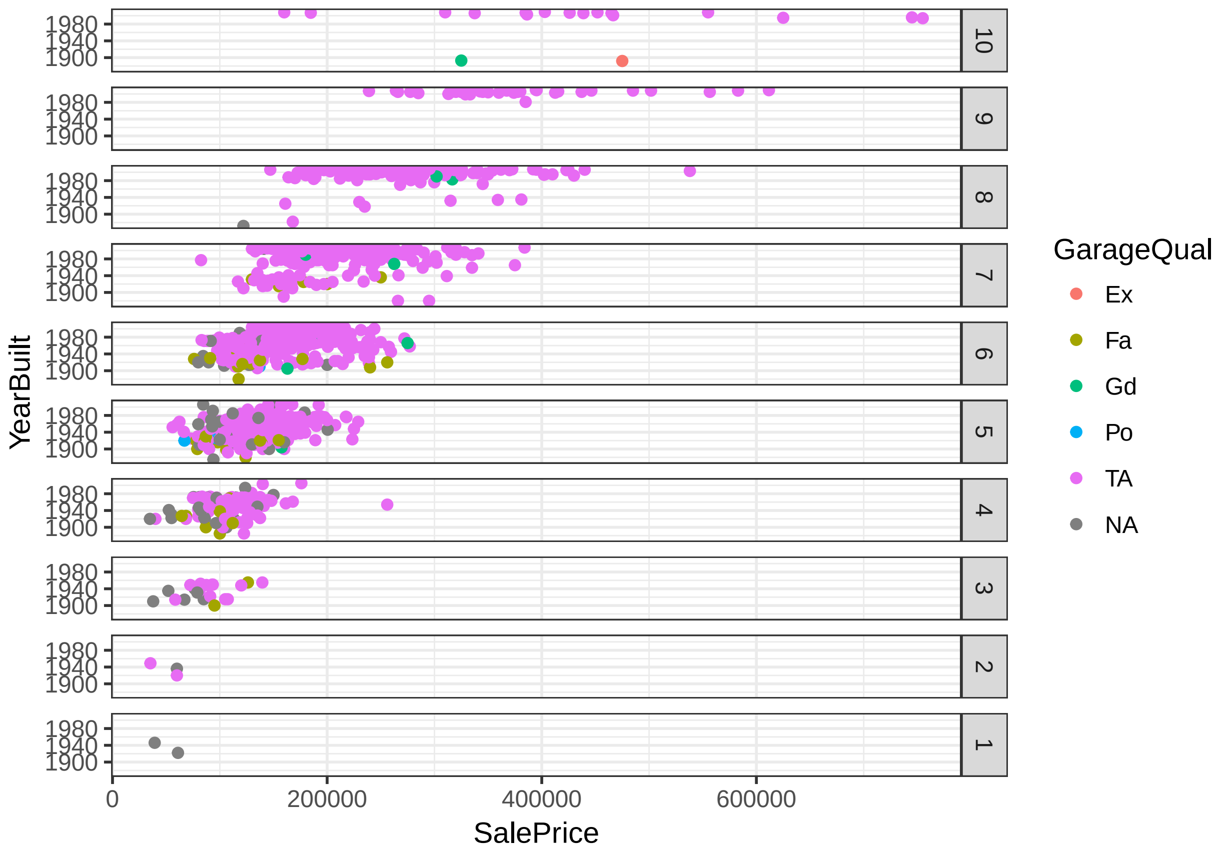
```
ggparcoord(data, columns=1:20, alphaLines=0.1,
scale='center', scaleSummary='median') +
xlab('') + ylab('') +
scale_x_discrete(labels=NULL) + theme_light()
```



```
ggplot(data, aes(ExterQual, SalePrice, colour=YearBuilt)) +
geom_point() + coord_flip() +
facet_grid(LotConfig ~ ., as.table=FALSE) +
theme_light() + scale_colour_gradientn(colours=rainbow(6))
```



```
ggplot(data, aes(YearBuilt, SalePrice, colour=GarageQual)) +
geom_point() + coord_flip() +
facet_grid(as.factor(OverallQual) ~ ., as.table=FALSE) +
theme_bw()
```

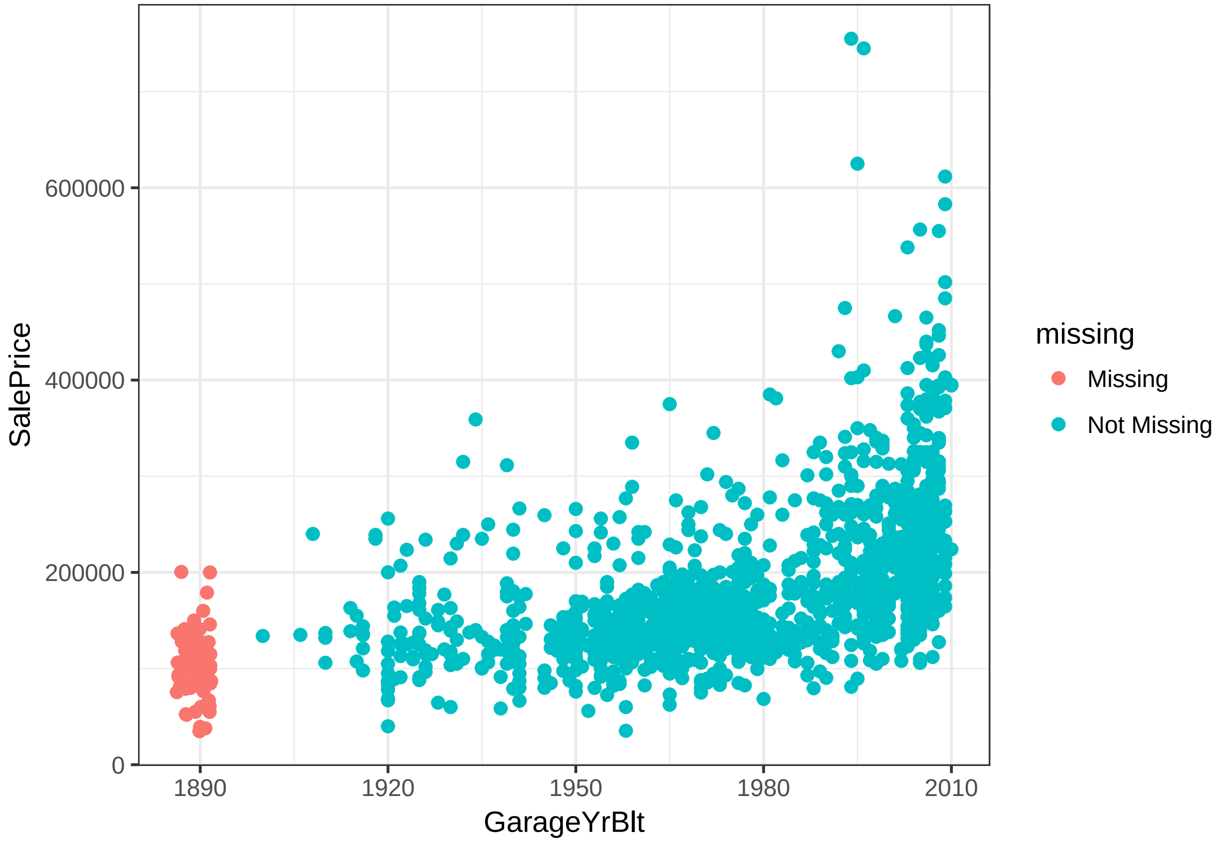


```
ggsave('grafico.png')
```

```
## Saving 6.5 x 4.5 in image
```

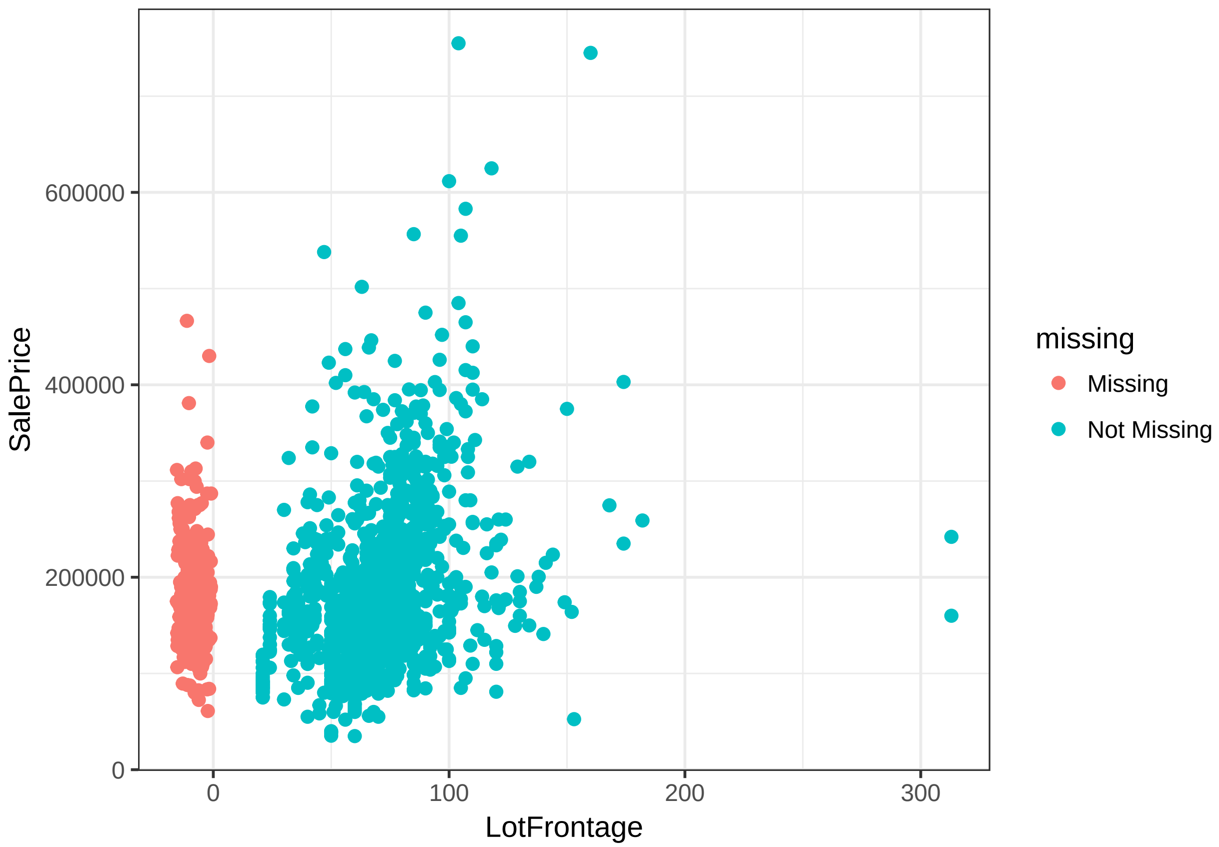
Valores perdidos

```
ggplot(data = data, aes(x=GarageYrBlt, y=SalePrice)) + geom_missing_point()
```

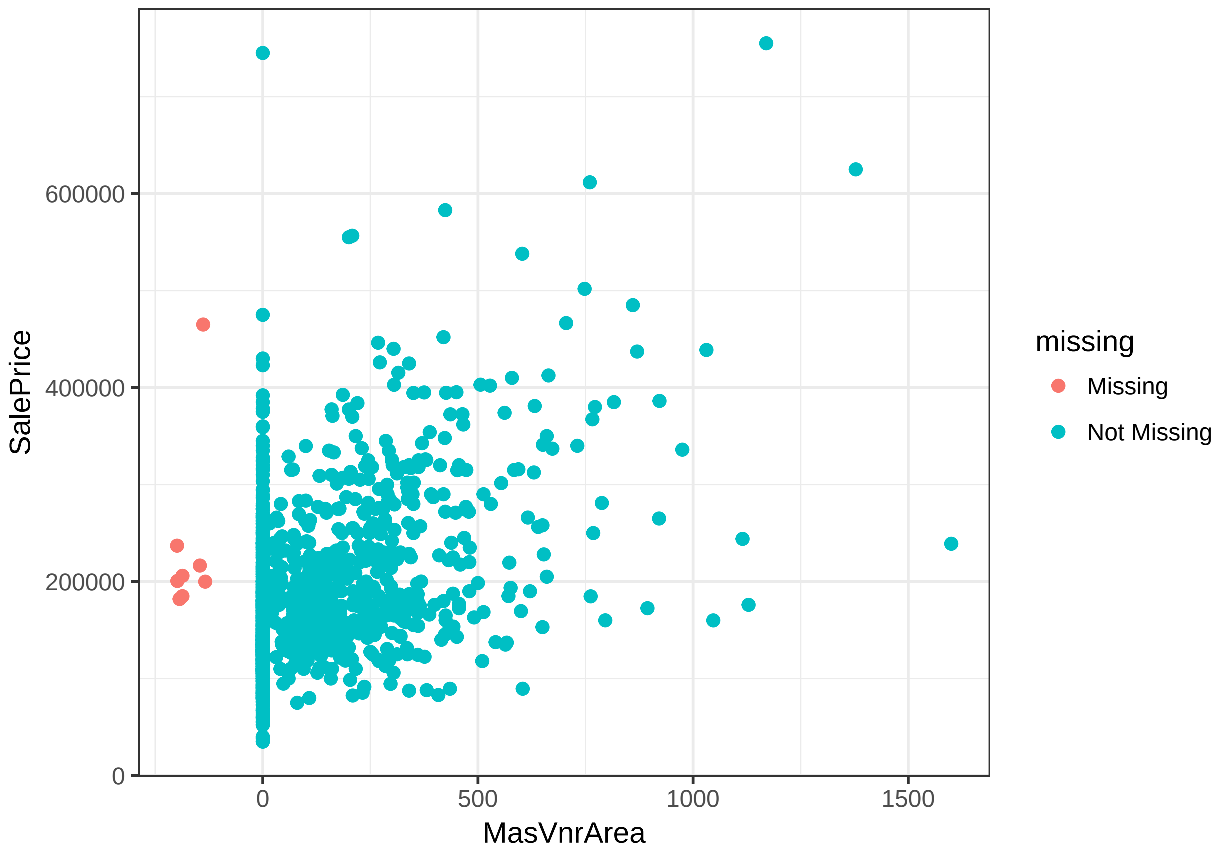


ggplot(data = bind_shadow(airquality), aes(x = Temp, color = Ozone_NA)) + geom_density()

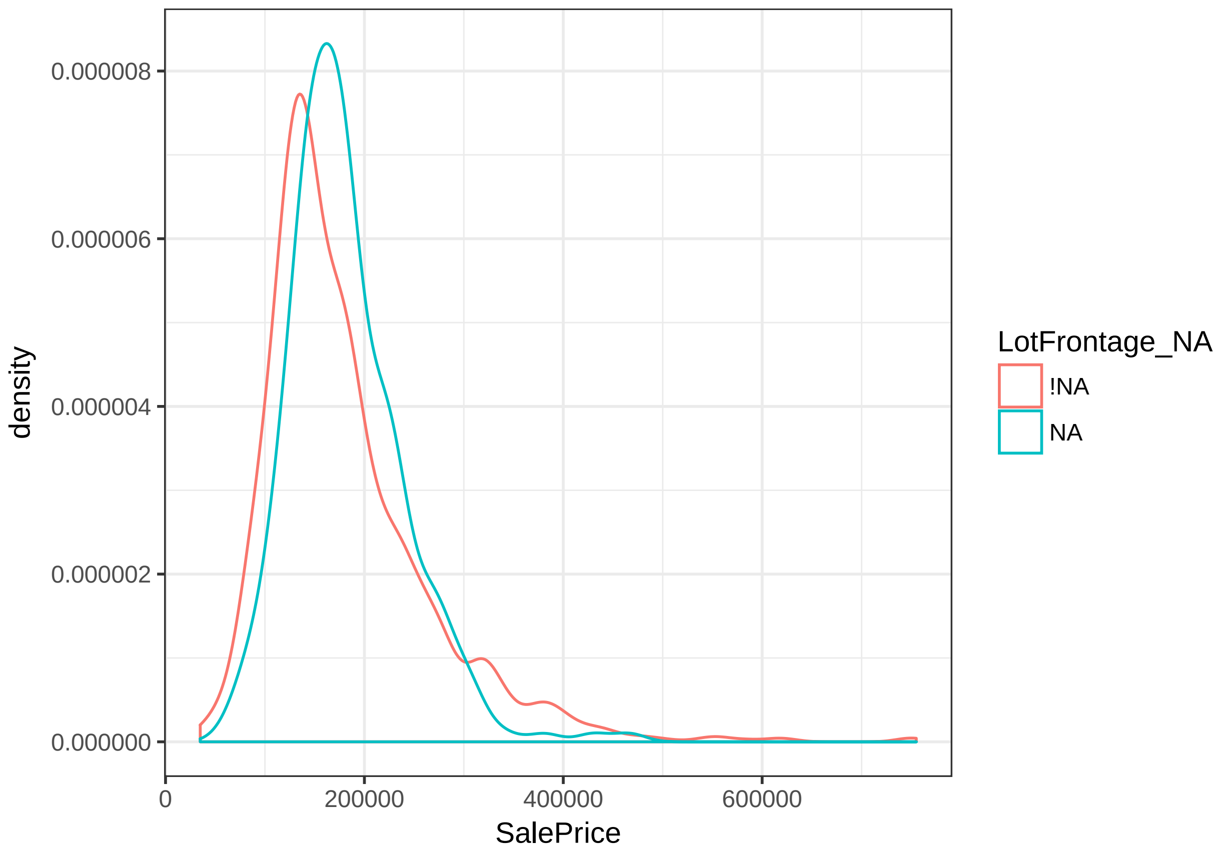
```
ggplot(data = data, aes(x=LotFrontage, y=SalePrice)) + geom_missing_point()
```



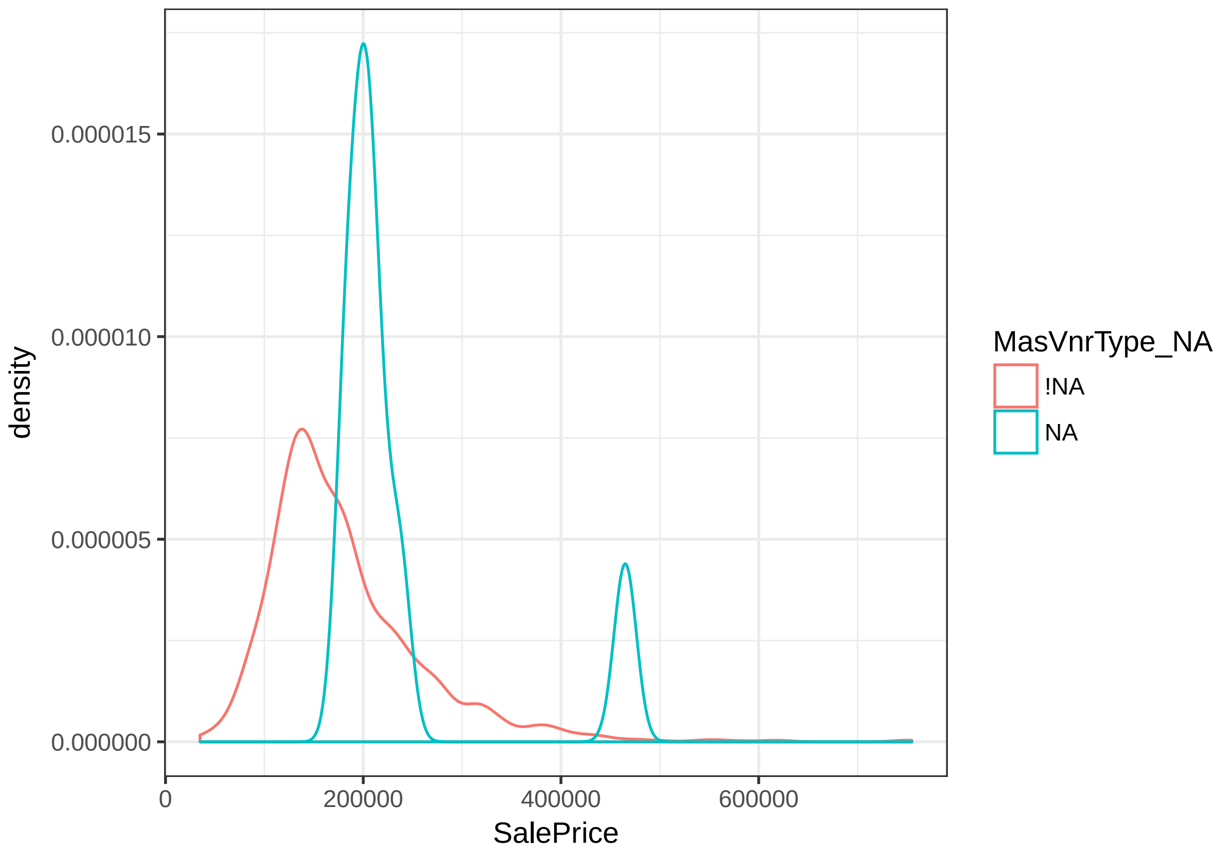
```r
ggplot(data = data, aes(x=MasVnrArea, y=SalePrice)) + geom_missing_point()
```



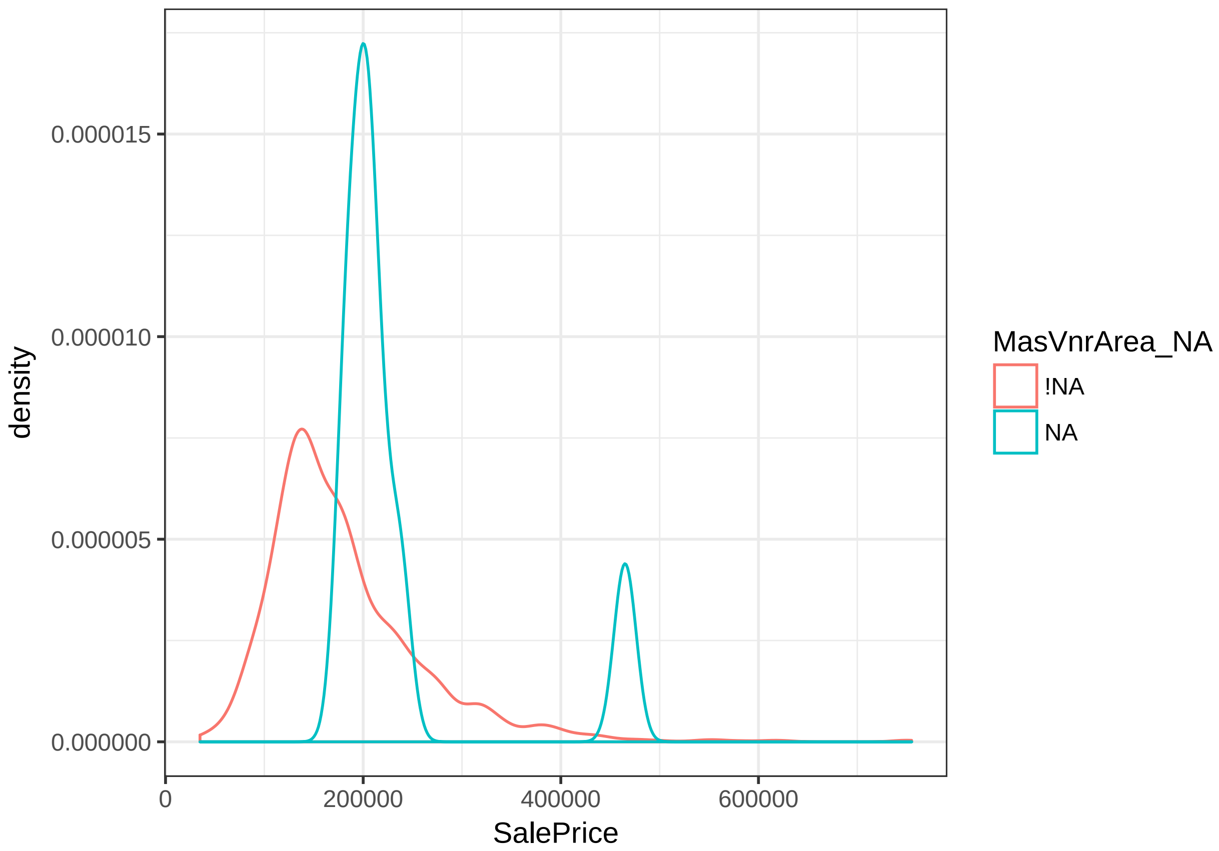
```
ggplot(data = bind_shadow(data),
aes(x = SalePrice, color = LotFrontage_NA)) +
geom_density()
```



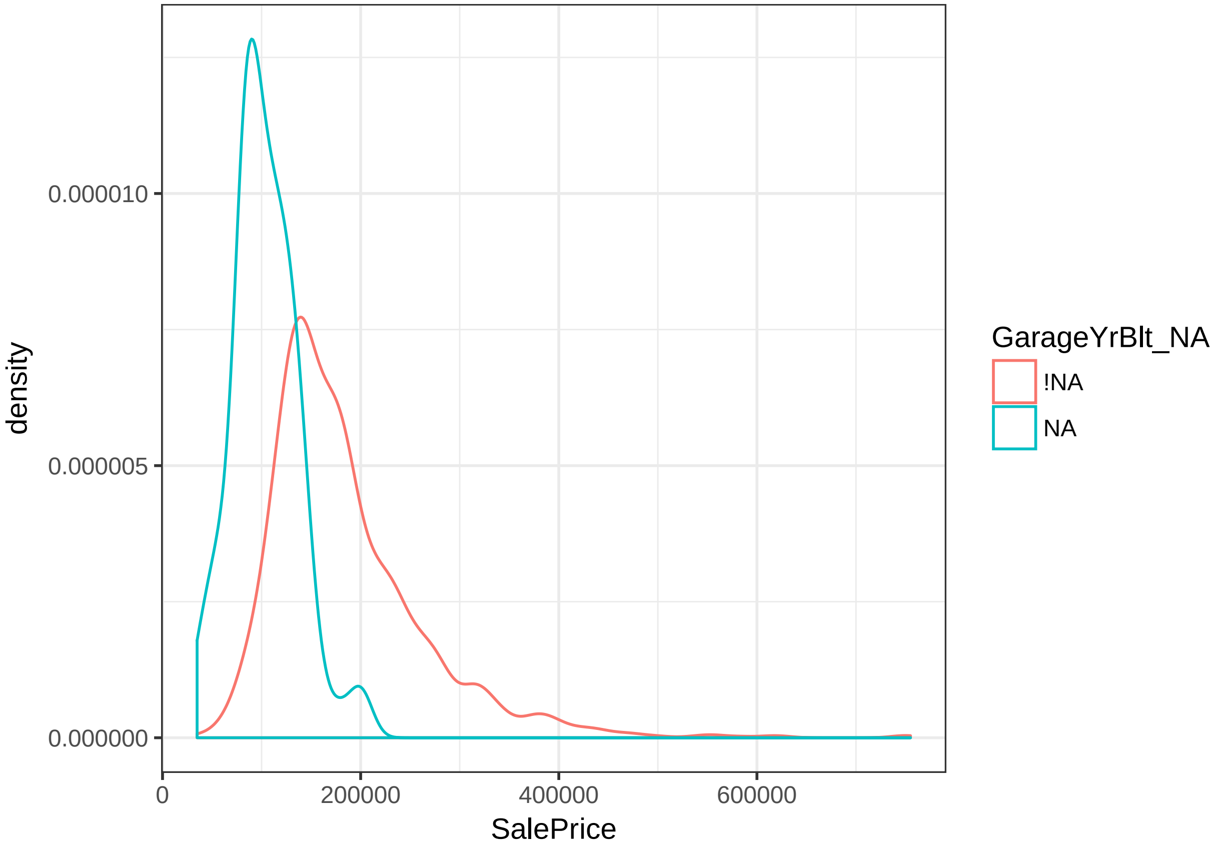
```
ggplot(data = bind_shadow(data),
aes(x = SalePrice, color = MasVnrType_NA)) +
geom_density()
```



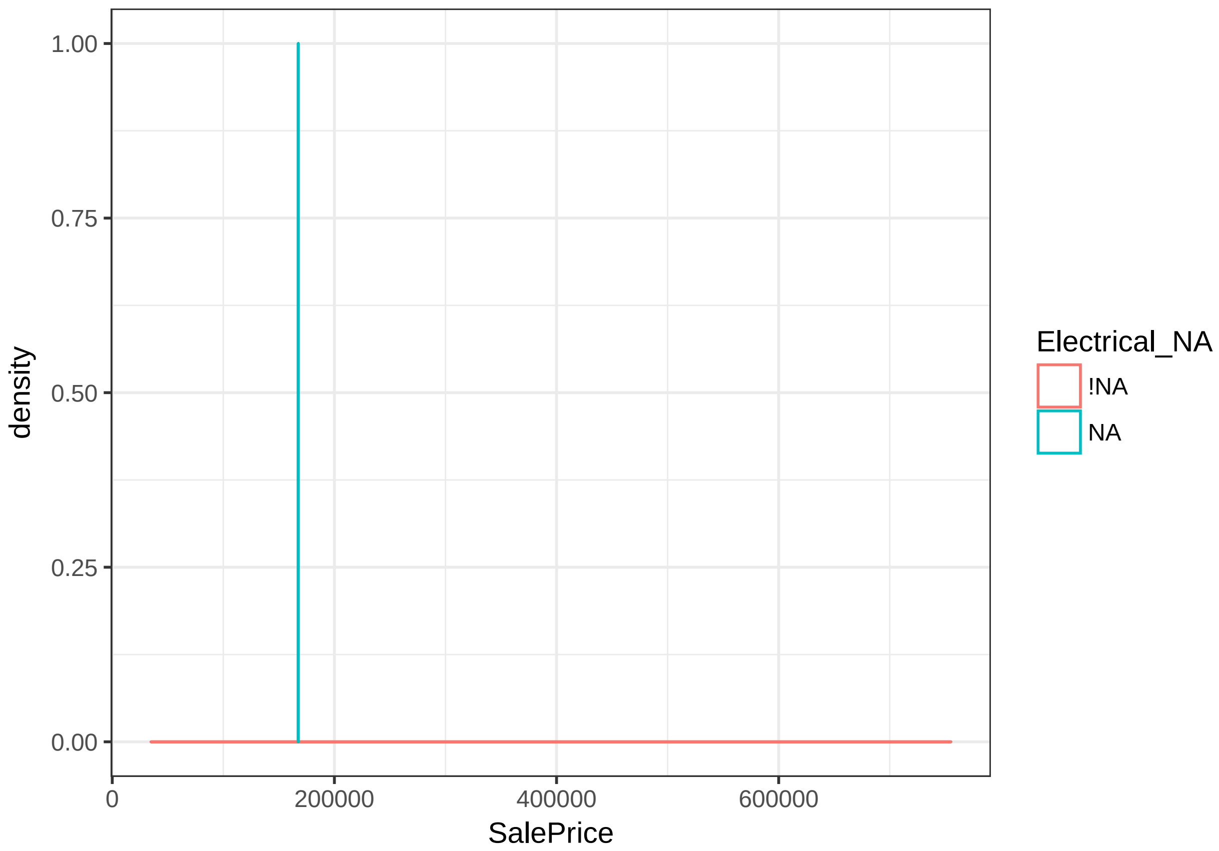
```
ggplot(data = bind_shadow(data),
aes(x = SalePrice, color = MasVnrArea_NA)) +
geom_density()
```



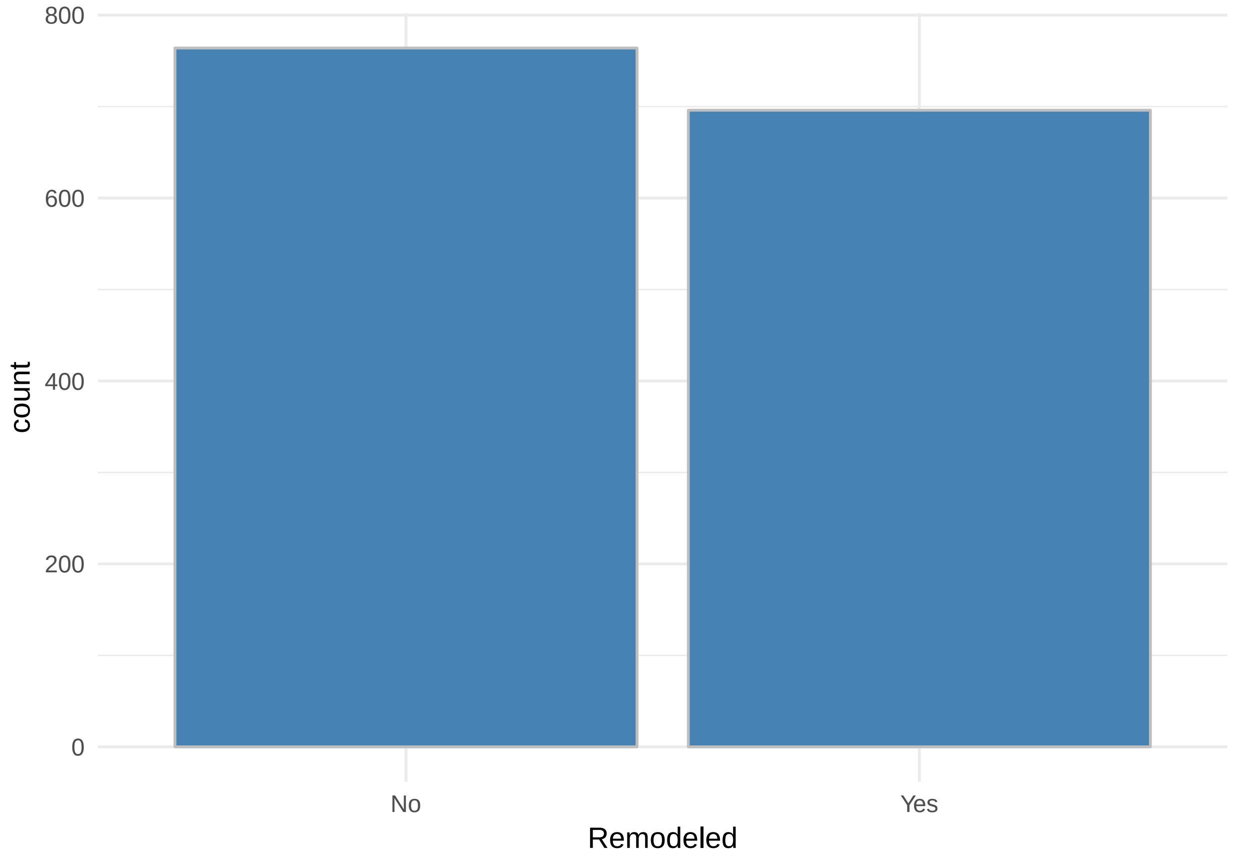
```
ggplot(data = bind_shadow(data),
aes(x = SalePrice, color = GarageYrBlt_NA)) +
geom_density()
```



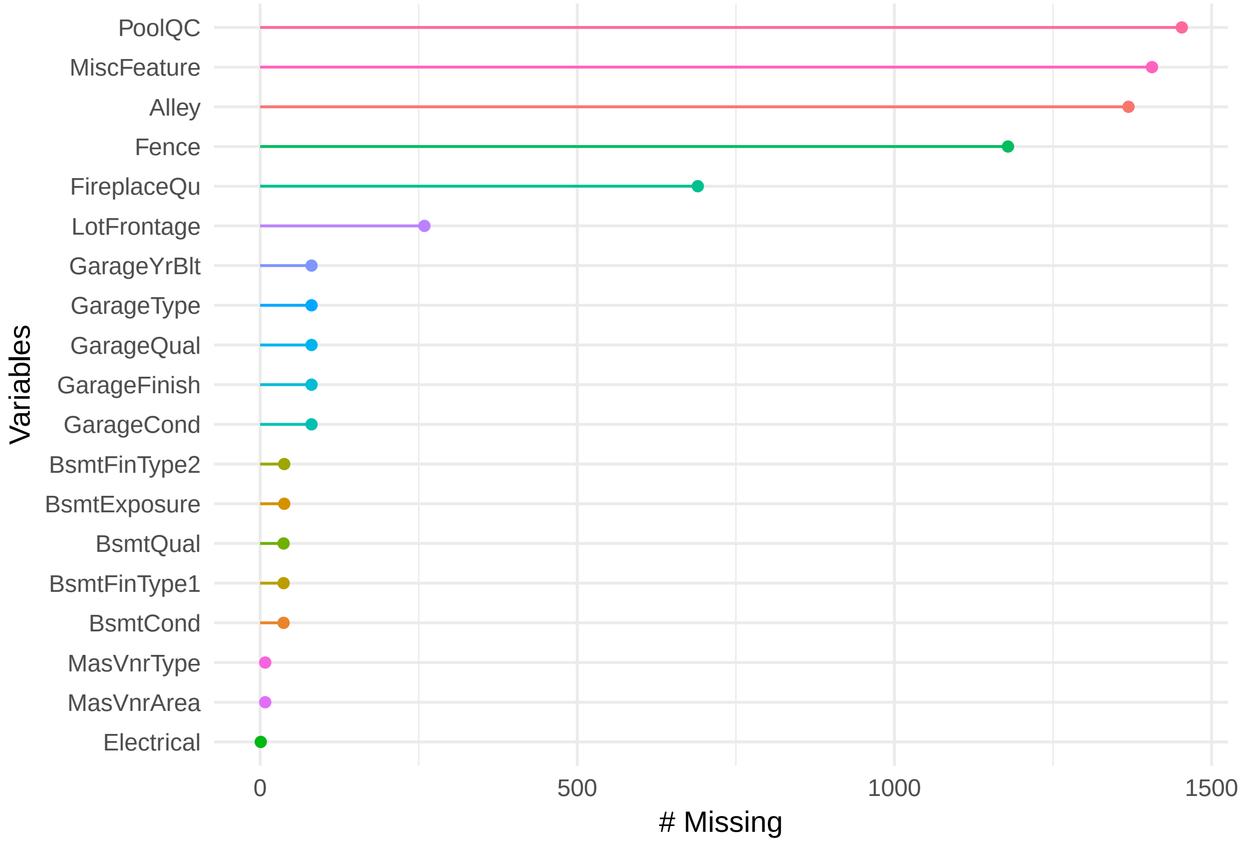
```
ggplot(data = bind_shadow(data),
aes(x = SalePrice, color = Electrical_NA)) +
geom_density()
```



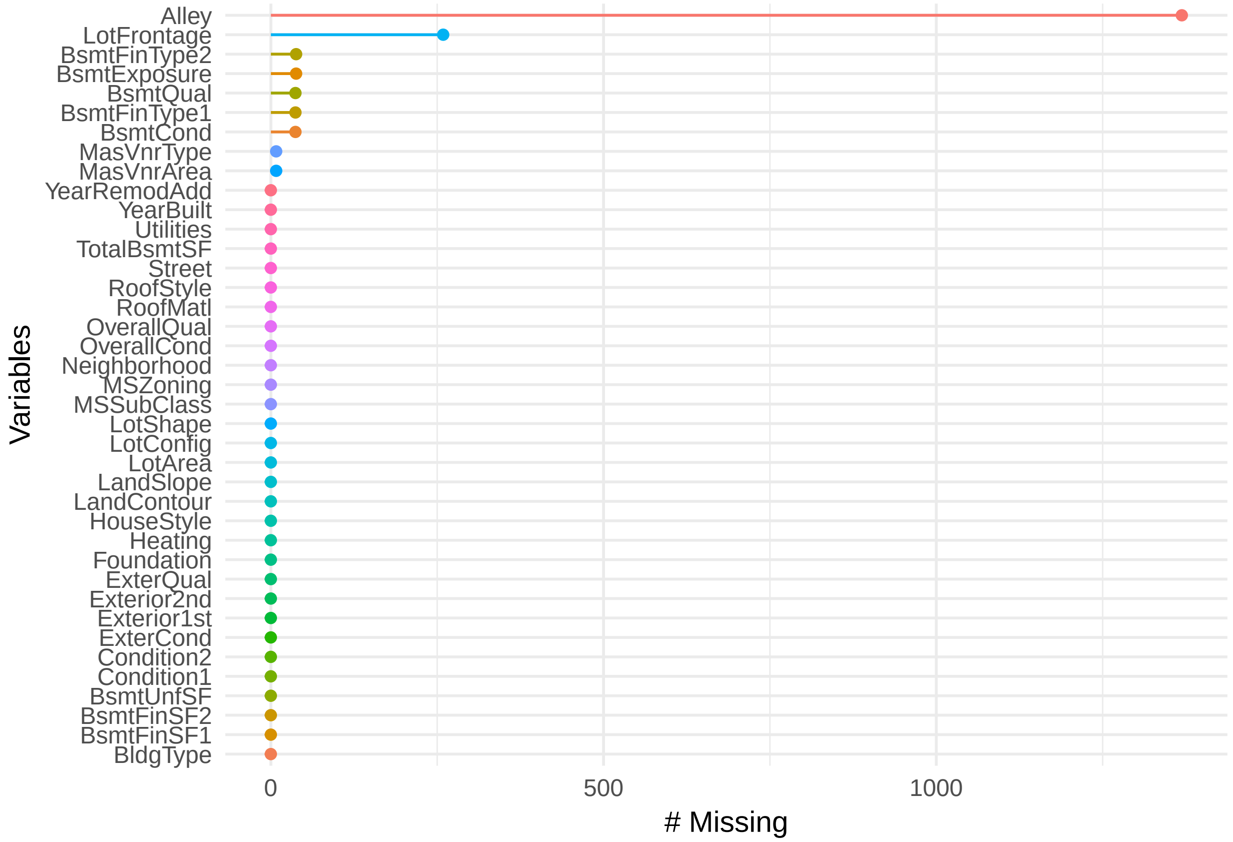
```
data %>% select(YearBuilt, YearRemodAdd) %>%    mutate(Remodeled = as.integer(YearBuilt != YearRemodAdd
```



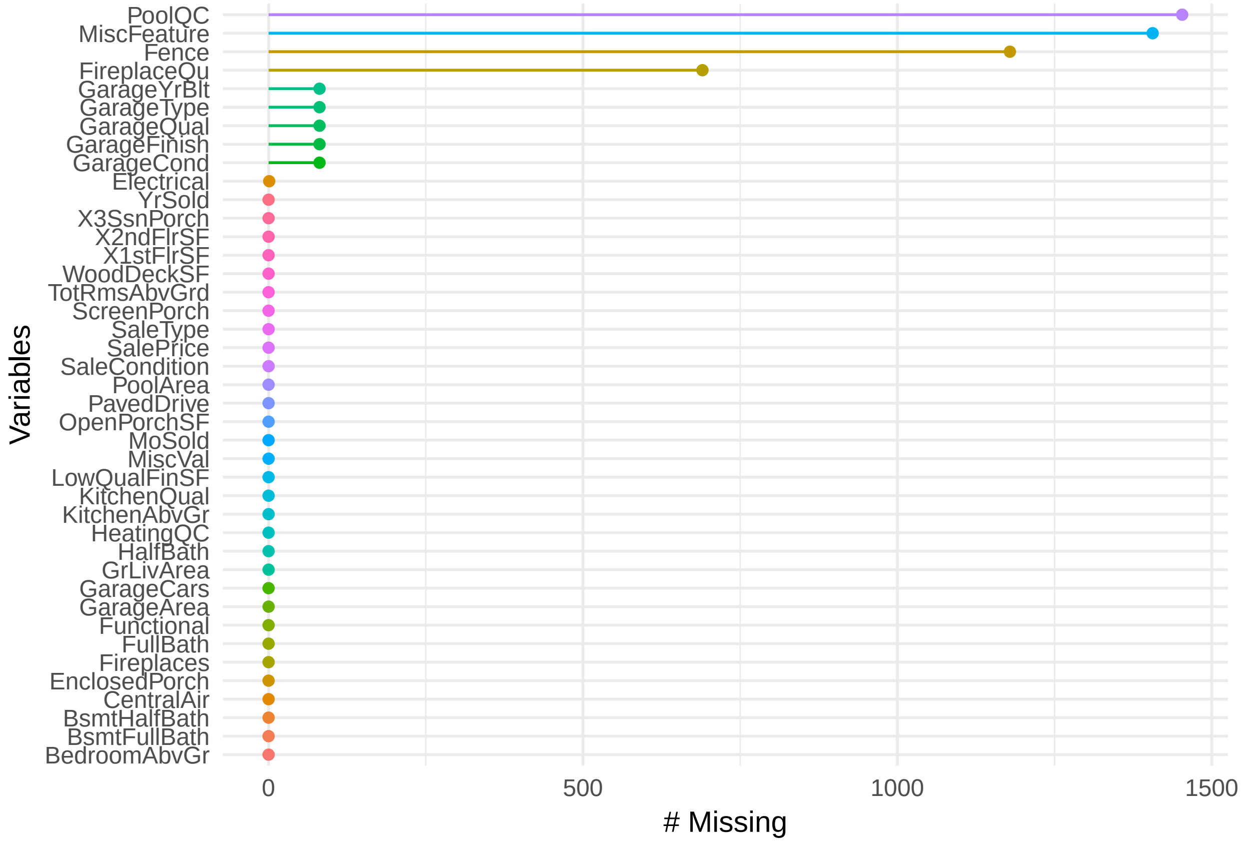
```r
gg_missing_var(data[,colSums(is.na(train)) > 0])
```



```
gg_missing_var(data[,2:40])
```

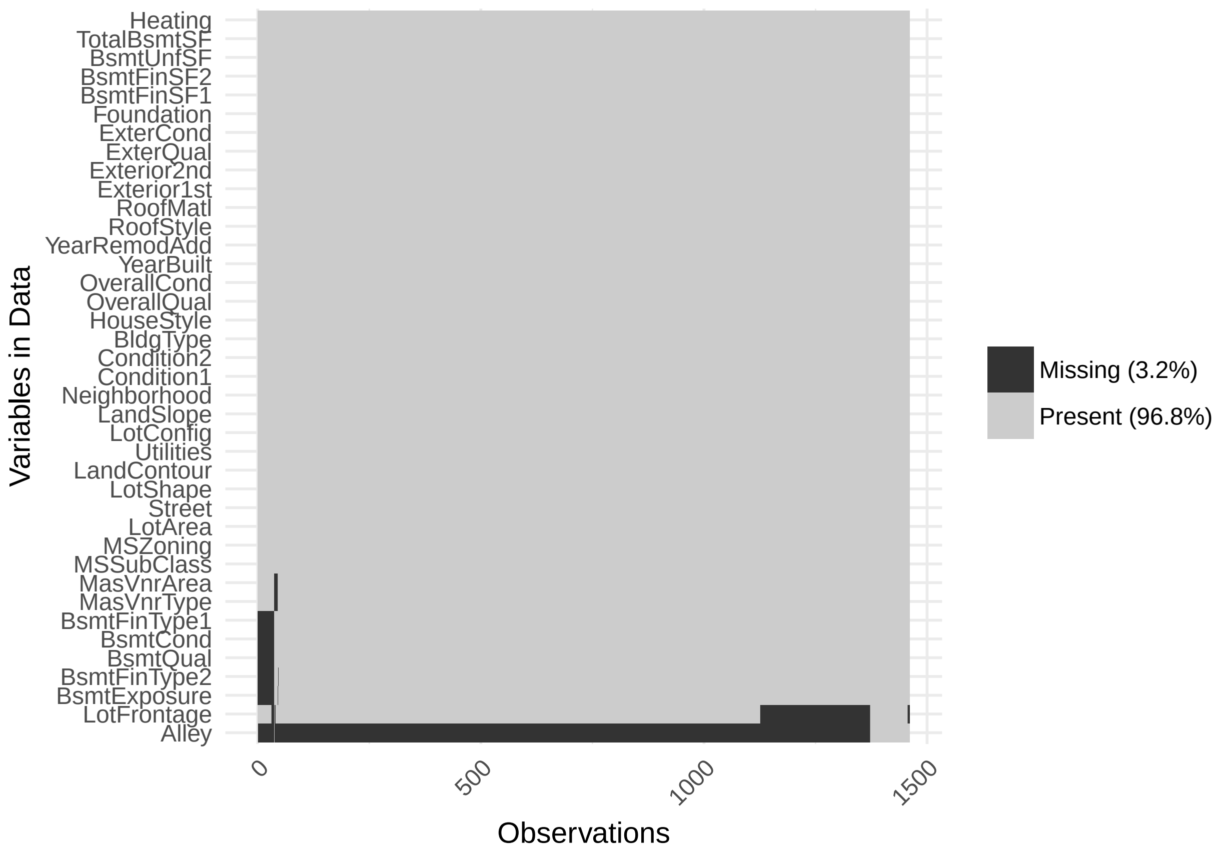


```
gg_missing_var(data[,41:81])
```



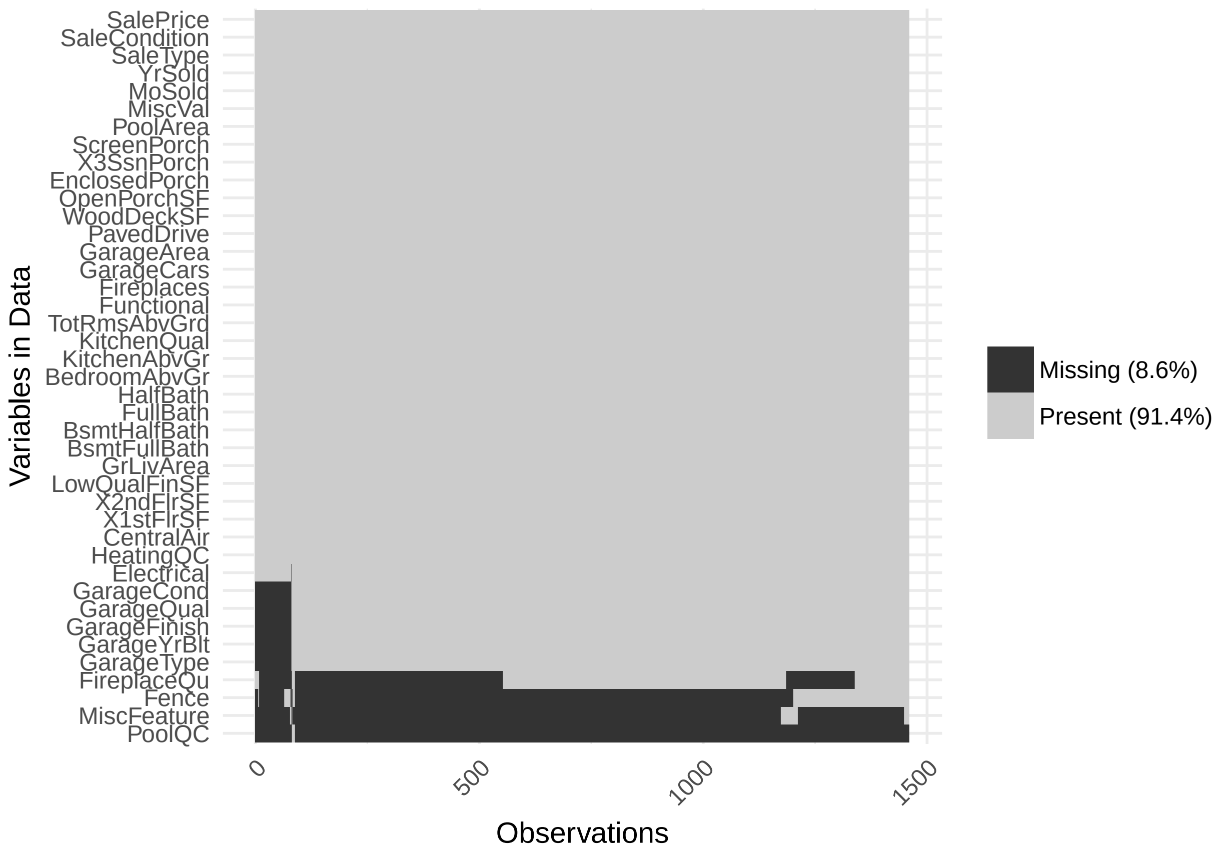
```
visdat::vis_miss(data[, 2:40], cluster = TRUE, sort_miss = TRUE) + coord_flip()
```

```
## Warning: attributes are not identical across measure variables; they will
## be dropped
```

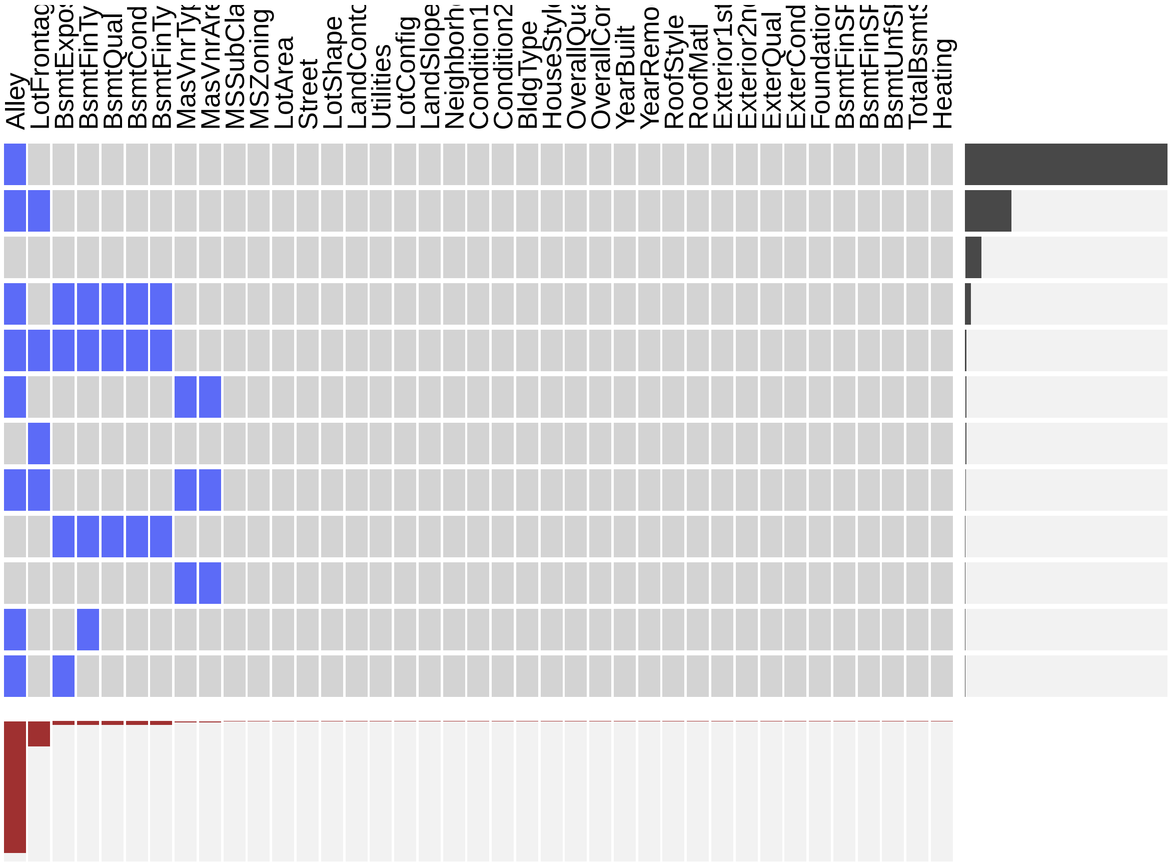


```r
visdat::vis_miss(data[, 41:81], cluster = TRUE, sort_miss = TRUE) + coord_flip()
```

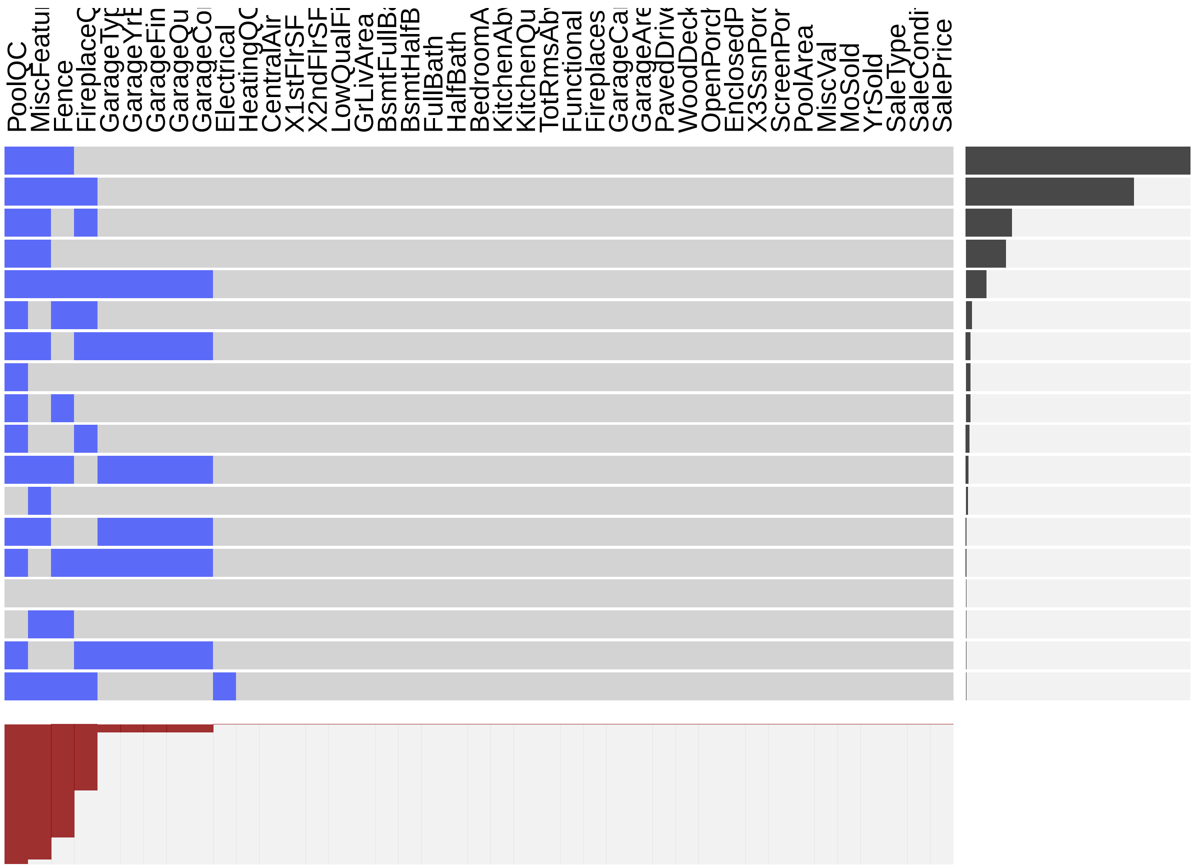
```
## Warning: attributes are not identical across measure variables; they will
## be dropped
```



```
extracat::visna(data[, 2:40], sort = "b")
```

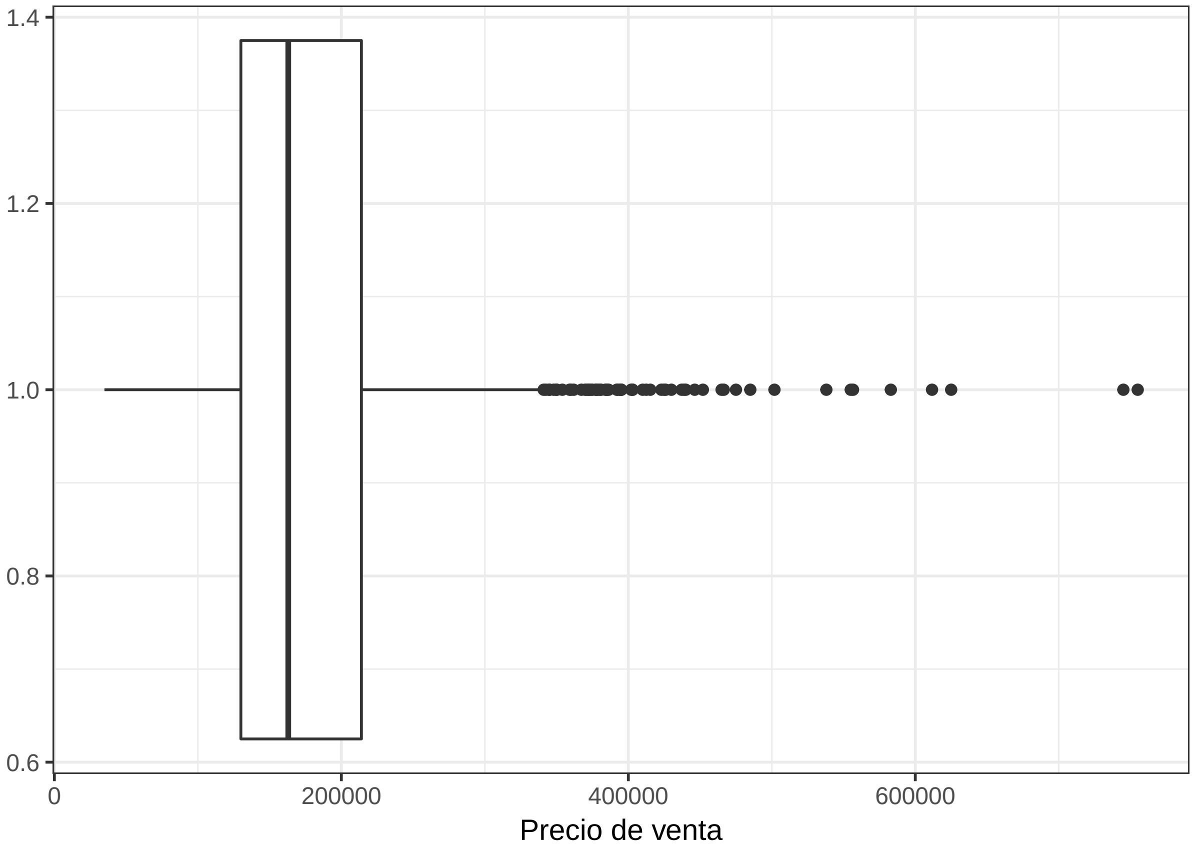


```
extracat::visna(data[, 41:81], sort = "b")
```

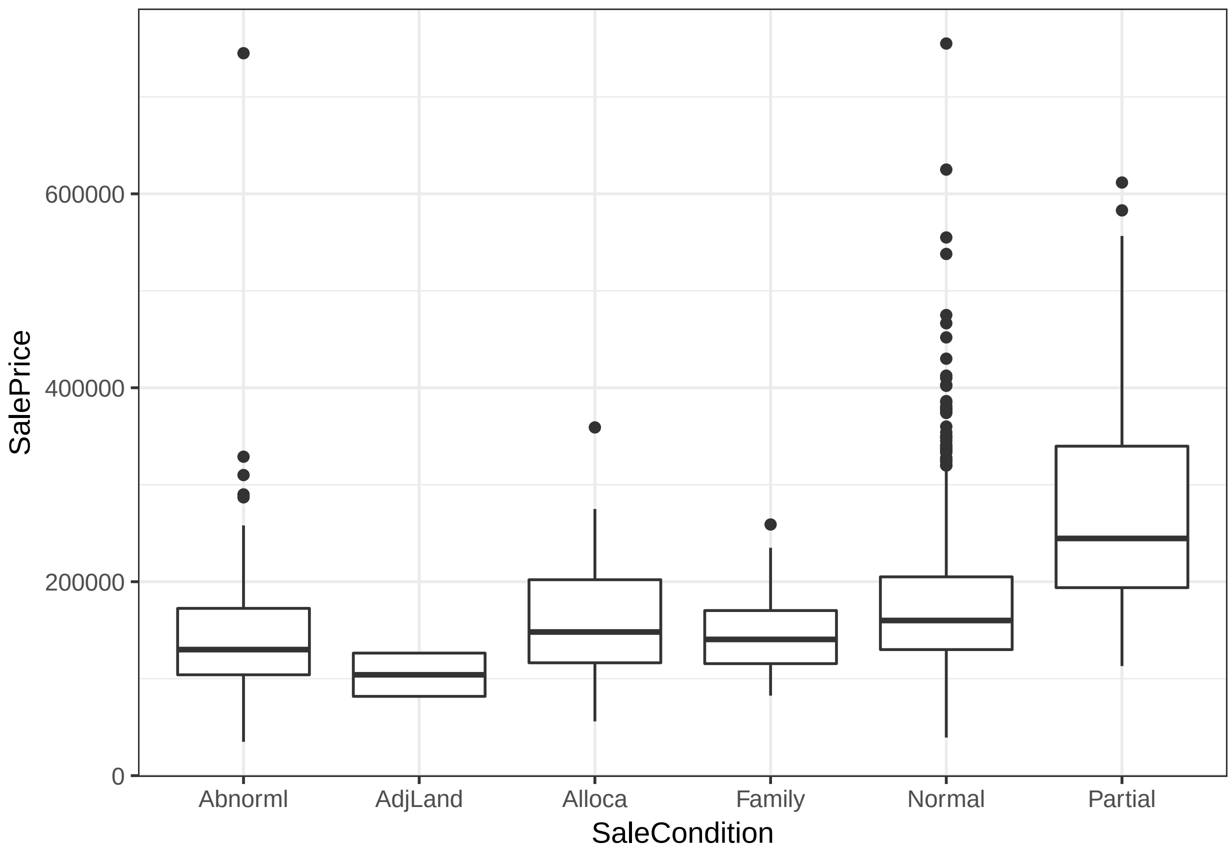


Valores atípicos

```
ggplot(data, aes(1, SalePrice)) +
geom_boxplot() + coord_flip() +
xlab('') +
ylab('Precio de venta')
```



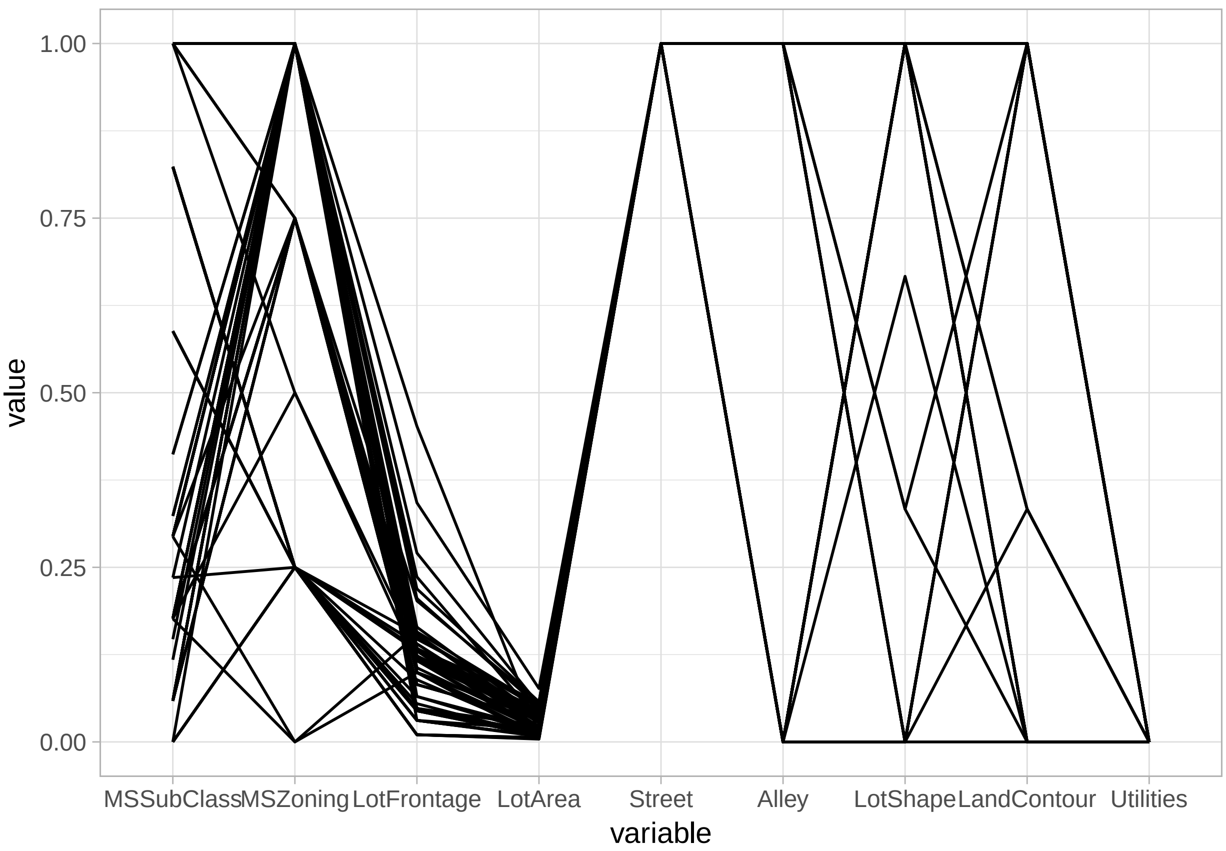
```
ggplot(data, aes(SaleCondition, SalePrice)) +
geom_boxplot()
```



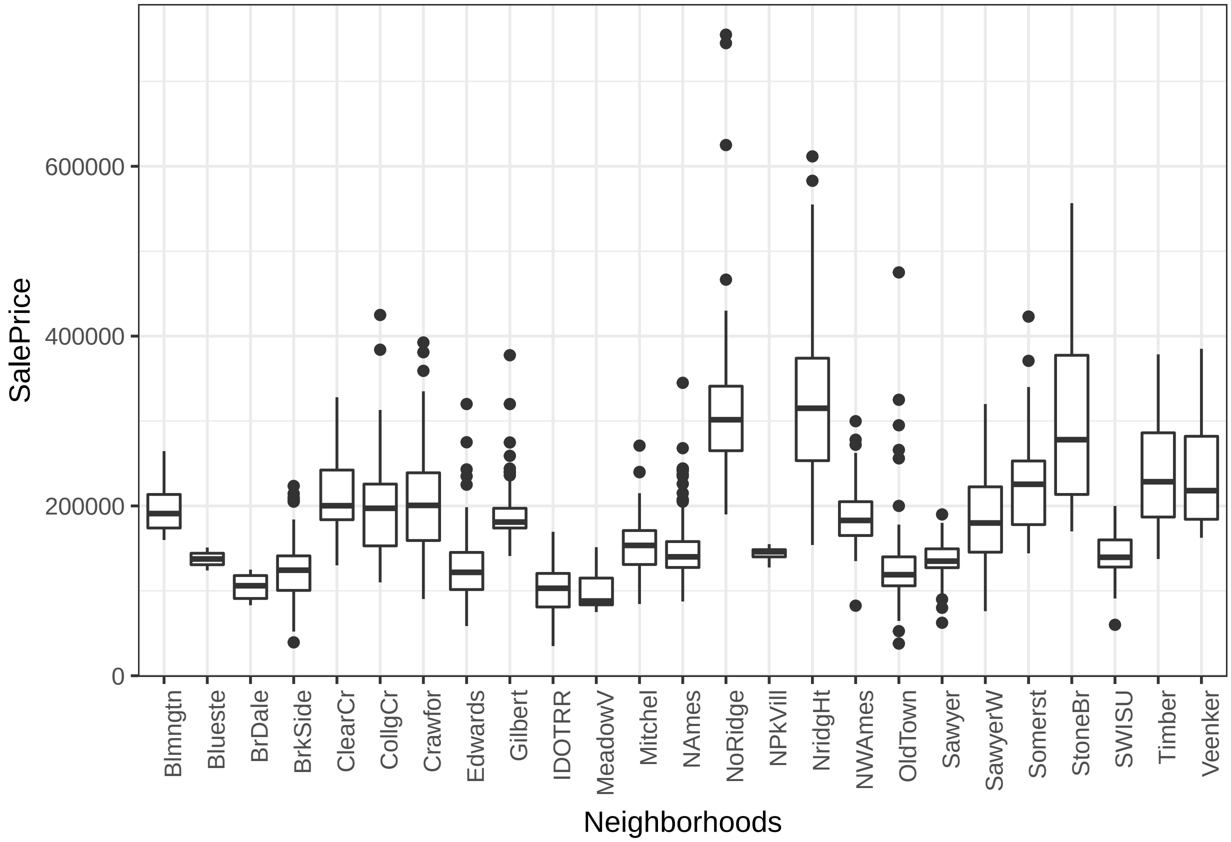
```
data %>%
select(SalePrice) %>%
filter(SalePrice > 350000)
```

```
##    SalePrice
## 1     385000
## 2     438780
## 3     383970
## 4     372402
## 5     412500
## 6     501837
## 7     475000
## 8     386250
## 9     403000
## 10    415298
## 11    360000
## 12    375000
## 13    354000
## 14    377426
## 15    437154
## 16    394432
## 17    426000
## 18    555000
## 19    440000
## 20    380000
## 21    374000
## 22    430000
## 23    402861
## 24    446261
## 25    369900
## 26    451950
## 27    359100
## 28    370878
## 29    402000
## 30    423000
## 31    372500
## 32    392000
## 33    755000
## 34    361919
## 35    538000
## 36    395000
## 37    485000
## 38    582933
## 39    385000
## 40    611657
## 41    395192
## 42    556581
## 43    424870
## 44    625000
## 45    392500
## 46    745000
## 47    367294
## 48    465000
## 49    378500
## 50    381000
## 51    410000
## 52    466500
## 53    377500
## 54    394617
```

```
ggparcoord(data, columns = 2:10,
scale = "uniminmax") + theme_light()
```

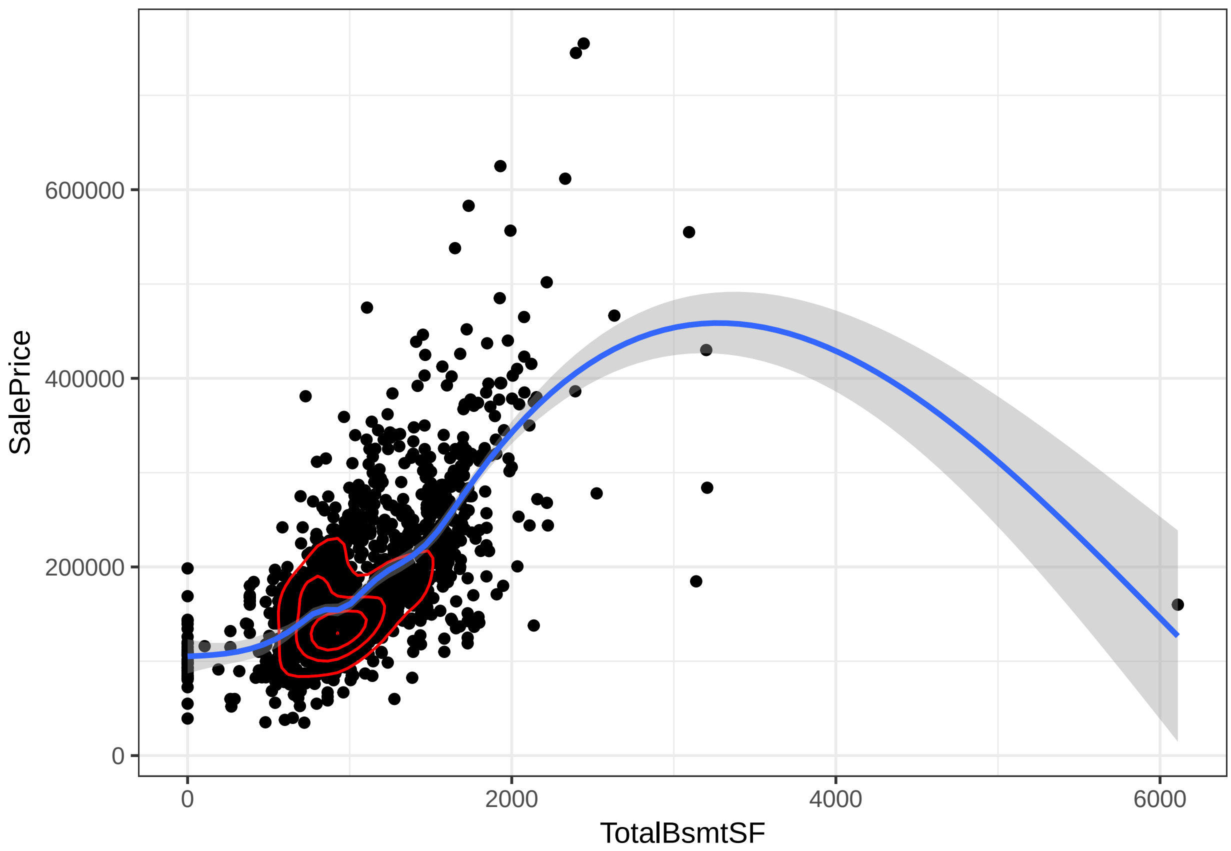


```
ggplot(data, aes(factor(Neighborhood), SalePrice)) + geom_boxplot() + theme(axis.text.x = element_text(a
```



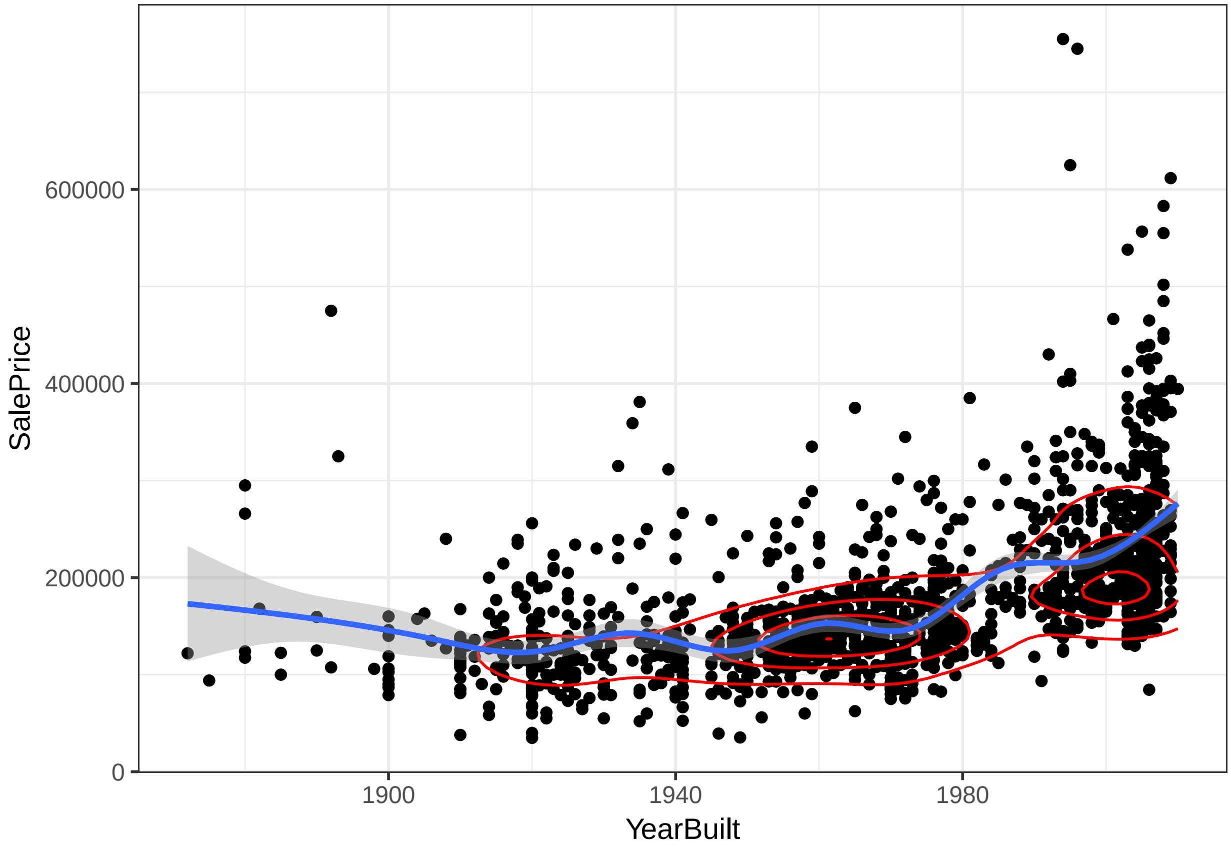
```r
ggplot(data, aes(TotalBsmtSF, SalePrice)) + geom_point() +
geom_density2d(bins = 4, color = "red") +
geom_smooth()
```

```
## `geom_smooth()` using method = 'gam'
```



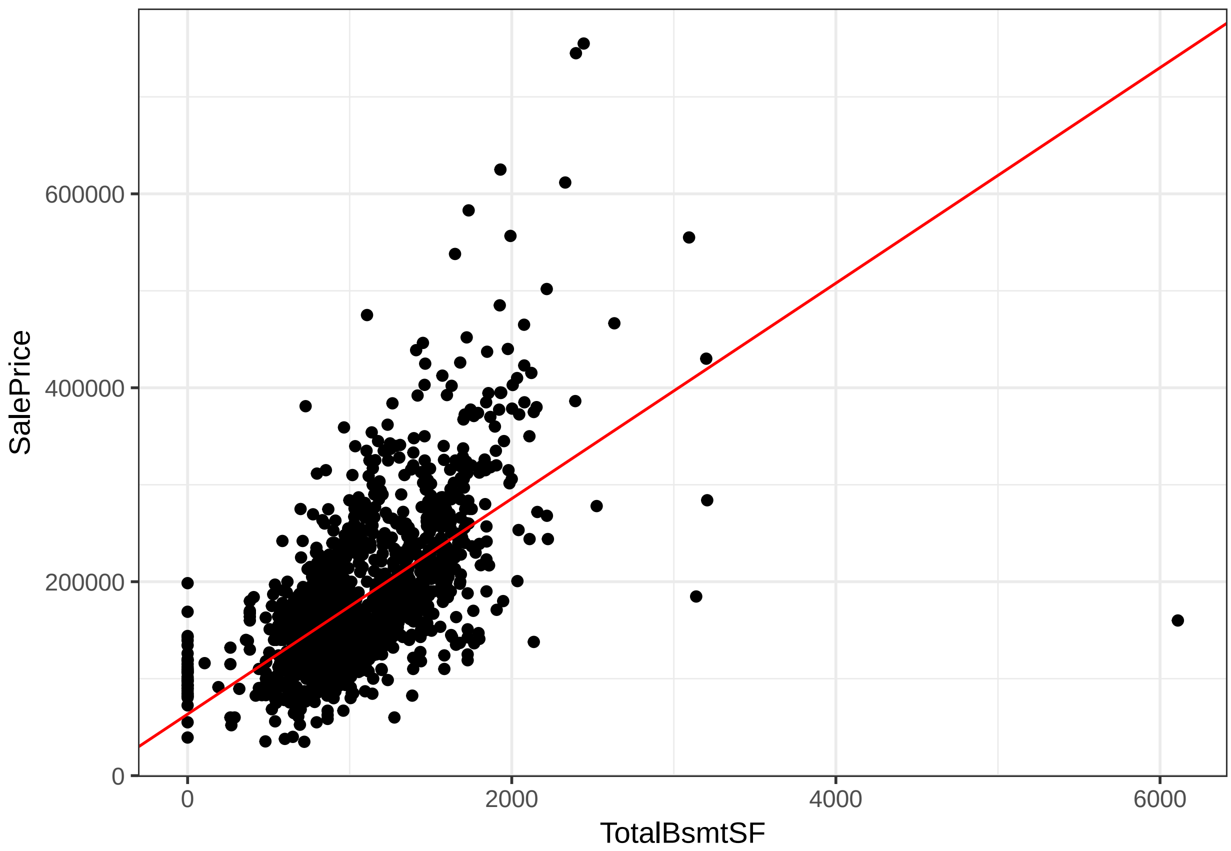
```
ggplot(data, aes(YearBuilt, SalePrice)) + geom_point() +
geom_density2d(bins = 4, color = "red") +
geom_smooth()
```

```
## `geom_smooth()` using method = 'gam'
```

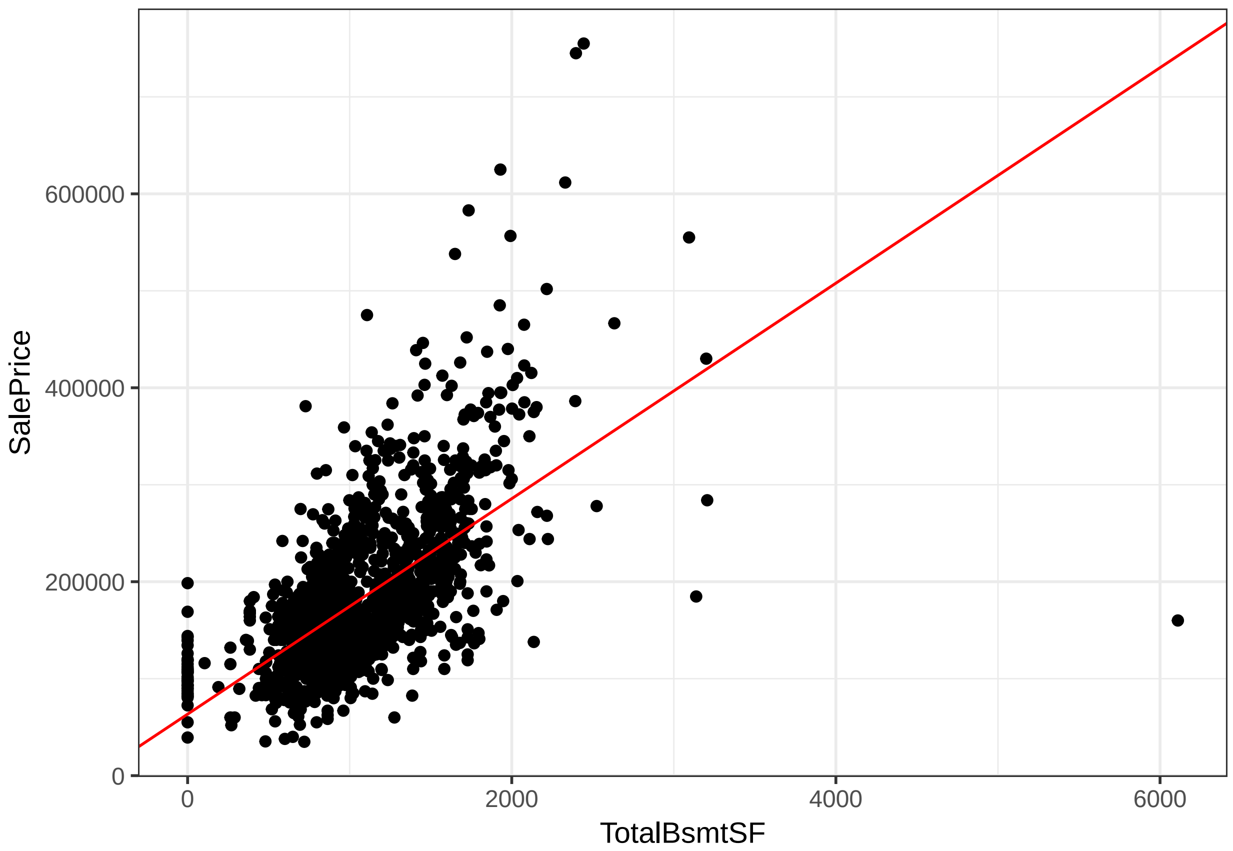


Análisis gráfico con modelos

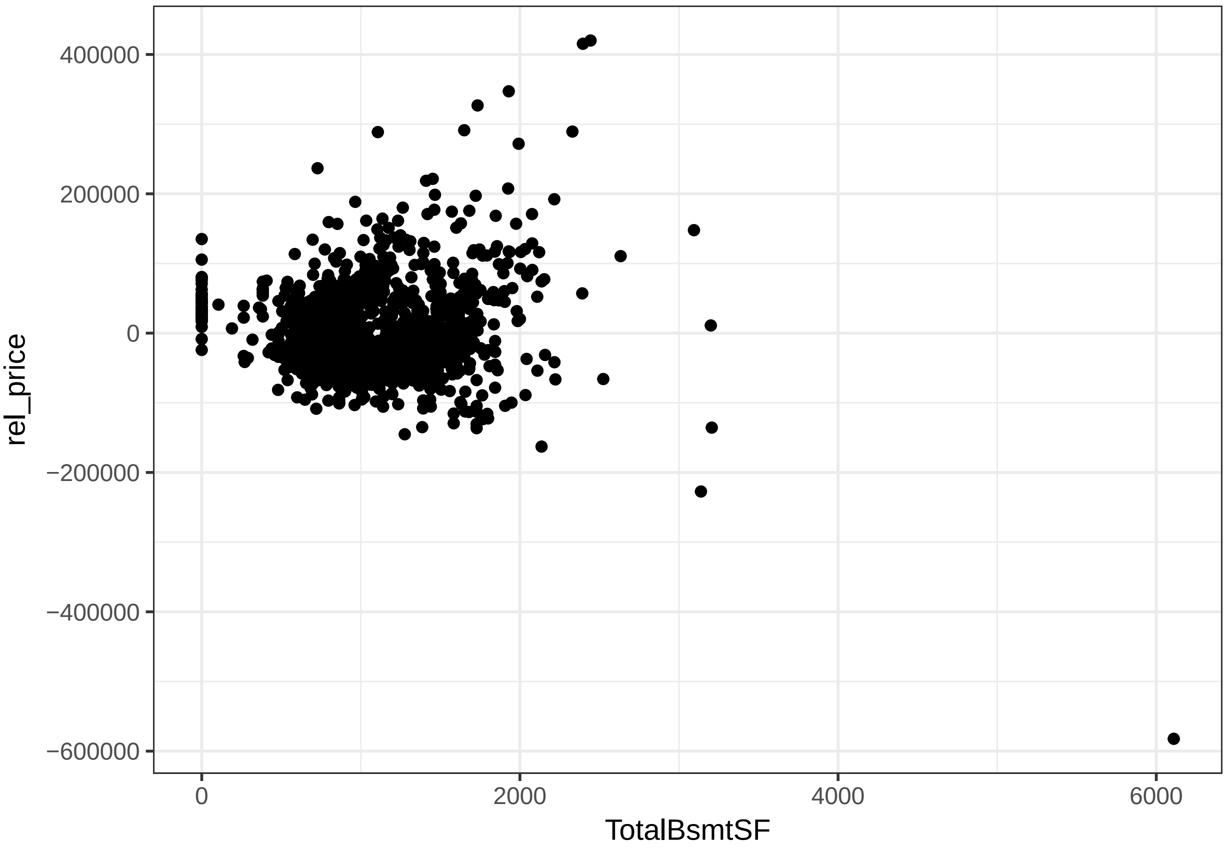
```
modelo_lineal <- lm(SalePrice ~ TotalBsmtSF, data = data)

ggplot(data, aes(TotalBsmtSF, SalePrice)) + geom_point() +
geom_abline(intercept = coef(modelo_lineal)[1],
slope = coef(modelo_lineal)[2],
color = "red")
```



```
modelo_lineal <- lm(SalePrice ~ TotalBsmtSF, data = data)

ggplot(data, aes(TotalBsmtSF, SalePrice)) + geom_point() +
geom_abline(intercept = coef(modelo_lineal)[1],
slope = coef(modelo_lineal)[2],
color = "red")
```



```
data2 <- data %>% mutate(rel_price = resid(modelo_lineal))
ggplot(data2, aes(TotalBsmtSF, rel_price)) +
geom_point()
```



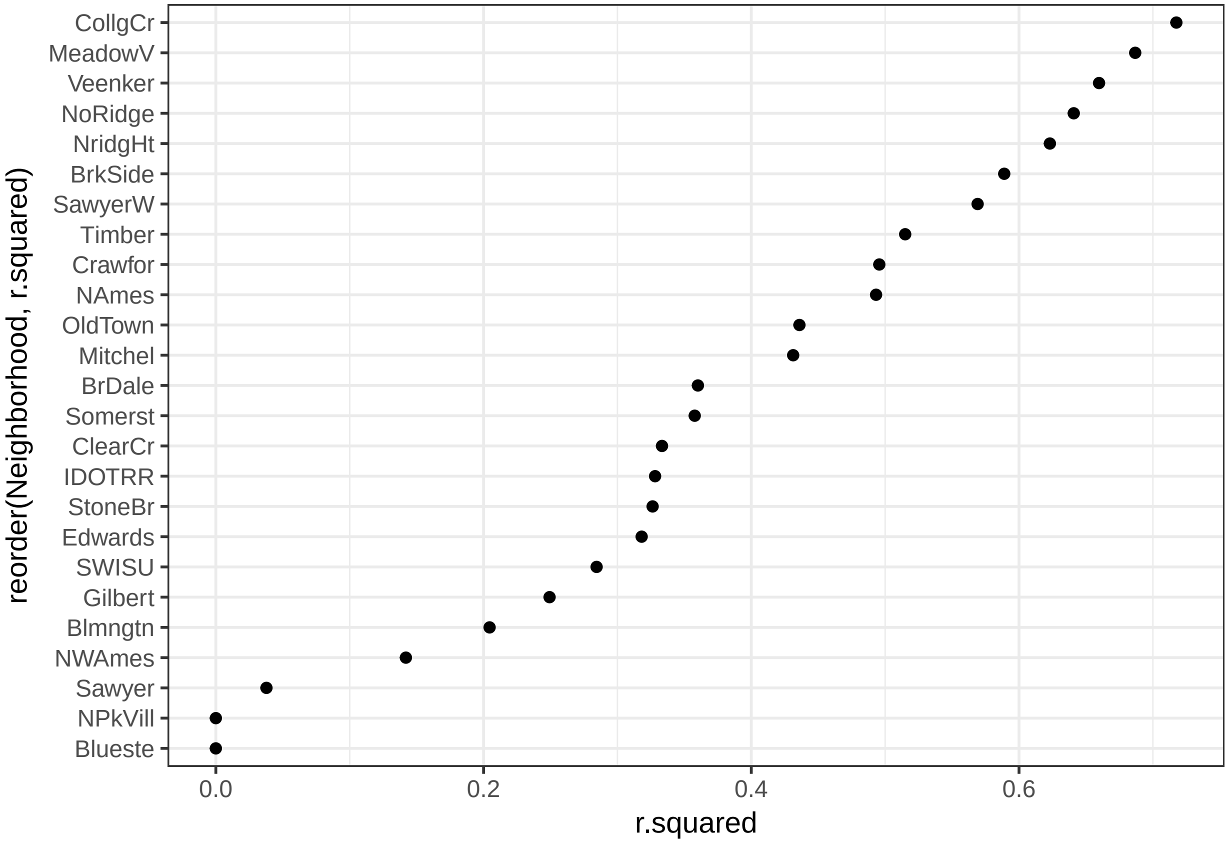
```
deseas <- function(y, x) {
resid(lm(y ~ factor(x), na.action = na.exclude))
}


data3 <- data %>%
group_by(Neighborhood) %>%
mutate(rel_sales = deseas(OverallQual, SalePrice))

models <- data3 %>%
group_by(Neighborhood) %>%
do(mod = lm(log2(SalePrice) ~ OverallQual,
data = ., na.action = na.exclude))
head(models)
```

```
## # A tibble: 6 x 2
##   Neighborhood      mod
##         <fctr>   <list>
## 1      Blmngtn <S3: lm>
## 2      Blueste <S3: lm>
## 3       BrDale <S3: lm>
## 4      BrkSide <S3: lm>
## 5      ClearCr <S3: lm>
## 6      CollgCr <S3: lm>
```

```
model_sum <- models %>% broom::glance(mod)
head(model_sum, 4)
```

```
## Source: local data frame [4 x 12]
## Groups: Neighborhood [4]
##
## # A tibble: 4 x 12
##   Neighborhood r.squared adj.r.squared     sigma statistic
##         <fctr>     <dbl>         <dbl>     <dbl>     <dbl>
## 1      Blmngtn 0.2044985     0.1514651 0.1968872   3.85603
## 2      Blueste 0.0000000     0.0000000 0.2009657        NA
## 3       BrDale 0.3601234     0.3144180 0.1666412   7.87922
## 4      BrkSide 0.5889607     0.5816207 0.3231762  80.24000
## # ... with 7 more variables: p.value <dbl>, df <int>, logLik <dbl>,
## #   AIC <dbl>, BIC <dbl>, deviance <dbl>, df.residual <int>
```

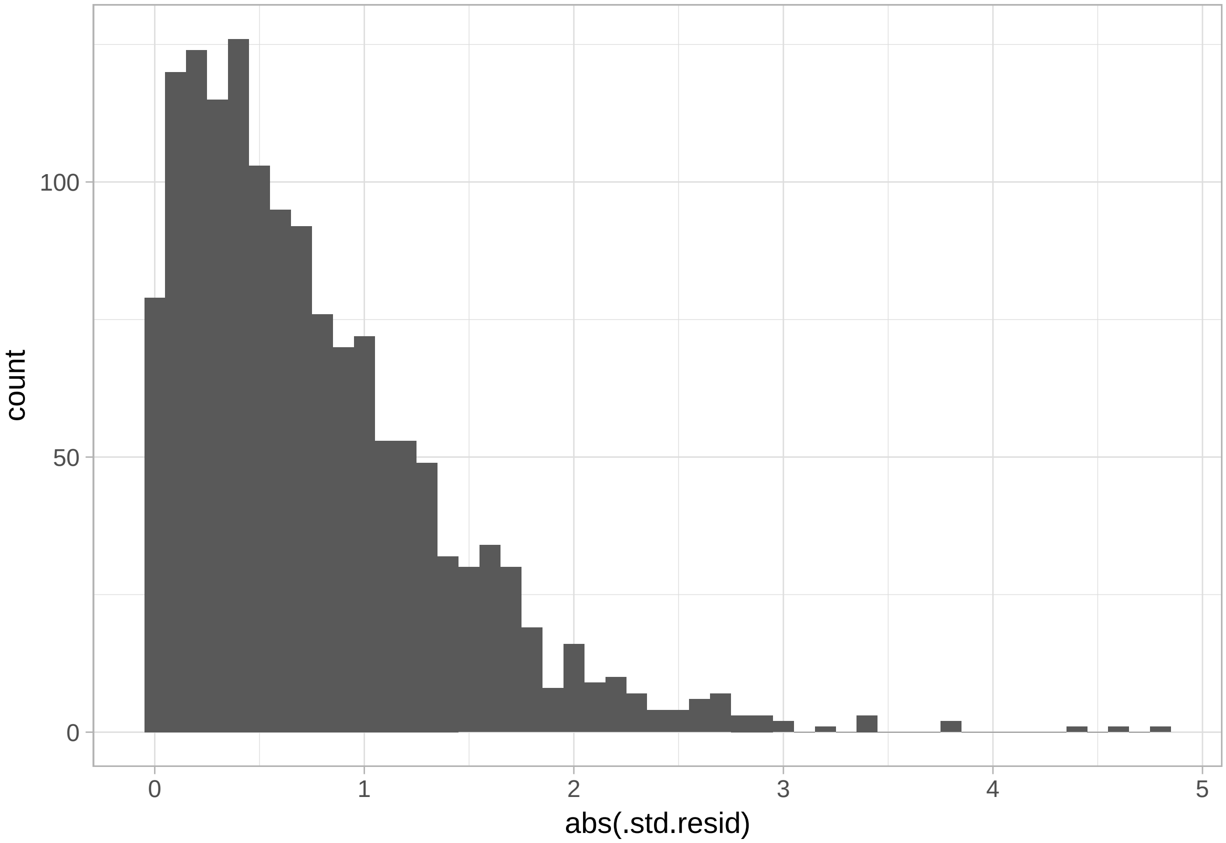
```
ggplot(model_sum, aes(r.squared, reorder(Neighborhood, r.squared))) +
geom_point()
```



```
obs_sum <- models %>% broom::augment(mod)
head(obs_sum, 5)
```

```
## Source: local data frame [5 x 10]
## Groups: Neighborhood [1]
##
## # A tibble: 5 x 10
##   Neighborhood log2.SalePrice. OverallQual  .fitted    .se.fit
##         <fctr>           <dbl>       <int>    <dbl>      <dbl>
## 1      Blmngtn        17.35156           7 17.51335 0.05262032
## 2      Blmngtn        17.55450           7 17.51335 0.05262032
## 3      Blmngtn        17.55075           8 17.75932 0.11367289
## 4      Blmngtn        17.39624           7 17.51335 0.05262032
## 5      Blmngtn        17.44750           7 17.51335 0.05262032
## # ... with 5 more variables: .resid <dbl>, .hat <dbl>, .sigma <dbl>,
## #   .cooksd <dbl>, .std.resid <dbl>
```

```
ggplot(obs_sum, aes(abs(.std.resid))) +
geom_histogram(binwidth = 0.1) + theme_light()
```



MasVnrType MasVnrArea Electrical GarageYrBlt LotFrontage

1stFlrSF BsmtFinSF1 Exterior1st ExterQual GarageArea GarageCars GrLivArea KitchenQual LotArea LotConfig Neighborhood OverallCond OverallQual TotalBsmtSF WoodDeckSF YearBuilt

CONTINUA

caja y bigotes diagrama de puntos histograma estimacion densidad Q-Q

CATEGÓRICA

diagrama de barras grafica de puntos gráfico circular

BIVARIANTE(CONTINUAS) diagrama de dispersion matriz de dispersion

MULTIVARIANTE coordenadas paralelas graficos facetados