Project Phase 1

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20/02/2022

Libraries

Load data from the CSData.csv file.

ames = read\_csv("ames\_student.csv")

## Rows: 2053 Columns: 81

## ── Column specification ───────────────────────────────────────────────────  
## Delimiter: ","  
## chr (47): MS\_SubClass, MS\_Zoning, Street, Alley, Lot\_Shape, Land\_Contou...  
## dbl (34): Lot\_Frontage, Lot\_Area, Year\_Built, Year\_Remod\_Add, Mas\_Vnr\_A...

##   
## ℹ Use `spec()` to retrieve the full column specification for this data.  
## ℹ Specify the column types or set `show\_col\_types = FALSE` to quiet this message.

Convert all character variables to factors

ames = ames %>% mutate\_if(is.character,as\_factor)

Check for missing data

skim(ames)

Data summary

|  |  |
| --- | --- |
| Name | ames |
| Number of rows | 2053 |
| Number of columns | 81 |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Column type frequency: |  |
| factor | 47 |
| numeric | 34 |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Group variables | None |

**Variable type: factor**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| skim\_variable | n\_missing | complete\_rate | ordered | n\_unique | top\_counts |
| MS\_SubClass | 0 | 1 | FALSE | 16 | One: 772, Two: 383, One: 204, One: 129 |
| MS\_Zoning | 0 | 1 | FALSE | 7 | Res: 1600, Res: 326, Flo: 87, Res: 20 |
| Street | 0 | 1 | FALSE | 2 | Pav: 2046, Grv: 7 |
| Alley | 0 | 1 | FALSE | 3 | No\_: 1914, Gra: 94, Pav: 45 |
| Lot\_Shape | 0 | 1 | FALSE | 4 | Reg: 1275, Sli: 714, Mod: 53, Irr: 11 |
| Land\_Contour | 0 | 1 | FALSE | 4 | Lvl: 1833, HLS: 94, Bnk: 81, Low: 45 |
| Utilities | 0 | 1 | FALSE | 2 | All: 2052, NoS: 1 |
| Lot\_Config | 0 | 1 | FALSE | 5 | Ins: 1495, Cor: 359, Cul: 135, FR2: 56 |
| Land\_Slope | 0 | 1 | FALSE | 3 | Gtl: 1951, Mod: 89, Sev: 13 |
| Neighborhood | 0 | 1 | FALSE | 28 | Nor: 327, Col: 183, Old: 181, Edw: 129 |
| Condition\_1 | 0 | 1 | FALSE | 9 | Nor: 1771, Fee: 113, Art: 67, RRA: 35 |
| Condition\_2 | 0 | 1 | FALSE | 8 | Nor: 2027, Fee: 12, Pos: 4, Art: 4 |
| Bldg\_Type | 0 | 1 | FALSE | 5 | One: 1706, Twn: 157, Dup: 76, Twn: 67 |
| House\_Style | 0 | 1 | FALSE | 8 | One: 1052, Two: 590, One: 225, SLv: 90 |
| Overall\_Qual | 0 | 1 | FALSE | 10 | Ave: 587, Abo: 518, Goo: 411, Ver: 237 |
| Overall\_Cond | 0 | 1 | FALSE | 9 | Ave: 1143, Abo: 376, Goo: 286, Ver: 98 |
| Roof\_Style | 0 | 1 | FALSE | 6 | Gab: 1607, Hip: 404, Gam: 14, Fla: 14 |
| Roof\_Matl | 0 | 1 | FALSE | 6 | Com: 2023, Tar: 17, WdS: 8, WdS: 3 |
| Exterior\_1st | 0 | 1 | FALSE | 16 | Vin: 705, Met: 319, Wd : 313, HdB: 303 |
| Exterior\_2nd | 0 | 1 | FALSE | 17 | Vin: 699, Met: 317, Wd : 302, HdB: 277 |
| Mas\_Vnr\_Type | 0 | 1 | FALSE | 5 | Non: 1231, Brk: 638, Sto: 166, Brk: 17 |
| Exter\_Qual | 0 | 1 | FALSE | 4 | Typ: 1272, Goo: 682, Exc: 78, Fai: 21 |
| Exter\_Cond | 0 | 1 | FALSE | 5 | Typ: 1787, Goo: 213, Fai: 43, Exc: 9 |
| Foundation | 0 | 1 | FALSE | 6 | PCo: 911, CBl: 880, Brk: 216, Sla: 36 |
| Bsmt\_Qual | 0 | 1 | FALSE | 6 | Typ: 911, Goo: 849, Exc: 178, No\_: 57 |
| Bsmt\_Cond | 0 | 1 | FALSE | 6 | Typ: 1833, Goo: 80, Fai: 76, No\_: 57 |
| Bsmt\_Exposure | 0 | 1 | FALSE | 5 | No: 1331, Av: 284, Gd: 199, Mn: 179 |
| BsmtFin\_Type\_1 | 0 | 1 | FALSE | 7 | Unf: 602, GLQ: 578, ALQ: 298, Rec: 216 |
| BsmtFin\_Type\_2 | 0 | 1 | FALSE | 7 | Unf: 1740, Rec: 79, LwQ: 64, No\_: 58 |
| Heating | 0 | 1 | FALSE | 6 | Gas: 2019, Gas: 21, Gra: 6, Wal: 5 |
| Heating\_QC | 0 | 1 | FALSE | 5 | Exc: 1040, Typ: 618, Goo: 333, Fai: 61 |
| Central\_Air | 0 | 1 | FALSE | 2 | Y: 1916, N: 137 |
| Electrical | 0 | 1 | FALSE | 5 | SBr: 1887, Fus: 126, Fus: 33, Fus: 6 |
| Kitchen\_Qual | 0 | 1 | FALSE | 5 | Typ: 1070, Goo: 790, Exc: 142, Fai: 50 |
| Functional | 0 | 1 | FALSE | 8 | Typ: 1896, Min: 54, Min: 51, Mod: 27 |
| Fireplace\_Qu | 0 | 1 | FALSE | 6 | No\_: 993, Goo: 538, Typ: 409, Fai: 56 |
| Garage\_Type | 0 | 1 | FALSE | 7 | Att: 1204, Det: 549, Bui: 127, No\_: 108 |
| Garage\_Finish | 0 | 1 | FALSE | 4 | Unf: 872, RFn: 563, Fin: 509, No\_: 109 |
| Garage\_Qual | 0 | 1 | FALSE | 6 | Typ: 1839, No\_: 109, Fai: 85, Goo: 16 |
| Garage\_Cond | 0 | 1 | FALSE | 6 | Typ: 1872, No\_: 109, Fai: 53, Goo: 10 |
| Paved\_Drive | 0 | 1 | FALSE | 3 | Pav: 1848, Dir: 163, Par: 42 |
| Pool\_QC | 0 | 1 | FALSE | 5 | No\_: 2047, Exc: 2, Typ: 2, Fai: 1 |
| Fence | 0 | 1 | FALSE | 5 | No\_: 1661, Min: 225, Goo: 81, Goo: 77 |
| Misc\_Feature | 0 | 1 | FALSE | 5 | Non: 1978, She: 66, Gar: 5, Oth: 3 |
| Sale\_Type | 0 | 1 | FALSE | 10 | WD: 1789, New: 163, COD: 54, Con: 16 |
| Sale\_Condition | 0 | 1 | FALSE | 6 | Nor: 1712, Par: 169, Abn: 121, Fam: 30 |
| Above\_Median | 0 | 1 | FALSE | 2 | Yes: 1043, No: 1010 |

**Variable type: numeric**

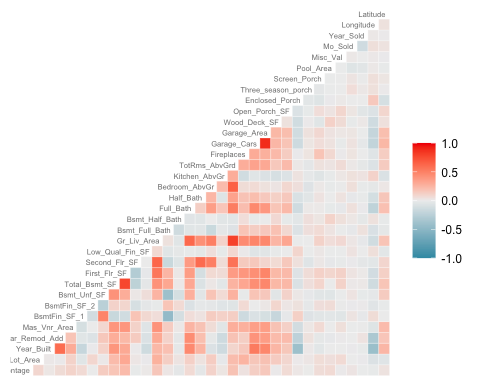
|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| skim\_variable | n\_missing | complete\_rate | mean | sd | p0 | p25 | p50 | p75 | p100 | hist |
| Lot\_Frontage | 0 | 1 | 57.38 | 33.20 | 0.00 | 43.00 | 62.00 | 78.00 | 313.00 | ▇▇▁▁▁ |
| Lot\_Area | 0 | 1 | 10258.40 | 8427.38 | 1300.00 | 7500.00 | 9548.00 | 11600.00 | 215245.00 | ▇▁▁▁▁ |
| Year\_Built | 0 | 1 | 1970.64 | 30.40 | 1875.00 | 1953.00 | 1972.00 | 2000.00 | 2010.00 | ▁▂▃▆▇ |
| Year\_Remod\_Add | 0 | 1 | 1984.08 | 20.96 | 1950.00 | 1965.00 | 1993.00 | 2004.00 | 2010.00 | ▅▂▂▃▇ |
| Mas\_Vnr\_Area | 0 | 1 | 103.75 | 183.59 | 0.00 | 0.00 | 0.00 | 164.00 | 1600.00 | ▇▁▁▁▁ |
| BsmtFin\_SF\_1 | 0 | 1 | 4.21 | 2.24 | 1.00 | 3.00 | 3.00 | 7.00 | 7.00 | ▅▆▁▁▇ |
| BsmtFin\_SF\_2 | 0 | 1 | 52.57 | 175.99 | 0.00 | 0.00 | 0.00 | 0.00 | 1526.00 | ▇▁▁▁▁ |
| Bsmt\_Unf\_SF | 0 | 1 | 561.19 | 441.72 | 0.00 | 226.00 | 460.00 | 801.00 | 2336.00 | ▇▅▂▁▁ |
| Total\_Bsmt\_SF | 0 | 1 | 1054.57 | 435.33 | 0.00 | 793.00 | 988.00 | 1304.00 | 5095.00 | ▇▇▁▁▁ |
| First\_Flr\_SF | 0 | 1 | 1167.52 | 391.79 | 432.00 | 882.00 | 1088.00 | 1402.00 | 5095.00 | ▇▃▁▁▁ |
| Second\_Flr\_SF | 0 | 1 | 326.07 | 422.44 | 0.00 | 0.00 | 0.00 | 701.00 | 1862.00 | ▇▂▂▁▁ |
| Low\_Qual\_Fin\_SF | 0 | 1 | 4.97 | 49.09 | 0.00 | 0.00 | 0.00 | 0.00 | 1064.00 | ▇▁▁▁▁ |
| Gr\_Liv\_Area | 0 | 1 | 1498.56 | 487.84 | 480.00 | 1137.00 | 1447.00 | 1737.00 | 5095.00 | ▇▇▁▁▁ |
| Bsmt\_Full\_Bath | 0 | 1 | 0.43 | 0.53 | 0.00 | 0.00 | 0.00 | 1.00 | 3.00 | ▇▆▁▁▁ |
| Bsmt\_Half\_Bath | 0 | 1 | 0.06 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 | ▇▁▁▁▁ |
| Full\_Bath | 0 | 1 | 1.56 | 0.55 | 0.00 | 1.00 | 2.00 | 2.00 | 4.00 | ▁▇▇▁▁ |
| Half\_Bath | 0 | 1 | 0.38 | 0.50 | 0.00 | 0.00 | 0.00 | 1.00 | 2.00 | ▇▁▅▁▁ |
| Bedroom\_AbvGr | 0 | 1 | 2.86 | 0.82 | 0.00 | 2.00 | 3.00 | 3.00 | 6.00 | ▁▃▇▂▁ |
| Kitchen\_AbvGr | 0 | 1 | 1.05 | 0.22 | 1.00 | 1.00 | 1.00 | 1.00 | 3.00 | ▇▁▁▁▁ |
| TotRms\_AbvGrd | 0 | 1 | 6.44 | 1.54 | 3.00 | 5.00 | 6.00 | 7.00 | 15.00 | ▅▇▃▁▁ |
| Fireplaces | 0 | 1 | 0.60 | 0.65 | 0.00 | 0.00 | 1.00 | 1.00 | 4.00 | ▇▇▁▁▁ |
| Garage\_Cars | 0 | 1 | 1.77 | 0.76 | 0.00 | 1.00 | 2.00 | 2.00 | 5.00 | ▅▇▂▁▁ |
| Garage\_Area | 0 | 1 | 471.96 | 213.43 | 0.00 | 320.00 | 478.00 | 576.00 | 1488.00 | ▃▇▂▁▁ |
| Wood\_Deck\_SF | 0 | 1 | 93.52 | 127.71 | 0.00 | 0.00 | 0.00 | 168.00 | 1424.00 | ▇▁▁▁▁ |
| Open\_Porch\_SF | 0 | 1 | 48.17 | 69.51 | 0.00 | 0.00 | 27.00 | 72.00 | 742.00 | ▇▁▁▁▁ |
| Enclosed\_Porch | 0 | 1 | 23.02 | 60.59 | 0.00 | 0.00 | 0.00 | 0.00 | 584.00 | ▇▁▁▁▁ |
| Three\_season\_porch | 0 | 1 | 2.80 | 25.65 | 0.00 | 0.00 | 0.00 | 0.00 | 407.00 | ▇▁▁▁▁ |
| Screen\_Porch | 0 | 1 | 16.68 | 57.94 | 0.00 | 0.00 | 0.00 | 0.00 | 576.00 | ▇▁▁▁▁ |
| Pool\_Area | 0 | 1 | 1.34 | 27.74 | 0.00 | 0.00 | 0.00 | 0.00 | 800.00 | ▇▁▁▁▁ |
| Misc\_Val | 0 | 1 | 60.12 | 662.76 | 0.00 | 0.00 | 0.00 | 0.00 | 17000.00 | ▇▁▁▁▁ |
| Mo\_Sold | 0 | 1 | 6.19 | 2.70 | 1.00 | 4.00 | 6.00 | 8.00 | 12.00 | ▅▆▇▃▃ |
| Year\_Sold | 0 | 1 | 2007.75 | 1.30 | 2006.00 | 2007.00 | 2008.00 | 2009.00 | 2010.00 | ▇▇▇▇▃ |
| Longitude | 0 | 1 | -93.64 | 0.03 | -93.69 | -93.66 | -93.64 | -93.62 | -93.58 | ▅▅▇▇▁ |
| Latitude | 0 | 1 | 42.03 | 0.02 | 41.99 | 42.02 | 42.03 | 42.05 | 42.06 | ▂▂▇▇▇ |

cor(ames[,unlist(lapply(ames, is.numeric))])

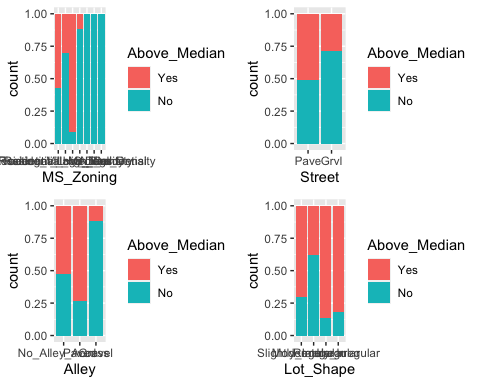
## Lot\_Frontage Lot\_Area Year\_Built Year\_Remod\_Add  
## Lot\_Frontage 1.000000000 0.092246440 0.019699676 0.068791295  
## Lot\_Area 0.092246440 1.000000000 0.009433852 0.004765368  
## Year\_Built 0.019699676 0.009433852 1.000000000 0.600710432  
## Year\_Remod\_Add 0.068791295 0.004765368 0.600710432 1.000000000  
## Mas\_Vnr\_Area 0.106450195 0.112781189 0.299702662 0.180880496  
## BsmtFin\_SF\_1 0.075437425 -0.051475126 -0.184698666 -0.048631872  
## BsmtFin\_SF\_2 -0.001716515 0.093190439 -0.007532313 -0.068331417  
## Bsmt\_Unf\_SF 0.140406858 0.009465972 0.117201697 0.162065761  
## Total\_Bsmt\_SF 0.174554728 0.220077382 0.403115710 0.290594715  
## First\_Flr\_SF 0.219875729 0.310651186 0.306281691 0.233475668  
## Second\_Flr\_SF -0.013277726 0.022592691 0.003218743 0.146884254  
## Low\_Qual\_Fin\_SF 0.006479209 -0.007087287 -0.142399168 -0.080187351  
## Gr\_Liv\_Area 0.165737527 0.268336062 0.234433383 0.306628660  
## Bsmt\_Full\_Bath 0.022176459 0.128929625 0.195696203 0.109249105  
## Bsmt\_Half\_Bath -0.031962652 0.027578063 -0.022248166 -0.029199944  
## Full\_Bath 0.076500169 0.121603075 0.463126113 0.445165572  
## Half\_Bath -0.032216086 0.035168477 0.254467198 0.205171783  
## Bedroom\_AbvGr 0.108002190 0.138216415 -0.076403662 -0.027050641  
## Kitchen\_AbvGr 0.025022868 -0.019083002 -0.146861473 -0.148355748  
## TotRms\_AbvGrd 0.186669661 0.214270849 0.099612881 0.183513072  
## Fireplaces 0.038802846 0.256445593 0.154849973 0.127245269  
## Garage\_Cars 0.130368723 0.169467636 0.534063285 0.410969490  
## Garage\_Area 0.157138820 0.191426198 0.473257140 0.365771853  
## Wood\_Deck\_SF 0.004908320 0.142313489 0.243952405 0.220055732  
## Open\_Porch\_SF 0.072114235 0.092949973 0.164899986 0.218906709  
## Enclosed\_Porch 0.017657893 0.006145339 -0.409993231 -0.238227175  
## Three\_season\_porch 0.002493541 0.021130764 0.009343778 0.040778072  
## Screen\_Porch 0.062239512 0.060109820 -0.035082660 -0.027262529  
## Pool\_Area 0.076114433 0.049386161 -0.001941260 -0.020206036  
## Misc\_Val 0.003713512 0.076469377 -0.003041866 0.003209673  
## Mo\_Sold 0.026600398 -0.003082949 -0.006709782 0.001208210  
## Year\_Sold -0.004253997 -0.006075016 -0.012080008 0.033695314  
## Longitude -0.011791220 -0.077966530 -0.427431552 -0.322435922  
## Latitude 0.037253112 -0.055519912 0.240374534 0.172739300  
## Mas\_Vnr\_Area BsmtFin\_SF\_1 BsmtFin\_SF\_2 Bsmt\_Unf\_SF  
## Lot\_Frontage 0.1064501952 0.0754374247 -0.0017165145 0.140406858  
## Lot\_Area 0.1127811889 -0.0514751263 0.0931904390 0.009465972  
## Year\_Built 0.2997026619 -0.1846986661 -0.0075323126 0.117201697  
## Year\_Remod\_Add 0.1808804961 -0.0486318721 -0.0683314168 0.162065761  
## Mas\_Vnr\_Area 1.0000000000 -0.1088734820 -0.0002976681 0.087378301  
## BsmtFin\_SF\_1 -0.1088734820 1.0000000000 -0.1238926122 0.488678725  
## BsmtFin\_SF\_2 -0.0002976681 -0.1238926122 1.0000000000 -0.246809223  
## Bsmt\_Unf\_SF 0.0873783014 0.4886787255 -0.2468092228 1.000000000  
## Total\_Bsmt\_SF 0.4035990779 -0.1744893179 0.1088678055 0.416603281  
## First\_Flr\_SF 0.4010746175 -0.1330829078 0.0955261351 0.289984552  
## Second\_Flr\_SF 0.1121340515 0.1791687404 -0.1013067990 0.016184483  
## Low\_Qual\_Fin\_SF -0.0572757225 0.0810557378 -0.0302742991 0.055853498  
## Gr\_Liv\_Area 0.4134422593 0.0564265854 -0.0140546207 0.252523406  
## Bsmt\_Full\_Bath 0.1365362704 -0.4661786163 0.1760485572 -0.406977236  
## Bsmt\_Half\_Bath 0.0113302515 -0.1152468082 0.0727177644 -0.108284377  
## Full\_Bath 0.2515555586 0.0570157964 -0.0765924269 0.276977487  
## Half\_Bath 0.1874265005 0.0327209613 -0.0229274920 -0.043197252  
## Bedroom\_AbvGr 0.0661269409 0.1408642028 -0.0303369024 0.178953214  
## Kitchen\_AbvGr -0.0454899536 0.1168406412 -0.0546602167 0.070010551  
## TotRms\_AbvGrd 0.2836771443 0.1283998818 -0.0583054681 0.264656069  
## Fireplaces 0.2721205521 -0.1525756653 0.0740824735 -0.011730462  
## Garage\_Cars 0.3548067201 -0.0844831340 -0.0021317827 0.180228052  
## Garage\_Area 0.3647154067 -0.1081721995 0.0157553713 0.160266522  
## Wood\_Deck\_SF 0.1864712536 -0.1813687593 0.0945032174 -0.046064927  
## Open\_Porch\_SF 0.1211212196 -0.0218114129 0.0220081764 0.108851428  
## Enclosed\_Porch -0.1260707200 0.1228116394 0.0415079448 0.017421766  
## Three\_season\_porch 0.0190606455 -0.0648519463 -0.0232020619 -0.021909045  
## Screen\_Porch 0.0753287987 -0.0449977963 0.0555548332 -0.045039908  
## Pool\_Area -0.0006838179 -0.0357380449 0.0626546968 -0.047694943  
## Misc\_Val 0.0523438986 -0.0495628019 -0.0089725657 -0.003195341  
## Mo\_Sold -0.0055204583 0.0286293249 -0.0080990505 0.029940576  
## Year\_Sold -0.0090505127 -0.0176359700 0.0046221858 -0.015719800  
## Longitude -0.0634715104 0.0640687945 -0.0529456518 -0.024128593  
## Latitude 0.2178832115 -0.0002411152 -0.0105657453 0.145598280  
## Total\_Bsmt\_SF First\_Flr\_SF Second\_Flr\_SF  
## Lot\_Frontage 0.1745547283 0.219875729 -0.013277726  
## Lot\_Area 0.2200773818 0.310651186 0.022592691  
## Year\_Built 0.4031157099 0.306281691 0.003218743  
## Year\_Remod\_Add 0.2905947152 0.233475668 0.146884254  
## Mas\_Vnr\_Area 0.4035990779 0.401074617 0.112134051  
## BsmtFin\_SF\_1 -0.1744893179 -0.133082908 0.179168740  
## BsmtFin\_SF\_2 0.1088678055 0.095526135 -0.101306799  
## Bsmt\_Unf\_SF 0.4166032810 0.289984552 0.016184483  
## Total\_Bsmt\_SF 1.0000000000 0.781496787 -0.238676059  
## First\_Flr\_SF 0.7814967874 1.000000000 -0.288625878  
## Second\_Flr\_SF -0.2386760591 -0.288625878 1.000000000  
## Low\_Qual\_Fin\_SF -0.0319217132 -0.020165584 -0.001440040  
## Gr\_Liv\_Area 0.4177323749 0.551142869 0.633997224  
## Bsmt\_Full\_Bath 0.3190452267 0.248425663 -0.178061276  
## Bsmt\_Half\_Bath 0.0094604699 0.013265838 -0.063851715  
## Full\_Bath 0.3139654431 0.367336107 0.375447461  
## Half\_Bath -0.0755310676 -0.115011471 0.606621562  
## Bedroom\_AbvGr 0.0167231440 0.077701115 0.511181585  
## Kitchen\_AbvGr -0.0373530239 0.067985184 0.063082880  
## TotRms\_AbvGrd 0.2624045419 0.372515107 0.575594155  
## Fireplaces 0.3224795782 0.399871084 0.148094136  
## Garage\_Cars 0.4378989097 0.436677783 0.158274148  
## Garage\_Area 0.4752769763 0.486475467 0.096252270  
## Wood\_Deck\_SF 0.2391678104 0.233956622 0.072491943  
## Open\_Porch\_SF 0.2356605133 0.228442430 0.157679688  
## Enclosed\_Porch -0.0839084006 -0.064595868 0.044079753  
## Three\_season\_porch 0.0498327719 0.061256697 -0.054378451  
## Screen\_Porch 0.0999806133 0.116584745 0.017459406  
## Pool\_Area 0.0003470245 0.093439404 -0.020807456  
## Misc\_Val 0.1128032272 0.114430685 -0.013367504  
## Mo\_Sold 0.0094390028 0.030011586 -0.007289048  
## Year\_Sold 0.0128980026 0.006292501 -0.029127940  
## Longitude -0.1397970047 -0.122741313 -0.040580565  
## Latitude 0.1751160983 0.123619540 0.096272500  
## Low\_Qual\_Fin\_SF Gr\_Liv\_Area Bsmt\_Full\_Bath  
## Lot\_Frontage 0.0064792093 0.165737527 0.022176459  
## Lot\_Area -0.0070872873 0.268336062 0.128929625  
## Year\_Built -0.1423991680 0.234433383 0.195696203  
## Year\_Remod\_Add -0.0801873510 0.306628660 0.109249105  
## Mas\_Vnr\_Area -0.0572757225 0.413442259 0.136536270  
## BsmtFin\_SF\_1 0.0810557378 0.056426585 -0.466178616  
## BsmtFin\_SF\_2 -0.0302742991 -0.014054621 0.176048557  
## Bsmt\_Unf\_SF 0.0558534983 0.252523406 -0.406977236  
## Total\_Bsmt\_SF -0.0319217132 0.417732375 0.319045227  
## First\_Flr\_SF -0.0201655840 0.551142869 0.248425663  
## Second\_Flr\_SF -0.0014400402 0.633997224 -0.178061276  
## Low\_Qual\_Fin\_SF 1.0000000000 0.083191096 -0.049518351  
## Gr\_Liv\_Area 0.0831910956 1.000000000 0.040338411  
## Bsmt\_Full\_Bath -0.0495183505 0.040338411 1.000000000  
## Bsmt\_Half\_Bath -0.0246974710 -0.047123213 -0.140745427  
## Full\_Bath -0.0132493593 0.618790544 -0.047275821  
## Half\_Bath -0.0290894743 0.430003606 -0.044648295  
## Bedroom\_AbvGr 0.0506593445 0.510152150 -0.168896219  
## Kitchen\_AbvGr -0.0169977919 0.107514591 -0.031264410  
## TotRms\_AbvGrd 0.0878983689 0.806443446 -0.065634594  
## Fireplaces 0.0032392172 0.449704742 0.178646360  
## Garage\_Cars -0.0572730758 0.481990095 0.132564546  
## Garage\_Area -0.0418038487 0.469832403 0.159632140  
## Wood\_Deck\_SF -0.0118388457 0.249473846 0.193005247  
## Open\_Porch\_SF 0.0003053473 0.320034864 0.082330066  
## Enclosed\_Porch 0.0975188583 -0.003893234 -0.069530420  
## Three\_season\_porch -0.0032586094 0.001779193 0.051117479  
## Screen\_Porch 0.0174341008 0.110502969 0.071122555  
## Pool\_Area -0.0048921243 0.056531317 0.030741308  
## Misc\_Val -0.0056342467 0.079757372 -0.005016051  
## Mo\_Sold 0.0332164822 0.021133251 -0.021773730  
## Year\_Sold -0.0018663160 -0.020357294 0.041575817  
## Longitude 0.0521221004 -0.128469188 -0.088847711  
## Latitude -0.0392704374 0.178693612 -0.027297963  
## Bsmt\_Half\_Bath Full\_Bath Half\_Bath Bedroom\_AbvGr  
## Lot\_Frontage -0.031962652 0.076500169 -0.0322160864 0.108002190  
## Lot\_Area 0.027578063 0.121603075 0.0351684767 0.138216415  
## Year\_Built -0.022248166 0.463126113 0.2544671979 -0.076403662  
## Year\_Remod\_Add -0.029199944 0.445165572 0.2051717830 -0.027050641  
## Mas\_Vnr\_Area 0.011330251 0.251555559 0.1874265005 0.066126941  
## BsmtFin\_SF\_1 -0.115246808 0.057015796 0.0327209613 0.140864203  
## BsmtFin\_SF\_2 0.072717764 -0.076592427 -0.0229274920 -0.030336902  
## Bsmt\_Unf\_SF -0.108284377 0.276977487 -0.0431972525 0.178953214  
## Total\_Bsmt\_SF 0.009460470 0.313965443 -0.0755310676 0.016723144  
## First\_Flr\_SF 0.013265838 0.367336107 -0.1150114710 0.077701115  
## Second\_Flr\_SF -0.063851715 0.375447461 0.6066215625 0.511181585  
## Low\_Qual\_Fin\_SF -0.024697471 -0.013249359 -0.0290894743 0.050659345  
## Gr\_Liv\_Area -0.047123213 0.618790544 0.4300036060 0.510152150  
## Bsmt\_Full\_Bath -0.140745427 -0.047275821 -0.0446482952 -0.168896219  
## Bsmt\_Half\_Bath 1.000000000 -0.052686477 -0.0475613230 -0.001966092  
## Full\_Bath -0.052686477 1.000000000 0.1269465873 0.361959094  
## Half\_Bath -0.047561323 0.126946587 1.0000000000 0.244294743  
## Bedroom\_AbvGr -0.001966092 0.361959094 0.2442947429 1.000000000  
## Kitchen\_AbvGr -0.043346096 0.172144860 -0.0631383857 0.217922322  
## TotRms\_AbvGrd -0.043388878 0.521813017 0.3381856454 0.660356132  
## Fireplaces 0.057477019 0.205689361 0.1849976893 0.064252718  
## Garage\_Cars -0.010897771 0.464578660 0.2076137871 0.070292096  
## Garage\_Area 0.001006649 0.392916529 0.1535763493 0.042166765  
## Wood\_Deck\_SF 0.078334562 0.174504833 0.1229011079 0.026148063  
## Open\_Porch\_SF -0.016851124 0.229516085 0.1560616964 0.088504316  
## Enclosed\_Porch -0.039794459 -0.137987373 -0.0865224100 0.049826693  
## Three\_season\_porch 0.049347156 0.006620815 -0.0425943227 -0.065599222  
## Screen\_Porch 0.024634865 0.006197511 0.0332665423 0.011293958  
## Pool\_Area 0.106398880 -0.016717274 -0.0003871419 -0.014594318  
## Misc\_Val 0.048860892 -0.021505964 0.0362696598 -0.009122418  
## Mo\_Sold 0.019427615 0.044995060 -0.0206138952 0.051719126  
## Year\_Sold -0.024877350 -0.006956226 -0.0154633004 -0.015209672  
## Longitude 0.040595068 -0.224906730 -0.1165082672 -0.024953442  
## Latitude -0.011699588 0.197929488 0.1664302878 0.018102879  
## Kitchen\_AbvGr TotRms\_AbvGrd Fireplaces Garage\_Cars  
## Lot\_Frontage 0.02502287 0.18666966 0.0388028461 0.130368723  
## Lot\_Area -0.01908300 0.21427085 0.2564455930 0.169467636  
## Year\_Built -0.14686147 0.09961288 0.1548499731 0.534063285  
## Year\_Remod\_Add -0.14835575 0.18351307 0.1272452689 0.410969490  
## Mas\_Vnr\_Area -0.04548995 0.28367714 0.2721205521 0.354806720  
## BsmtFin\_SF\_1 0.11684064 0.12839988 -0.1525756653 -0.084483134  
## BsmtFin\_SF\_2 -0.05466022 -0.05830547 0.0740824735 -0.002131783  
## Bsmt\_Unf\_SF 0.07001055 0.26465607 -0.0117304620 0.180228052  
## Total\_Bsmt\_SF -0.03735302 0.26240454 0.3224795782 0.437898910  
## First\_Flr\_SF 0.06798518 0.37251511 0.3998710836 0.436677783  
## Second\_Flr\_SF 0.06308288 0.57559415 0.1480941365 0.158274148  
## Low\_Qual\_Fin\_SF -0.01699779 0.08789837 0.0032392172 -0.057273076  
## Gr\_Liv\_Area 0.10751459 0.80644345 0.4497047416 0.481990095  
## Bsmt\_Full\_Bath -0.03126441 -0.06563459 0.1786463602 0.132564546  
## Bsmt\_Half\_Bath -0.04334610 -0.04338888 0.0574770194 -0.010897771  
## Full\_Bath 0.17214486 0.52181302 0.2056893614 0.464578660  
## Half\_Bath -0.06313839 0.33818565 0.1849976893 0.207613787  
## Bedroom\_AbvGr 0.21792232 0.66035613 0.0642527183 0.070292096  
## Kitchen\_AbvGr 1.00000000 0.28577631 -0.1316351897 -0.048266217  
## TotRms\_AbvGrd 0.28577631 1.00000000 0.2870596105 0.339606550  
## Fireplaces -0.13163519 0.28705961 1.0000000000 0.300885063  
## Garage\_Cars -0.04826622 0.33960655 0.3008850634 1.000000000  
## Garage\_Area -0.07604242 0.30880274 0.2717432363 0.892088006  
## Wood\_Deck\_SF -0.09996338 0.15817669 0.2319613989 0.241048754  
## Open\_Porch\_SF -0.06648638 0.22339697 0.1402144647 0.177806745  
## Enclosed\_Porch 0.03617832 0.01439820 -0.0074950471 -0.150865253  
## Three\_season\_porch -0.02366325 -0.02971713 0.0319191858 0.026061337  
## Screen\_Porch -0.05858113 0.03946780 0.1814458353 0.058526898  
## Pool\_Area -0.01046712 0.02700694 0.0830649400 0.035113530  
## Misc\_Val 0.01922542 0.06802059 0.0050066281 -0.010119594  
## Mo\_Sold 0.04348250 0.01175426 0.0315876129 0.036028840  
## Year\_Sold 0.03246114 -0.02614802 -0.0002748122 -0.022937165  
## Longitude 0.10836655 -0.07166032 -0.0566936571 -0.206355933  
## Latitude -0.08074177 0.14654385 0.1360093914 0.238403843  
## Garage\_Area Wood\_Deck\_SF Open\_Porch\_SF Enclosed\_Porch  
## Lot\_Frontage 0.157138820 0.004908320 0.0721142355 0.017657893  
## Lot\_Area 0.191426198 0.142313489 0.0929499732 0.006145339  
## Year\_Built 0.473257140 0.243952405 0.1648999863 -0.409993231  
## Year\_Remod\_Add 0.365771853 0.220055732 0.2189067087 -0.238227175  
## Mas\_Vnr\_Area 0.364715407 0.186471254 0.1211212196 -0.126070720  
## BsmtFin\_SF\_1 -0.108172200 -0.181368759 -0.0218114129 0.122811639  
## BsmtFin\_SF\_2 0.015755371 0.094503217 0.0220081764 0.041507945  
## Bsmt\_Unf\_SF 0.160266522 -0.046064927 0.1088514282 0.017421766  
## Total\_Bsmt\_SF 0.475276976 0.239167810 0.2356605133 -0.083908401  
## First\_Flr\_SF 0.486475467 0.233956622 0.2284424302 -0.064595868  
## Second\_Flr\_SF 0.096252270 0.072491943 0.1576796879 0.044079753  
## Low\_Qual\_Fin\_SF -0.041803849 -0.011838846 0.0003053473 0.097518858  
## Gr\_Liv\_Area 0.469832403 0.249473846 0.3200348638 -0.003893234  
## Bsmt\_Full\_Bath 0.159632140 0.193005247 0.0823300661 -0.069530420  
## Bsmt\_Half\_Bath 0.001006649 0.078334562 -0.0168511243 -0.039794459  
## Full\_Bath 0.392916529 0.174504833 0.2295160850 -0.137987373  
## Half\_Bath 0.153576349 0.122901108 0.1560616964 -0.086522410  
## Bedroom\_AbvGr 0.042166765 0.026148063 0.0885043162 0.049826693  
## Kitchen\_AbvGr -0.076042419 -0.099963377 -0.0664863847 0.036178316  
## TotRms\_AbvGrd 0.308802741 0.158176694 0.2233969685 0.014398202  
## Fireplaces 0.271743236 0.231961399 0.1402144647 -0.007495047  
## Garage\_Cars 0.892088006 0.241048754 0.1778067446 -0.150865253  
## Garage\_Area 1.000000000 0.238855230 0.2098070643 -0.128423137  
## Wood\_Deck\_SF 0.238855230 1.000000000 0.0420745704 -0.132409775  
## Open\_Porch\_SF 0.209807064 0.042074570 1.0000000000 -0.072458506  
## Enclosed\_Porch -0.128423137 -0.132409775 -0.0724585057 1.000000000  
## Three\_season\_porch 0.041085209 0.005423668 -0.0162052040 -0.036185322  
## Screen\_Porch 0.084470923 -0.050917977 0.0576361315 -0.063841897  
## Pool\_Area 0.034110688 0.117280692 0.0305234580 -0.007172672  
## Misc\_Val 0.019921892 0.068933224 0.0947347527 0.008220530  
## Mo\_Sold 0.024951657 -0.013144559 0.0238546797 -0.001996237  
## Year\_Sold -0.003614856 0.013293291 -0.0422108633 -0.002563721  
## Longitude -0.194916721 -0.136744452 -0.0695896884 0.154126401  
## Latitude 0.202900705 0.046873656 0.0941762458 -0.105607877  
## Three\_season\_porch Screen\_Porch Pool\_Area  
## Lot\_Frontage 0.0024935415 0.062239512 0.0761144332  
## Lot\_Area 0.0211307644 0.060109820 0.0493861613  
## Year\_Built 0.0093437780 -0.035082660 -0.0019412600  
## Year\_Remod\_Add 0.0407780724 -0.027262529 -0.0202060364  
## Mas\_Vnr\_Area 0.0190606455 0.075328799 -0.0006838179  
## BsmtFin\_SF\_1 -0.0648519463 -0.044997796 -0.0357380449  
## BsmtFin\_SF\_2 -0.0232020619 0.055554833 0.0626546968  
## Bsmt\_Unf\_SF -0.0219090454 -0.045039908 -0.0476949427  
## Total\_Bsmt\_SF 0.0498327719 0.099980613 0.0003470245  
## First\_Flr\_SF 0.0612566973 0.116584745 0.0934394040  
## Second\_Flr\_SF -0.0543784511 0.017459406 -0.0208074563  
## Low\_Qual\_Fin\_SF -0.0032586094 0.017434101 -0.0048921243  
## Gr\_Liv\_Area 0.0017791932 0.110502969 0.0565313166  
## Bsmt\_Full\_Bath 0.0511174788 0.071122555 0.0307413078  
## Bsmt\_Half\_Bath 0.0493471565 0.024634865 0.1063988798  
## Full\_Bath 0.0066208146 0.006197511 -0.0167172742  
## Half\_Bath -0.0425943227 0.033266542 -0.0003871419  
## Bedroom\_AbvGr -0.0655992221 0.011293958 -0.0145943180  
## Kitchen\_AbvGr -0.0236632534 -0.058581127 -0.0104671210  
## TotRms\_AbvGrd -0.0297171265 0.039467804 0.0270069400  
## Fireplaces 0.0319191858 0.181445835 0.0830649400  
## Garage\_Cars 0.0260613373 0.058526898 0.0351135301  
## Garage\_Area 0.0410852091 0.084470923 0.0341106880  
## Wood\_Deck\_SF 0.0054236682 -0.050917977 0.1172806918  
## Open\_Porch\_SF -0.0162052040 0.057636131 0.0305234580  
## Enclosed\_Porch -0.0361853216 -0.063841897 -0.0071726719  
## Three\_season\_porch 1.0000000000 -0.031437098 -0.0052698881  
## Screen\_Porch -0.0314370978 1.000000000 -0.0044748916  
## Pool\_Area -0.0052698881 -0.004474892 1.0000000000  
## Misc\_Val 0.0002211841 0.001287313 -0.0043803640  
## Mo\_Sold 0.0593502563 0.028922423 -0.0609202506  
## Year\_Sold 0.0147493293 -0.009135752 -0.0457980694  
## Longitude 0.0474841945 0.053590823 0.0127917345  
## Latitude 0.0049967176 0.024454796 -0.0127046590  
## Misc\_Val Mo\_Sold Year\_Sold Longitude  
## Lot\_Frontage 0.0037135118 0.026600398 -0.0042539972 -0.01179122  
## Lot\_Area 0.0764693774 -0.003082949 -0.0060750156 -0.07796653  
## Year\_Built -0.0030418664 -0.006709782 -0.0120800082 -0.42743155  
## Year\_Remod\_Add 0.0032096726 0.001208210 0.0336953143 -0.32243592  
## Mas\_Vnr\_Area 0.0523438986 -0.005520458 -0.0090505127 -0.06347151  
## BsmtFin\_SF\_1 -0.0495628019 0.028629325 -0.0176359700 0.06406879  
## BsmtFin\_SF\_2 -0.0089725657 -0.008099050 0.0046221858 -0.05294565  
## Bsmt\_Unf\_SF -0.0031953408 0.029940576 -0.0157197997 -0.02412859  
## Total\_Bsmt\_SF 0.1128032272 0.009439003 0.0128980026 -0.13979700  
## First\_Flr\_SF 0.1144306845 0.030011586 0.0062925009 -0.12274131  
## Second\_Flr\_SF -0.0133675036 -0.007289048 -0.0291279404 -0.04058056  
## Low\_Qual\_Fin\_SF -0.0056342467 0.033216482 -0.0018663160 0.05212210  
## Gr\_Liv\_Area 0.0797573724 0.021133251 -0.0203572937 -0.12846919  
## Bsmt\_Full\_Bath -0.0050160506 -0.021773730 0.0415758173 -0.08884771  
## Bsmt\_Half\_Bath 0.0488608922 0.019427615 -0.0248773496 0.04059507  
## Full\_Bath -0.0215059642 0.044995060 -0.0069562263 -0.22490673  
## Half\_Bath 0.0362696598 -0.020613895 -0.0154633004 -0.11650827  
## Bedroom\_AbvGr -0.0091224177 0.051719126 -0.0152096723 -0.02495344  
## Kitchen\_AbvGr 0.0192254162 0.043482499 0.0324611361 0.10836655  
## TotRms\_AbvGrd 0.0680205922 0.011754256 -0.0261480249 -0.07166032  
## Fireplaces 0.0050066281 0.031587613 -0.0002748122 -0.05669366  
## Garage\_Cars -0.0101195942 0.036028840 -0.0229371652 -0.20635593  
## Garage\_Area 0.0199218917 0.024951657 -0.0036148558 -0.19491672  
## Wood\_Deck\_SF 0.0689332240 -0.013144559 0.0132932911 -0.13674445  
## Open\_Porch\_SF 0.0947347527 0.023854680 -0.0422108633 -0.06958969  
## Enclosed\_Porch 0.0082205301 -0.001996237 -0.0025637207 0.15412640  
## Three\_season\_porch 0.0002211841 0.059350256 0.0147493293 0.04748419  
## Screen\_Porch 0.0012873132 0.028922423 -0.0091357517 0.05359082  
## Pool\_Area -0.0043803640 -0.060920251 -0.0457980694 0.01279173  
## Misc\_Val 1.0000000000 0.010917921 -0.0015007576 0.00926386  
## Mo\_Sold 0.0109179207 1.000000000 -0.1349050962 0.05334590  
## Year\_Sold -0.0015007576 -0.134905096 1.0000000000 0.01128208  
## Longitude 0.0092638601 0.053345898 0.0112820830 1.00000000  
## Latitude -0.0061412315 0.036155906 0.0047912956 0.04213814  
## Latitude  
## Lot\_Frontage 0.0372531122  
## Lot\_Area -0.0555199119  
## Year\_Built 0.2403745339  
## Year\_Remod\_Add 0.1727392999  
## Mas\_Vnr\_Area 0.2178832115  
## BsmtFin\_SF\_1 -0.0002411152  
## BsmtFin\_SF\_2 -0.0105657453  
## Bsmt\_Unf\_SF 0.1455982800  
## Total\_Bsmt\_SF 0.1751160983  
## First\_Flr\_SF 0.1236195397  
## Second\_Flr\_SF 0.0962725001  
## Low\_Qual\_Fin\_SF -0.0392704374  
## Gr\_Liv\_Area 0.1786936124  
## Bsmt\_Full\_Bath -0.0272979633  
## Bsmt\_Half\_Bath -0.0116995875  
## Full\_Bath 0.1979294883  
## Half\_Bath 0.1664302878  
## Bedroom\_AbvGr 0.0181028794  
## Kitchen\_AbvGr -0.0807417702  
## TotRms\_AbvGrd 0.1465438525  
## Fireplaces 0.1360093914  
## Garage\_Cars 0.2384038426  
## Garage\_Area 0.2029007050  
## Wood\_Deck\_SF 0.0468736556  
## Open\_Porch\_SF 0.0941762458  
## Enclosed\_Porch -0.1056078768  
## Three\_season\_porch 0.0049967176  
## Screen\_Porch 0.0244547963  
## Pool\_Area -0.0127046590  
## Misc\_Val -0.0061412315  
## Mo\_Sold 0.0361559058  
## Year\_Sold 0.0047912956  
## Longitude 0.0421381360  
## Latitude 1.0000000000

ggcorr(ames, hjust = 0.95, size = 2, color = "grey50", layout.exp = 1)

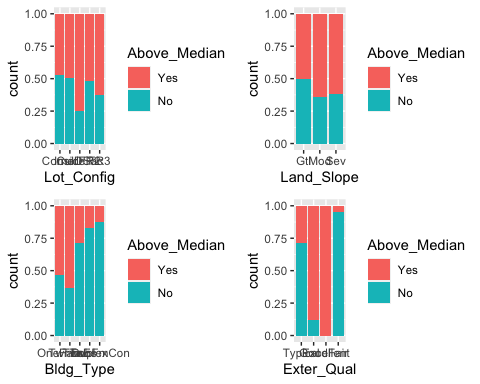
## Warning in ggcorr(ames, hjust = 0.95, size = 2, color = "grey50",  
## layout.exp = 1): data in column(s) 'MS\_SubClass', 'MS\_Zoning', 'Street',  
## 'Alley', 'Lot\_Shape', 'Land\_Contour', 'Utilities', 'Lot\_Config',  
## 'Land\_Slope', 'Neighborhood', 'Condition\_1', 'Condition\_2', 'Bldg\_Type',  
## 'House\_Style', 'Overall\_Qual', 'Overall\_Cond', 'Roof\_Style', 'Roof\_Matl',  
## 'Exterior\_1st', 'Exterior\_2nd', 'Mas\_Vnr\_Type', 'Exter\_Qual',  
## 'Exter\_Cond', 'Foundation', 'Bsmt\_Qual', 'Bsmt\_Cond', 'Bsmt\_Exposure',  
## 'BsmtFin\_Type\_1', 'BsmtFin\_Type\_2', 'Heating', 'Heating\_QC', 'Central\_Air',  
## 'Electrical', 'Kitchen\_Qual', 'Functional', 'Fireplace\_Qu', 'Garage\_Type',  
## 'Garage\_Finish', 'Garage\_Qual', 'Garage\_Cond', 'Paved\_Drive', 'Pool\_QC',  
## 'Fence', 'Misc\_Feature', 'Sale\_Type', 'Sale\_Condition', 'Above\_Median' are  
## not numeric and were ignored



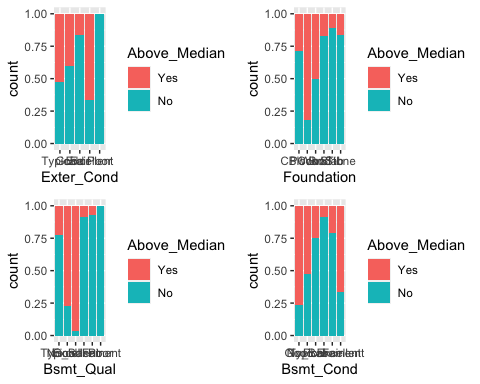
p1 = ggplot(ames, aes(x = MS\_Zoning, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames, aes(x = Street, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames, aes(x = Alley, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames, aes(x = Lot\_Shape, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



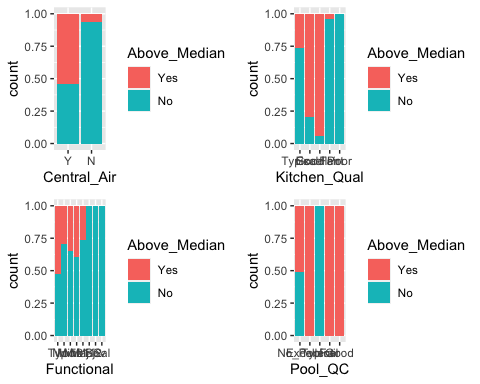
p1 = ggplot(ames, aes(x = Lot\_Config, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames, aes(x = Land\_Slope, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames, aes(x = Bldg\_Type, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames, aes(x = Exter\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



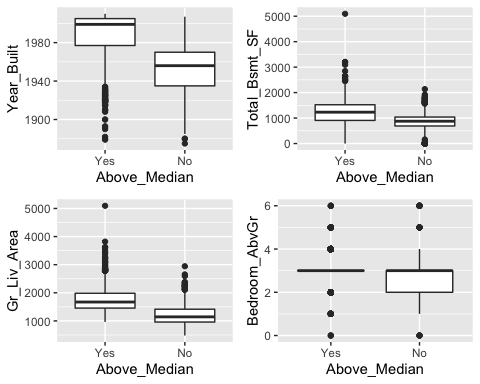
p1 = ggplot(ames, aes(x = Exter\_Cond, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames, aes(x = Foundation, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames, aes(x = Bsmt\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames, aes(x = Bsmt\_Cond, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



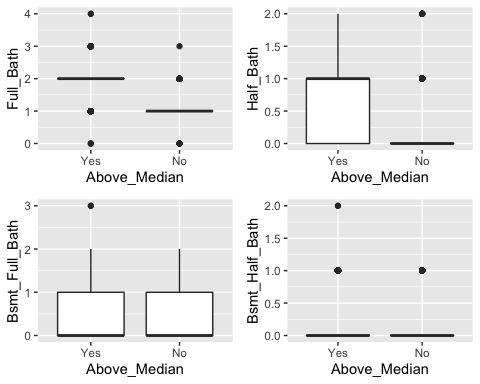
p1 = ggplot(ames, aes(x = Central\_Air, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames, aes(x = Kitchen\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames, aes(x = Functional, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames, aes(x = Pool\_QC, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



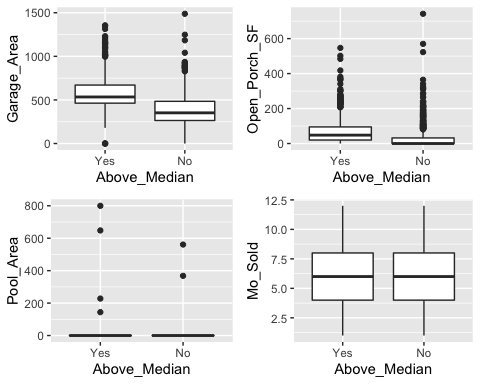
p1 = ggplot(ames, aes(x = Above\_Median, y = Year\_Built)) + geom\_boxplot()  
p2 = ggplot(ames, aes(x = Above\_Median, y = Total\_Bsmt\_SF)) + geom\_boxplot()  
p3 = ggplot(ames, aes(x = Above\_Median, y = Gr\_Liv\_Area)) + geom\_boxplot()  
p4 = ggplot(ames, aes(x = Above\_Median, y = Bedroom\_AbvGr)) + geom\_boxplot()  
grid.arrange(p1,p2,p3,p4, ncol = 2)



p1 = ggplot(ames, aes(x = Above\_Median, y = Full\_Bath)) + geom\_boxplot()  
p2 = ggplot(ames, aes(x = Above\_Median, y = Half\_Bath)) + geom\_boxplot()  
p3 = ggplot(ames, aes(x = Above\_Median, y = Bsmt\_Full\_Bath)) + geom\_boxplot()  
p4 = ggplot(ames, aes(x = Above\_Median, y = Bsmt\_Half\_Bath)) + geom\_boxplot()  
grid.arrange(p1,p2,p3,p4, ncol = 2)



p1 = ggplot(ames, aes(x = Above\_Median, y = Garage\_Area)) + geom\_boxplot()  
p2 = ggplot(ames, aes(x = Above\_Median, y = Open\_Porch\_SF)) + geom\_boxplot()  
p3 = ggplot(ames, aes(x = Above\_Median, y = Pool\_Area)) + geom\_boxplot()  
p4 = ggplot(ames, aes(x = Above\_Median, y = Mo\_Sold)) + geom\_boxplot()  
grid.arrange(p1,p2,p3,p4, ncol = 2)



p1 = ggplot(ames, aes(x = Above\_Median, y = Year\_Sold)) + geom\_boxplot()  
p2 = ggplot(ames, aes(x = Above\_Median, y = Year\_Built)) + geom\_boxplot()  
p3 = ggplot(ames, aes(x = Above\_Median, y = Second\_Flr\_SF)) + geom\_boxplot()  
p4 = ggplot(ames, aes(x = Above\_Median, y = Fireplaces)) + geom\_boxplot()  
grid.arrange(p1,p2,p3,p4, ncol = 2)

