# Project Part 1

## Katherine Schumann

ames\_student <- read\_csv("C:/Users/kathe/OneDrive/Desktop/Ban 502/Project/ames\_student.csv")

ames\_clean = ames\_student %>% mutate\_at(vars(MS\_SubClass:Above\_Median), funs(as\_factor)) %>%  
mutate(MS\_SubClass = as\_factor(MS\_SubClass)) %>%  
mutate(MS\_Zoning = as\_factor(MS\_Zoning))%>%  
mutate(Street = as\_factor(Street))%>%  
mutate(Alley = as\_factor(Alley))%>%  
mutate(Lot\_Shape = as\_factor(Lot\_Shape))%>%  
mutate(Land\_Contour = as\_factor(Land\_Contour))%>%  
 mutate(Utilities = as\_factor(Utilities))%>%  
 mutate(Land\_Slope = as\_factor(Land\_Slope))%>%  
 mutate(Neighborhood = as\_factor(Neighborhood))%>%  
 mutate(Condition\_1 = as\_factor(Condition\_1))%>%  
 mutate(Condition\_2 = as\_factor(Condition\_2))%>%  
 mutate(Bldg\_Type = as\_factor(Bldg\_Type))%>%  
 mutate(House\_Style = as\_factor(House\_Style))%>%  
 mutate(Overall\_Qual = as\_factor(Overall\_Qual))%>%  
 mutate(Overall\_Cond = as\_factor(Overall\_Cond))%>%  
 mutate(Roof\_Style = as\_factor(Roof\_Style))%>%  
 mutate(Roof\_Matl = as\_factor(Roof\_Matl))%>%  
 mutate(Exterior\_1st = as\_factor(Exterior\_1st))%>%  
 mutate(Exterior\_2nd = as\_factor(Exterior\_2nd))%>%  
 mutate(Mas\_Vnr\_Type = as\_factor(Mas\_Vnr\_Type))%>%  
 mutate(Exter\_Cond = as\_factor(Exter\_Cond))%>%  
 mutate(Foundation = as\_factor(Foundation))%>%  
 mutate(Bsmt\_Qual = as\_factor(Bsmt\_Qual))%>%  
 mutate(Bsmt\_Cond = as\_factor(Bsmt\_Cond))%>%  
 mutate(BsmtFin\_Type\_1 = as\_factor(MS\_Zoning))%>%  
 mutate(BsmtFin\_Type\_2 = as\_factor(BsmtFin\_Type\_2))%>%  
 mutate(Heating = as\_factor(Heating))%>%  
 mutate(Central\_Air = as\_factor(Central\_Air))%>%  
 mutate(ElElectrical = as\_factor(Electrical))%>%  
 mutate(Kitchen\_Qual = as\_factor(Kitchen\_Qual))%>%  
 mutate(Functional = as\_factor(Functional))%>%  
 mutate(Fireplace\_Qu = as\_factor(Fireplace\_Qu))%>%  
 mutate(Garage\_Type = as\_factor(Garage\_Type))%>%  
 mutate(Garage\_Finish = as\_factor(Garage\_Finish))%>%  
 mutate(Garage\_Qual = as\_factor(Garage\_Qual))%>%  
 mutate(Garage\_Cond = as\_factor(Garage\_Cond))%>%  
 mutate(Paved\_Drive = as\_factor(Paved\_Drive))%>%  
 mutate(Pool\_QC = as\_factor(Pool\_QC))%>%  
 mutate(Misc\_Feature = as\_factor(Misc\_Feature))%>%  
 mutate(Sale\_Type = as\_factor(Sale\_Type))%>%  
 mutate(Sale\_Condition = as\_factor(Sale\_Condition))%>%  
 mutate(Garage\_Cars = factor(Garage\_Cars, labels = c("0","1","2","3","4","5")))%>%  
mutate(Fireplaces = factor(Fireplaces, labels = c("0","1","2","3","4")))%>%  
mutate(Kitchen\_AbvGr = factor(Kitchen\_AbvGr, labels = c("1","2","3")))%>%  
 mutate(Bedroom\_AbvGr = factor(Bedroom\_AbvGr, labels = c("0","1","2","3","4","5","6")))%>%  
 mutate(Half\_Bath = factor(Half\_Bath, labels = c("0","1","2")))%>%  
 mutate(Full\_Bath = factor(Full\_Bath, labels = c("0","1","2","3","4")))%>%  
 mutate(Bsmt\_Half\_Bath = factor(Bsmt\_Half\_Bath, labels = c("0","1","2")))%>%  
 mutate(Bsmt\_Full\_Bath = factor(Bsmt\_Full\_Bath, labels = c("0","1","2","3")))%>%  
 mutate(BsmtFin\_SF\_1 = factor(BsmtFin\_SF\_1, labels = c("1","2","3","4","5","6", "7")))

skim(ames\_clean)

Data summary

|  |  |
| --- | --- |
| Name | ames\_clean |
| Number of rows | 2053 |
| Number of columns | 83 |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Column type frequency: |  |
| factor | 82 |
| numeric | 1 |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Group variables | None |

**Variable type: factor**

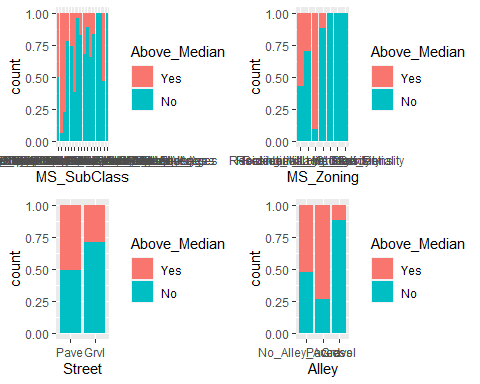
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| skim\_variable | n\_missing | complete\_rate | ordered | n\_unique | top\_counts |
| MS\_SubClass | 0 | 1 | FALSE | 16 | One: 772, Two: 383, One: 204, One: 129 |
| MS\_Zoning | 0 | 1 | FALSE | 7 | Res: 1600, Res: 326, Flo: 87, Res: 20 |
| Lot\_Frontage | 0 | 1 | FALSE | 120 | 0: 349, 60: 213, 80: 103, 70: 87 |
| Lot\_Area | 0 | 1 | FALSE | 1458 | 720: 36, 960: 35, 600: 28, 900: 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 |
| Year\_Built | 0 | 1 | FALSE | 114 | 200: 104, 200: 93, 200: 76, 200: 62 |
| Year\_Remod\_Add | 0 | 1 | FALSE | 61 | 195: 256, 200: 147, 200: 116, 200: 94 |
| 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 |
| Mas\_Vnr\_Area | 0 | 1 | FALSE | 382 | 0: 1227, 16: 11, 120: 10, 72: 9 |
| 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 | Res: 1600, Res: 326, Flo: 87, Res: 20 |
| BsmtFin\_SF\_1 | 0 | 1 | FALSE | 7 | 7: 602, 3: 578, 1: 298, 6: 216 |
| BsmtFin\_Type\_2 | 0 | 1 | FALSE | 7 | Unf: 1740, Rec: 79, LwQ: 64, No\_: 58 |
| BsmtFin\_SF\_2 | 0 | 1 | FALSE | 210 | 0: 1798, 180: 5, 294: 4, 144: 3 |
| Bsmt\_Unf\_SF | 0 | 1 | FALSE | 947 | 0: 174, 384: 13, 728: 12, 672: 10 |
| Total\_Bsmt\_SF | 0 | 1 | FALSE | 892 | 0: 57, 864: 54, 672: 25, 912: 22 |
| 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 |
| First\_Flr\_SF | 0 | 1 | FALSE | 942 | 864: 31, 104: 20, 912: 17, 672: 13 |
| Second\_Flr\_SF | 0 | 1 | FALSE | 508 | 0: 1192, 546: 18, 728: 14, 504: 11 |
| Low\_Qual\_Fin\_SF | 0 | 1 | FALSE | 28 | 0: 2024, 80: 2, 360: 2, 53: 1 |
| Gr\_Liv\_Area | 0 | 1 | FALSE | 1057 | 864: 28, 109: 18, 104: 16, 120: 16 |
| Bsmt\_Full\_Bath | 0 | 1 | FALSE | 4 | 0: 1201, 1: 823, 2: 27, 3: 2 |
| Bsmt\_Half\_Bath | 0 | 1 | FALSE | 3 | 0: 1936, 1: 115, 2: 2 |
| Full\_Bath | 0 | 1 | FALSE | 5 | 2: 1080, 1: 920, 3: 41, 0: 10 |
| Half\_Bath | 0 | 1 | FALSE | 3 | 0: 1300, 1: 736, 2: 17 |
| Bedroom\_AbvGr | 0 | 1 | FALSE | 7 | 3: 1105, 2: 527, 4: 297, 1: 73 |
| Kitchen\_AbvGr | 0 | 1 | FALSE | 3 | 1: 1959, 2: 92, 3: 2 |
| Kitchen\_Qual | 0 | 1 | FALSE | 5 | Typ: 1070, Goo: 790, Exc: 142, Fai: 50 |
| TotRms\_AbvGrd | 0 | 1 | FALSE | 11 | 6: 589, 7: 468, 5: 416, 8: 245 |
| Functional | 0 | 1 | FALSE | 8 | Typ: 1896, Min: 54, Min: 51, Mod: 27 |
| Fireplaces | 0 | 1 | FALSE | 5 | 0: 993, 1: 891, 2: 161, 3: 7 |
| 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\_Cars | 0 | 1 | FALSE | 6 | 2: 1131, 1: 539, 3: 261, 0: 108 |
| Garage\_Area | 0 | 1 | FALSE | 523 | 0: 108, 576: 71, 440: 68, 240: 50 |
| 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 |
| Wood\_Deck\_SF | 0 | 1 | FALSE | 321 | 0: 1084, 100: 55, 192: 49, 168: 45 |
| Open\_Porch\_SF | 0 | 1 | FALSE | 226 | 0: 907, 48: 37, 36: 36, 40: 30 |
| Enclosed\_Porch | 0 | 1 | FALSE | 150 | 0: 1716, 112: 14, 144: 10, 96: 9 |
| Three\_season\_porch | 0 | 1 | FALSE | 24 | 0: 2025, 153: 3, 168: 2, 180: 2 |
| Screen\_Porch | 0 | 1 | FALSE | 97 | 0: 1868, 144: 10, 120: 7, 192: 7 |
| Pool\_Area | 0 | 1 | FALSE | 7 | 0: 2047, 144: 1, 228: 1, 368: 1 |
| 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 |
| Misc\_Val | 0 | 1 | FALSE | 33 | 0: 1979, 400: 13, 500: 11, 700: 6 |
| Mo\_Sold | 0 | 1 | FALSE | 12 | 6: 352, 7: 320, 5: 275, 4: 187 |
| Year\_Sold | 0 | 1 | FALSE | 5 | 200: 499, 200: 456, 200: 445, 200: 442 |
| 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 |
| Longitude | 0 | 1 | FALSE | 1970 | -93: 4, -93: 4, -93: 3, -93: 3 |
| Latitude | 0 | 1 | FALSE | 1965 | 42.: 5, 42.: 4, 42.: 4, 42.: 3 |
| Above\_Median | 0 | 1 | FALSE | 2 | Yes: 1043, No: 1010 |
| ElElectrical | 0 | 1 | FALSE | 5 | SBr: 1887, Fus: 126, Fus: 33, Fus: 6 |

**Variable type: numeric**

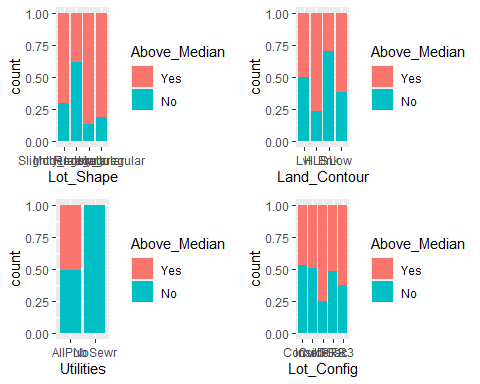
|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| skim\_variable | n\_missing | complete\_rate | mean | sd | p0 | p25 | p50 | p75 | p100 | hist |
| X1 | 0 | 1 | 1027 | 592.79 | 1 | 514 | 1027 | 1540 | 2053 | ▇▇▇▇▇ |

Visualization

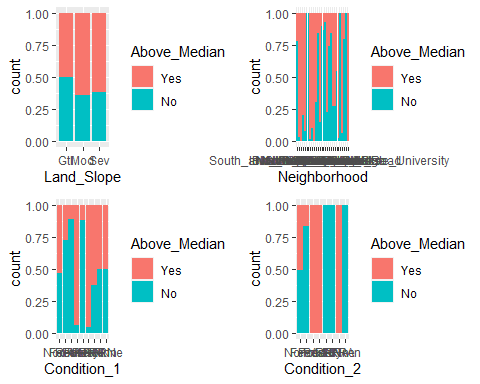
p1 = ggplot(ames\_clean, aes(x = MS\_SubClass, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = MS\_Zoning, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Street, fill = Above\_Median)) + geom\_bar(position = "fill")  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



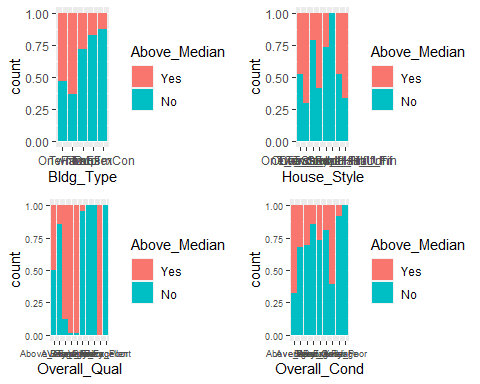
p1 = ggplot(ames\_clean, aes(x = Lot\_Shape, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Land\_Contour, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Utilities, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Lot\_Config, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



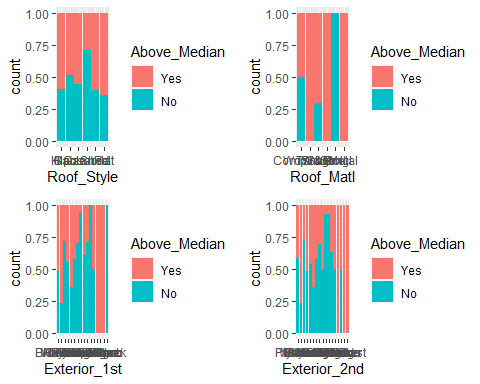
p1 = ggplot(ames\_clean, aes(x = Land\_Slope, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Neighborhood, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Condition\_1, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Condition\_2, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



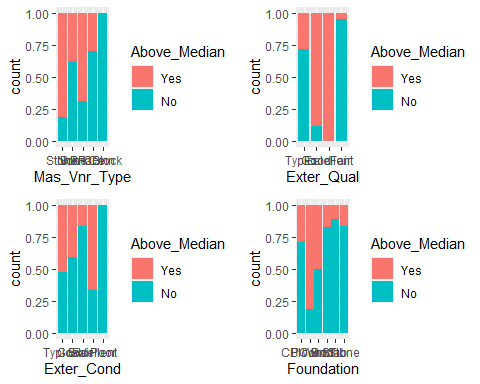
p1 = ggplot(ames\_clean, aes(x = Bldg\_Type, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = House\_Style, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Overall\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")+theme(axis.text=element\_text(size=7))  
p4 = ggplot(ames\_clean, aes(x = Overall\_Cond, fill = Above\_Median)) + geom\_bar(position = "fill")+theme(axis.text=element\_text(size=7))  
grid.arrange(p1,p2,p3,p4)



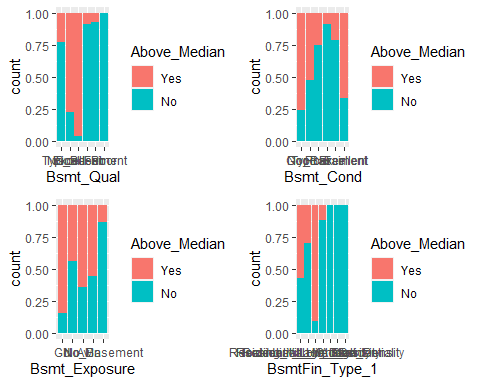
p1 = ggplot(ames\_clean, aes(x = Roof\_Style, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Roof\_Matl, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Exterior\_1st, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Exterior\_2nd, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



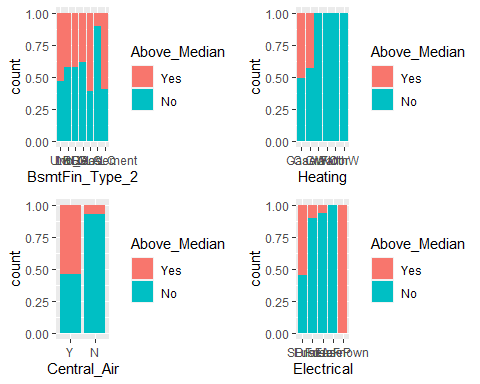
p1 = ggplot(ames\_clean, aes(x = Mas\_Vnr\_Type, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Exter\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Exter\_Cond, fill = Above\_Median)) + geom\_bar(position = "fill")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



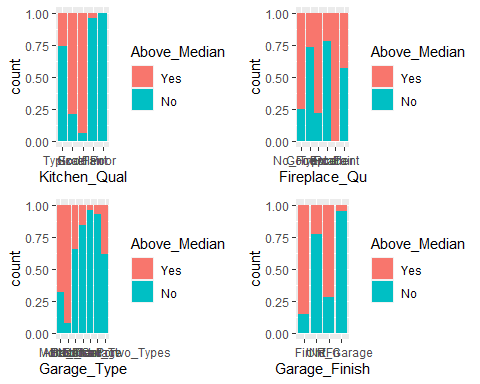
p1 = ggplot(ames\_clean, aes(x = Bsmt\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Bsmt\_Cond, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Bsmt\_Exposure, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = BsmtFin\_Type\_1, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



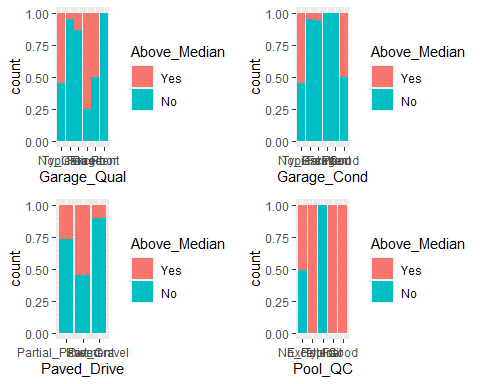
p1 = ggplot(ames\_clean, aes(x = BsmtFin\_Type\_2, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Heating, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Central\_Air, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Electrical, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



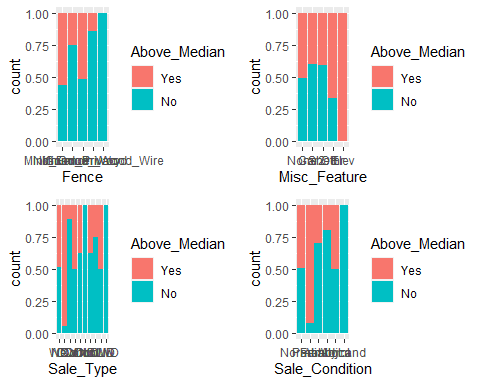
p1 = ggplot(ames\_clean, aes(x = Kitchen\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Fireplace\_Qu, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Garage\_Type, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Garage\_Finish, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



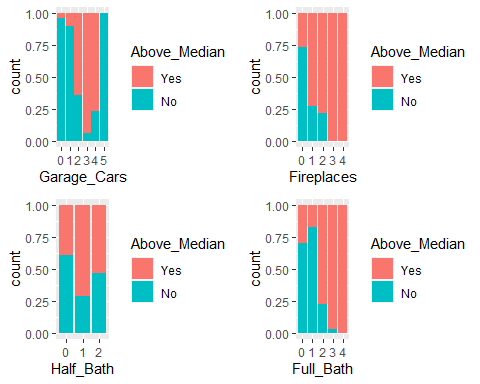
p1 = ggplot(ames\_clean, aes(x = Garage\_Qual, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Garage\_Cond, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Paved\_Drive, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Pool\_QC, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



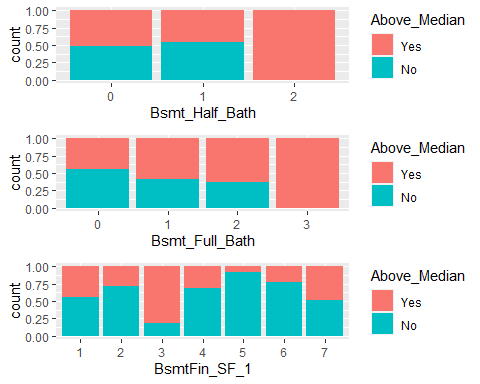
p1 = ggplot(ames\_clean, aes(x = Fence, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Misc\_Feature, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Sale\_Type, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Sale\_Condition, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



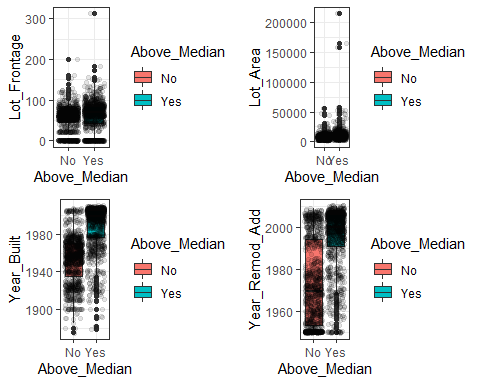
p1 = ggplot(ames\_clean, aes(x = Garage\_Cars, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Fireplaces, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = Half\_Bath, fill = Above\_Median)) + geom\_bar(position = "fill")  
p4 = ggplot(ames\_clean, aes(x = Full\_Bath, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3,p4)



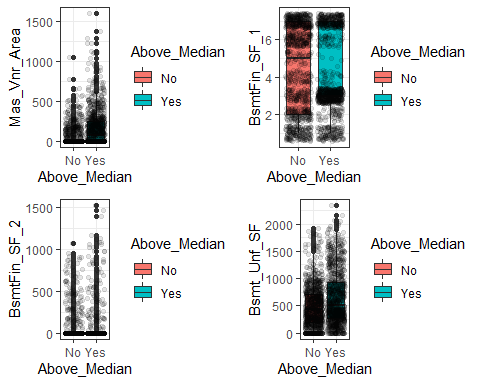
p1 = ggplot(ames\_clean, aes(x = Bsmt\_Half\_Bath, fill = Above\_Median)) + geom\_bar(position = "fill")  
p2 = ggplot(ames\_clean, aes(x = Bsmt\_Full\_Bath, fill = Above\_Median)) + geom\_bar(position = "fill")  
p3 = ggplot(ames\_clean, aes(x = BsmtFin\_SF\_1, fill = Above\_Median)) + geom\_bar(position = "fill")  
grid.arrange(p1,p2,p3)



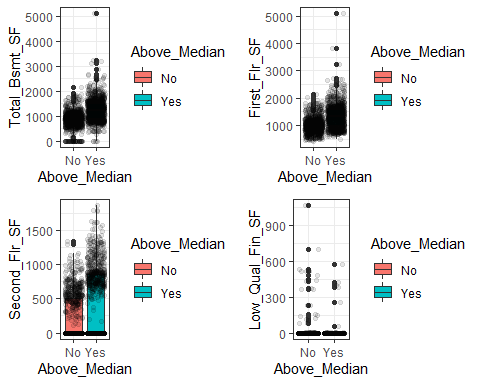
p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Lot\_Frontage)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = Lot\_Area)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Year\_Built)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Year\_Remod\_Add)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



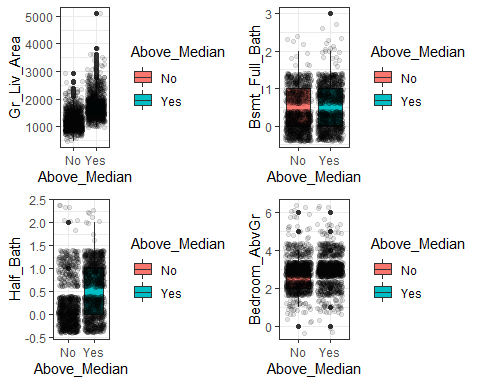
p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Mas\_Vnr\_Area)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw() +geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = BsmtFin\_SF\_1)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = BsmtFin\_SF\_2)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Bsmt\_Unf\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



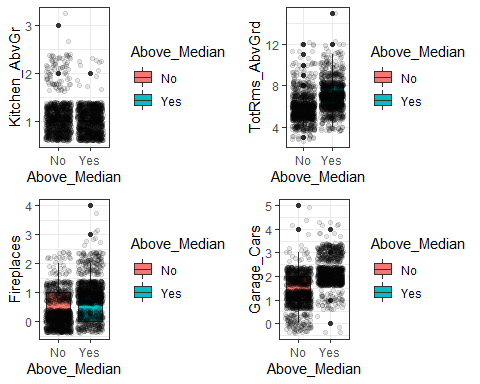
p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Total\_Bsmt\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = First\_Flr\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Second\_Flr\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Low\_Qual\_Fin\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



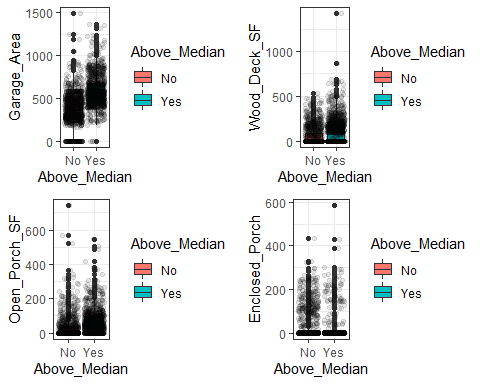
p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Gr\_Liv\_Area)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = Bsmt\_Full\_Bath)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Half\_Bath)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Bedroom\_AbvGr)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



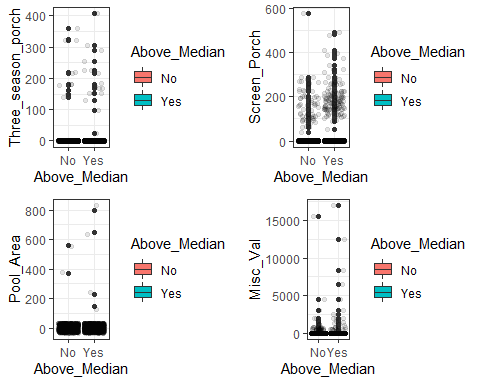
p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Kitchen\_AbvGr)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = TotRms\_AbvGrd)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Fireplaces)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Garage\_Cars)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Garage\_Area)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = Wood\_Deck\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Open\_Porch\_SF)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Enclosed\_Porch)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Three\_season\_porch)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = Screen\_Porch)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Pool\_Area)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Misc\_Val)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)



p1 = ggplot(ames\_student, aes(x = Above\_Median, y = Mo\_Sold)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p2 = ggplot(ames\_student, aes(x = Above\_Median, y = Year\_Sold)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p3 = ggplot(ames\_student, aes(x = Above\_Median, y = Longitude)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
p4 = ggplot(ames\_student, aes(x = Above\_Median, y = Latitude)) + geom\_boxplot(aes(fill = Above\_Median)) + theme\_bw()+geom\_jitter(alpha = 0.1)  
grid.arrange(p1,p2,p3,p4)

