Final Project

2023-11-10

```
data <- read_csv("diabetes.csv")
```

```
## Rows: 768 Columns: 9
## ── Column specification ──────────────────────────────────────────────────
## Delimiter: ","
## dbl (9): Pregnancies, Glucose, BloodPressure, SkinThickness, Insulin, BMI, D...
##
## 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.
```

```
colnames(data)
```

```
## [1] "Pregnancies"              "Glucose"
## [3] "BloodPressure"            "SkinThickness"
## [5] "Insulin"                  "BMI"
## [7] "DiabetesPedigreeFunction" "Age"
## [9] "Outcome"
```

```
data
```

```
## # A tibble: 768 × 9
##    Pregnancies Glucose BloodPressure SkinThickness Insulin   BMI
##          <dbl>   <dbl>         <dbl>         <dbl>   <dbl> <dbl>
## 1            6     148            72            35       0  33.6
## 2            1      85            66            29       0  26.6
## 3            8     183            64             0       0  23.3
## 4            1      89            66            23      94  28.1
## 5            0     137            40            35     168  43.1
## 6            5     116            74             0       0  25.6
## 7            3      78            50            32      88  31
## 8           10     115             0             0       0  35.3
## 9            2     197            70            45     543  30.5
## 10           8     125            96             0       0   0
## # ℹ 758 more rows
## # ℹ 3 more variables: DiabetesPedigreeFunction <dbl>, Age <dbl>, Outcome <dbl>
```

```
test <- na.omit(data)
test
```

```
## # A tibble: 768 × 9
##    Pregnancies Glucose BloodPressure SkinThickness Insulin   BMI
##          <dbl>   <dbl>         <dbl>         <dbl>   <dbl> <dbl>
##  1           6     148            72            35       0  33.6
##  2           1      85            66            29       0  26.6
##  3           8     183            64             0       0  23.3
##  4           1      89            66            23      94  28.1
##  5           0     137            40            35     168  43.1
##  6           5     116            74             0       0  25.6
##  7           3      78            50            32      88  31
##  8          10     115             0             0       0  35.3
##  9           2     197            70            45     543  30.5
## 10           8     125            96             0       0   0
## # ℹ 758 more rows
## # ℹ 3 more variables: DiabetesPedigreeFunction <dbl>, Age <dbl>, Outcome <dbl>
```
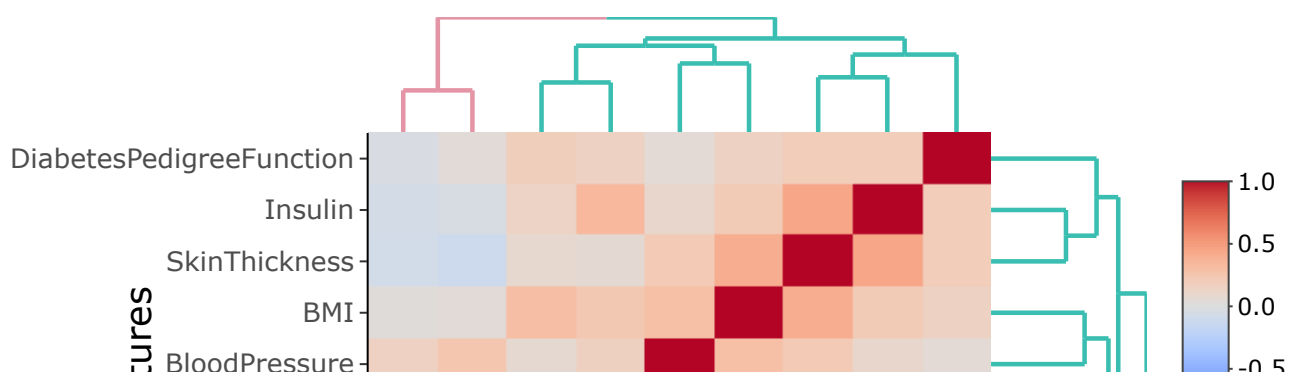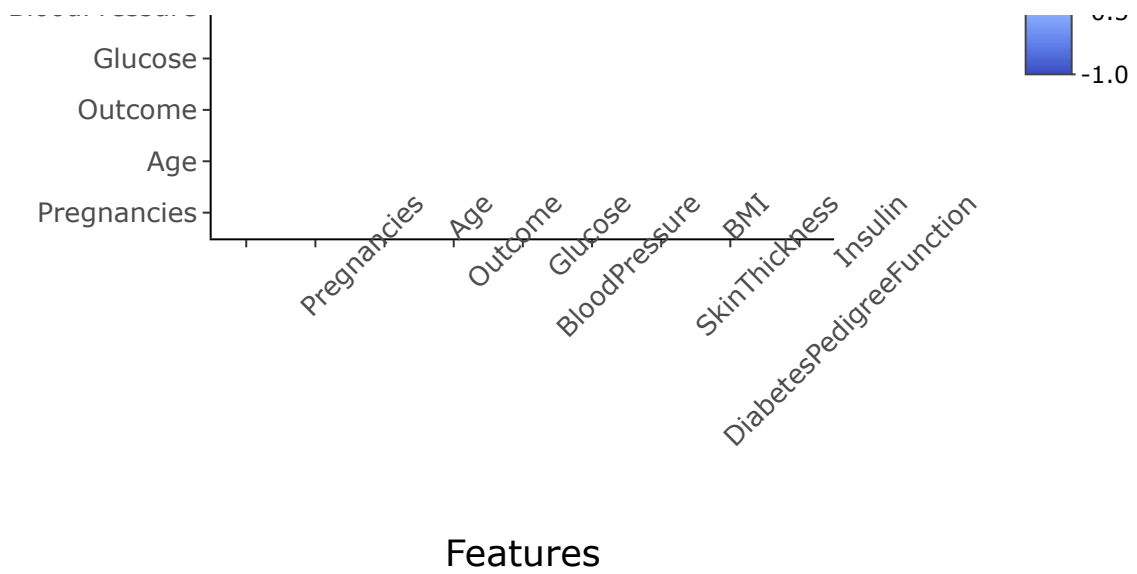
```
colnames(test)
```

```
## [1] "Pregnancies"              "Glucose"
## [3] "BloodPressure"            "SkinThickness"
## [5] "Insulin"                  "BMI"
## [7] "DiabetesPedigreeFunction" "Age"
## [9] "Outcome"
```

```
heatmaply_cor(x = cor(test), xlab = "Features",
              ylab = "Features", k_col = 2, k_row = 2)
```

```
## Warning in doTryCatch(return(expr), name, parentenv, handler): unable to load shar
ed object '/Library/Frameworks/R.framework/Resources/modules//R_X11.so':
##   dlopen(/Library/Frameworks/R.framework/Resources/modules//R_X11.so, 0x0006): Lib
rary not loaded: /opt/X11/lib/libSM.6.dylib
##   Referenced from: <B3716E5A-BF4D-3CA3-B8EB-89643DB72A04> /Library/Frameworks/R.fr
amework/Versions/4.3-arm64/Resources/modules/R_X11.so
##   Reason: tried: '/opt/X11/lib/libSM.6.dylib' (no such file), '/System/Volumes/Pre
boot/Cryptexes/OS/opt/X11/lib/libSM.6.dylib' (no such file), '/opt/X11/lib/libSM.6.dy
lib' (no such file), '/Library/Frameworks/R.framework/Resources/lib/libSM.6.dylib' (n
o such file), '/Library/Java/JavaVirtualMachines/jdk-11.0.18+10/Contents/Home/lib/ser
ver/libSM.6.dylib' (no such file)
```

Features

```
cor_matrix <- cor(test)

print(cor_matrix)
```

```
##                          Pregnancies      Glucose BloodPressure SkinThickness
## Pregnancies               1.00000000 0.12945867    0.14128198    -0.08167177
## Glucose                   0.12945867 1.00000000    0.15258959     0.05732789
## BloodPressure             0.14128198 0.15258959    1.00000000     0.20737054
## SkinThickness            -0.08167177 0.05732789    0.20737054     1.00000000
## Insulin                  -0.07353461 0.33135711    0.08893338     0.43678257
## BMI                       0.01768309 0.22107107    0.28180529     0.39257320
## DiabetesPedigreeFunction -0.03352267 0.13733730    0.04126495     0.18392757
## Age                       0.54434123 0.26351432    0.23952795    -0.11397026
## Outcome                   0.22189815 0.46658140    0.06506836     0.07475223
##                              Insulin        BMI DiabetesPedigreeFunction
## Pregnancies              -0.07353461 0.01768309              -0.03352267
## Glucose                   0.33135711 0.22107107               0.13733730
## BloodPressure             0.08893338 0.28180529               0.04126495
## SkinThickness             0.43678257 0.39257320               0.18392757
## Insulin                   1.00000000 0.19785906               0.18507093
## BMI                       0.19785906 1.00000000               0.14064695
## DiabetesPedigreeFunction  0.18507093 0.14064695               1.00000000
## Age                      -0.04216295 0.03624187               0.03356131
## Outcome                   0.13054795 0.29269466               0.17384407
##                                  Age    Outcome
## Pregnancies               0.54434123 0.22189815
## Glucose                   0.26351432 0.46658140
## BloodPressure             0.23952795 0.06506836
## SkinThickness            -0.11397026 0.07475223
## Insulin                  -0.04216295 0.13054795
## BMI                       0.03624187 0.29269466
## DiabetesPedigreeFunction  0.03356131 0.17384407
## Age                       1.00000000 0.23835598
## Outcome                   0.23835598 1.00000000
```

```
summary(test)
```

```
##    Pregnancies        Glucose       BloodPressure    SkinThickness
##  Min.    : 0.000   Min.    :  0.0   Min.    :  0.00   Min.    : 0.00
##  1st Qu.: 1.000   1st Qu.: 99.0   1st Qu.: 62.00   1st Qu.: 0.00
##  Median : 3.000   Median :117.0   Median : 72.00   Median :23.00
##  Mean    : 3.845   Mean    :120.9   Mean    : 69.11   Mean    :20.54
##  3rd Qu.: 6.000   3rd Qu.:140.2   3rd Qu.: 80.00   3rd Qu.:32.00
##  Max.    :17.000   Max.    :199.0   Max.    :122.00   Max.    :99.00
##     Insulin          BMI        DiabetesPedigreeFunction     Age
##  Min.    :  0.0   Min.    : 0.00   Min.    :0.0780          Min.    :21.00
##  1st Qu.:  0.0   1st Qu.:27.30   1st Qu.:0.2437          1st Qu.:24.00
##  Median : 30.5   Median :32.00   Median :0.3725          Median :29.00
##  Mean    : 79.8   Mean    :31.99   Mean    :0.4719          Mean    :33.24
##  3rd Qu.:127.2   3rd Qu.:36.60   3rd Qu.:0.6262          3rd Qu.:41.00
##  Max.    :846.0   Max.    :67.10   Max.    :2.4200          Max.    :81.00
##     Outcome
##  Min.    :0.000
##  1st Qu.:0.000
##  Median :0.000
##  Mean    :0.349
##  3rd Qu.:1.000
##  Max.    :1.000
```
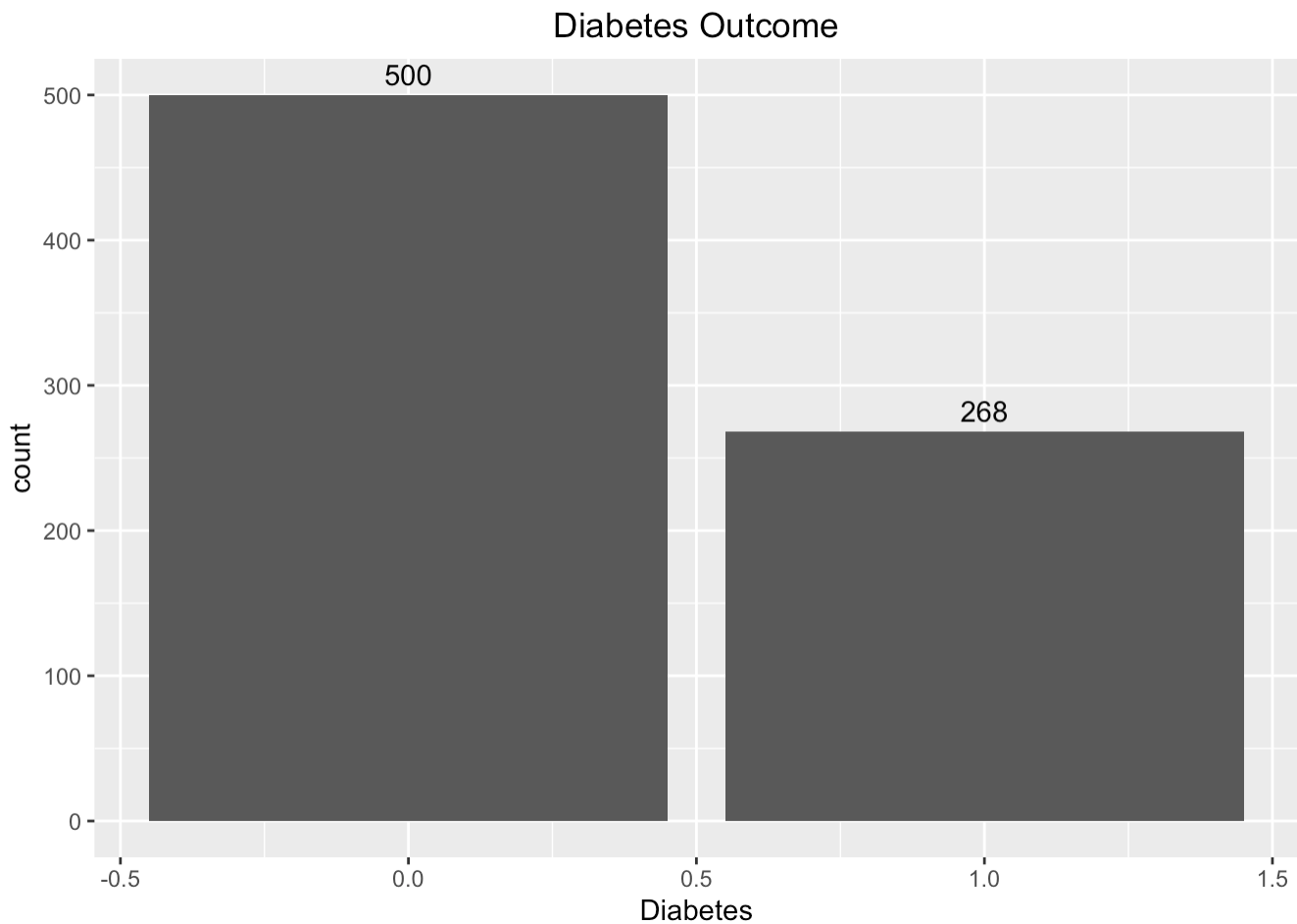
```
ggplot(test, aes(test$Outcome, fill = test$Outcome, color = Outcome)) +
  geom_bar() +
  labs(title = "Diabetes Outcome", x = "Diabetes") +
  geom_text(stat = "count", aes(label = ..count..), vjust = -0.5) +
  theme(plot.title = element_text(hjust = 0.5))
```

```
## Warning: Use of `test$Outcome` is discouraged.
## ℹ Use `Outcome` instead.
## Use of `test$Outcome` is discouraged.
## ℹ Use `Outcome` instead.
```

```
## Warning: The dot-dot notation (`..count..`) was deprecated in ggplot2 3.4.0.
## ℹ Please use `after_stat(count)` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
## Warning: Use of `test$Outcome` is discouraged.
## ℹ Use `Outcome` instead.
## Use of `test$Outcome` is discouraged.
## ℹ Use `Outcome` instead.
```
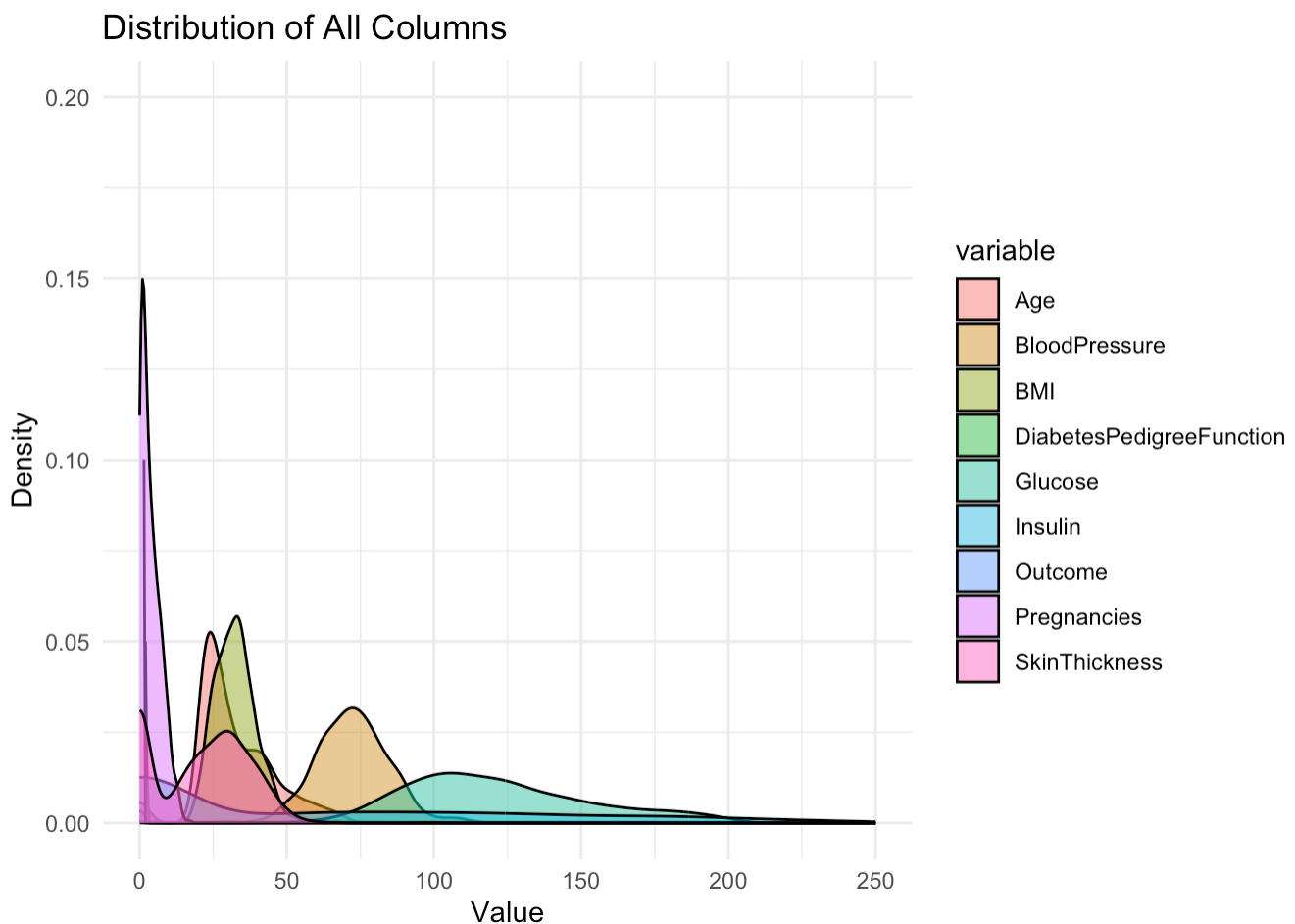
```
## Warning: The following aesthetics were dropped during statistical transformation:
fill,
## colour
## ℹ This can happen when ggplot fails to infer the correct grouping structure in
##   the data.
## ℹ Did you forget to specify a `group` aesthetic or to convert a numerical
##   variable into a factor?
## The following aesthetics were dropped during statistical transformation: fill,
## colour
## ℹ This can happen when ggplot fails to infer the correct grouping structure in
##   the data.
## ℹ Did you forget to specify a `group` aesthetic or to convert a numerical
##   variable into a factor?
```

Final Project

file:///Users/mac/Desktop/School/Columbia/Fall%202023/statistics/sta...

```
df <- test %>%
  gather(key = "variable", value = "value")

# Plot the distribution of all columns in one graph
ggplot(df, aes(x = value, fill = variable)) +
  geom_density(alpha = 0.5) +
  labs(title = "Distribution of All Columns",
       x = "Value",
       y = "Density") +
  theme_minimal() +
  ylim(c(0, 0.2)) +
  xlim(c(0, 250))
```

```
## Warning: Removed 56 rows containing non-finite values (`stat_density()`).
```



```
# Calculate skewness for each column
skewness_values <- sapply(test, skewness)

# Print the skewness values
print(skewness_values)
```

```
##           Pregnancies              Glucose        BloodPressure
##             0.8981549            0.1730754           -1.8364126
##           SkinThickness              Insulin                  BMI
##             0.1089456            2.2633826           -0.4273073
## DiabetesPedigreeFunction                  Age              Outcome
##             1.9124179            1.1251880            0.6325383
```

```
# Separate glucose levels for diabetic and non-diabetic individuals
blood_pressure_age_lt_30 <- test$BloodPressure[test$Age <= 30]
blood_pressure_age_gt_30 <- test$BloodPressure[test$Age > 30]
```

```
t_test_result <- t.test(blood_pressure_age_lt_30, blood_pressure_age_gt_30)
print(t_test_result)
```

```
##
##  Welch Two Sample t-test
##
## data:  blood_pressure_age_lt_30 and blood_pressure_age_gt_30
## t = -6.0637, df = 755.07, p-value = 2.101e-09
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -10.953401  -5.595698
## sample estimates:
## mean of x mean of y
##  65.32374  73.59829
```

```
cor_test_result <- cor.test(test$Age, test$BloodPressure)
print(cor_test_result)
```

```
##
##  Pearson's product-moment correlation
##
## data:  test$Age and test$BloodPressure
## t = 6.8281, df = 766, p-value = 1.752e-11
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.1716931 0.3051022
## sample estimates:
##       cor
## 0.2395279
```
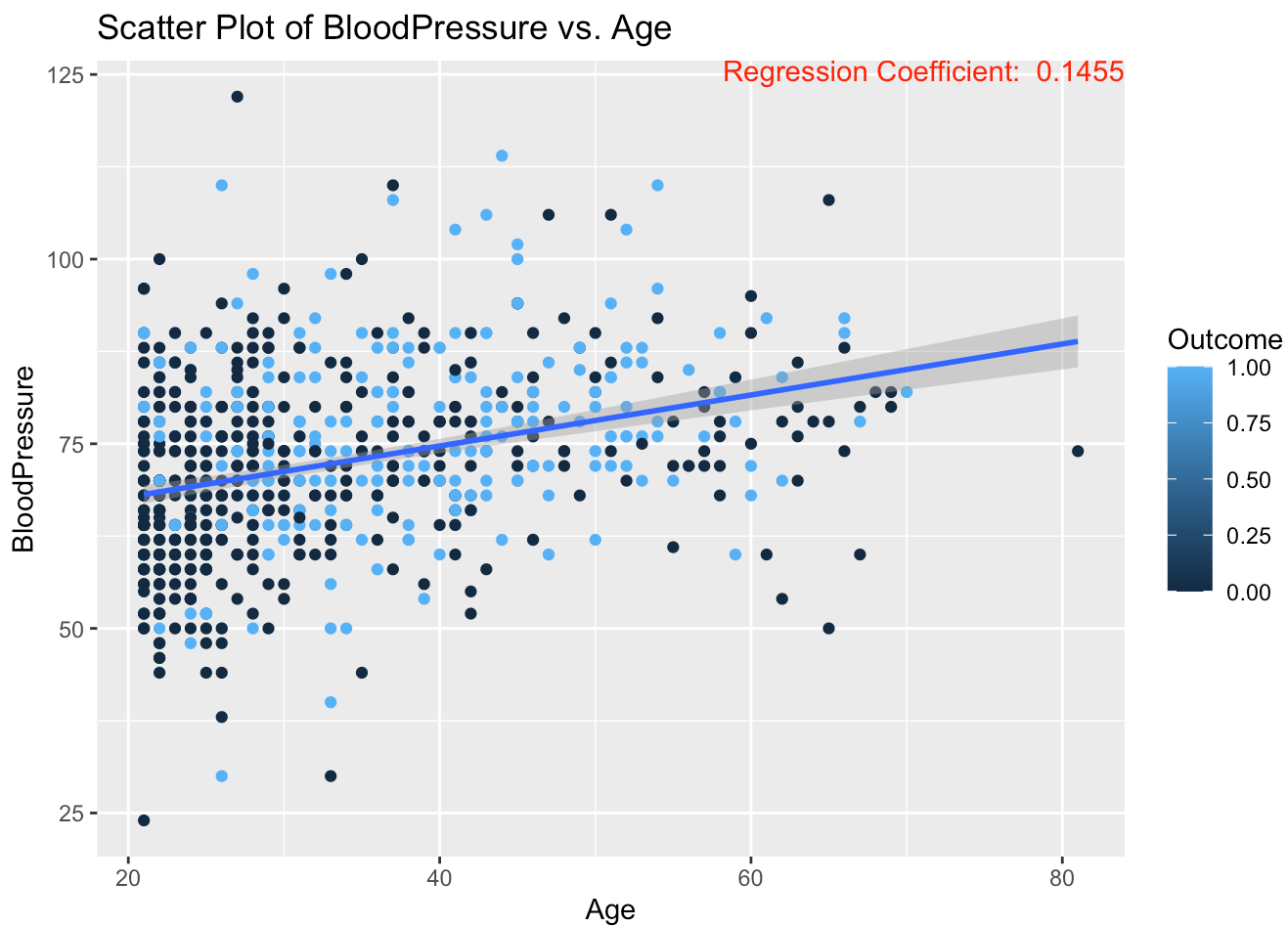
```
test1 <- subset(test, BloodPressure != 0)



# Scatter plot with color based on another variable
ggplot(test1, aes(x = Age, y = BloodPressure, color = Outcome)) +
  geom_point() +
  labs(title = "Scatter Plot of BloodPressure vs. Age",
       x = "Age",
       y = "BloodPressure",
       color = "Outcome") +
       geom_smooth(method = "lm", se = TRUE, aes(group = 1)) +
       annotate("text", x = Inf, y = Inf, hjust = 1, vjust = 1,
           label = paste("Regression Coefficient: ",
                         round(coef(lm(Age ~ BloodPressure, data = data))[2], 4)),
           color = "red")
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

```
## Warning: The following aesthetics were dropped during statistical transformation:
colour
## ℹ This can happen when ggplot fails to infer the correct grouping structure in
##   the data.
## ℹ Did you forget to specify a `group` aesthetic or to convert a numerical
##   variable into a factor?
```

Scatter Plot of BloodPressure vs. Age

Regression Coefficient: 0.1455

```
theme_minimal()
```

```
## List of 97
##  $ line                      :List of 6
##   ..$ colour      : chr "black"
##   ..$ linewidth   : num 0.5
##   ..$ linetype    : num 1
##   ..$ lineend     : chr "butt"
##   ..$ arrow       : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
##  $ rect                      :List of 5
##   ..$ fill        : chr "white"
##   ..$ colour      : chr "black"
##   ..$ linewidth   : num 0.5
##   ..$ linetype    : num 1
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_rect" "element"
##  $ text                      :List of 11
##   ..$ family      : chr ""
##   ..$ face        : chr "plain"
##   ..$ colour      : chr "black"
##   ..$ size        : num 11
##   ..$ hjust       : num 0.5
##   ..$ vjust       : num 0.5
##   ..$ angle       : num 0
##   ..$ lineheight  : num 0.9
##   ..$ margin      : 'margin' num [1:4] 0points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug       : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ title                     : NULL
##  $ aspect.ratio              : NULL
##  $ axis.title                : NULL
##  $ axis.title.x              :List of 11
##   ..$ family      : NULL
##   ..$ face        : NULL
##   ..$ colour      : NULL
##   ..$ size        : NULL
##   ..$ hjust       : NULL
##   ..$ vjust       : num 1
##   ..$ angle       : NULL
##   ..$ lineheight  : NULL
##   ..$ margin      : 'margin' num [1:4] 2.75points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug       : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.title.x.top          :List of 11
##   ..$ family      : NULL
##   ..$ face        : NULL
##   ..$ colour      : NULL
```

```
##    ..$ size        : NULL
##    ..$ hjust       : NULL
##    ..$ vjust       : num 0
##    ..$ angle       : NULL
##    ..$ lineheight  : NULL
##    ..$ margin      : 'margin' num [1:4] 0points 0points 2.75points 0points
##    .. ..- attr(*, "unit")= int 8
##    ..$ debug       : NULL
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.title.x.bottom      : NULL
##  $ axis.title.y             :List of 11
##    ..$ family      : NULL
##    ..$ face        : NULL
##    ..$ colour      : NULL
##    ..$ size        : NULL
##    ..$ hjust       : NULL
##    ..$ vjust       : num 1
##    ..$ angle       : num 90
##    ..$ lineheight  : NULL
##    ..$ margin      : 'margin' num [1:4] 0points 2.75points 0points 0points
##    .. ..- attr(*, "unit")= int 8
##    ..$ debug       : NULL
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.title.y.left        : NULL
##  $ axis.title.y.right       :List of 11
##    ..$ family      : NULL
##    ..$ face        : NULL
##    ..$ colour      : NULL
##    ..$ size        : NULL
##    ..$ hjust       : NULL
##    ..$ vjust       : num 0
##    ..$ angle       : num -90
##    ..$ lineheight  : NULL
##    ..$ margin      : 'margin' num [1:4] 0points 0points 0points 2.75points
##    .. ..- attr(*, "unit")= int 8
##    ..$ debug       : NULL
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ axis.text                :List of 11
##    ..$ family      : NULL
##    ..$ face        : NULL
##    ..$ colour      : chr "grey30"
##    ..$ size        : 'rel' num 0.8
##    ..$ hjust       : NULL
##    ..$ vjust       : NULL
##    ..$ angle       : NULL
##    ..$ lineheight  : NULL
##    ..$ margin      : NULL
##    ..$ debug       : NULL
```

```
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x              :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : num 1
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 2.2points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x.top          :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : NULL
##   ..$ vjust        : num 0
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 0points 0points 2.2points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x.bottom       : NULL
## $ axis.text.y              :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : num 1
##   ..$ vjust        : NULL
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : 'margin' num [1:4] 0points 2.2points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.y.left         : NULL
## $ axis.text.y.right        :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
```

```
##    ..$ hjust      : num 0
##    ..$ vjust      : NULL
##    ..$ angle      : NULL
##    ..$ lineheight : NULL
##    ..$ margin     : 'margin' num [1:4] 0points 0points 0points 2.2points
##    .. ..- attr(*, "unit")= int 8
##    ..$ debug      : NULL
##    ..$ inherit.blank: logi TRUE
##    ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.ticks                 : list()
##    ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ axis.ticks.x               : NULL
## $ axis.ticks.x.top           : NULL
## $ axis.ticks.x.bottom        : NULL
## $ axis.ticks.y               : NULL
## $ axis.ticks.y.left          : NULL
## $ axis.ticks.y.right         : NULL
## $ axis.ticks.length          : 'simpleUnit' num 2.75points
##    ..- attr(*, "unit")= int 8
## $ axis.ticks.length.x        : NULL
## $ axis.ticks.length.x.top    : NULL
## $ axis.ticks.length.x.bottom: NULL
## $ axis.ticks.length.y        : NULL
## $ axis.ticks.length.y.left   : NULL
## $ axis.ticks.length.y.right  : NULL
## $ axis.line                  : list()
##    ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ axis.line.x                : NULL
## $ axis.line.x.top            : NULL
## $ axis.line.x.bottom         : NULL
## $ axis.line.y                : NULL
## $ axis.line.y.left           : NULL
## $ axis.line.y.right          : NULL
## $ legend.background          : list()
##    ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.margin              : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points
##    ..- attr(*, "unit")= int 8
## $ legend.spacing             : 'simpleUnit' num 11points
##    ..- attr(*, "unit")= int 8
## $ legend.spacing.x           : NULL
## $ legend.spacing.y           : NULL
## $ legend.key                 : list()
##    ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.key.size            : 'simpleUnit' num 1.2lines
##    ..- attr(*, "unit")= int 3
## $ legend.key.height          : NULL
## $ legend.key.width           : NULL
## $ legend.text                :List of 11
##    ..$ family   : NULL
##    ..$ face     : NULL
```

```
##   ..$ colour       : NULL
##   ..$ size         : 'rel' num 0.8
##   ..$ hjust        : NULL
##   ..$ vjust        : NULL
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : NULL
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ legend.text.align        : NULL
##  $ legend.title             :List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : num 0
##   ..$ vjust        : NULL
##   ..$ angle        : NULL
##   ..$ lineheight   : NULL
##   ..$ margin       : NULL
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  $ legend.title.align       : NULL
##  $ legend.position          : chr "right"
##  $ legend.direction         : NULL
##  $ legend.justification     : chr "center"
##  $ legend.box               : NULL
##  $ legend.box.just          : NULL
##  $ legend.box.margin        : 'margin' num [1:4] 0cm 0cm 0cm 0cm
##   ..- attr(*, "unit")= int 1
##  $ legend.box.background     : list()
##   ..- attr(*, "class")= chr [1:2] "element_blank" "element"
##  $ legend.box.spacing        : 'simpleUnit' num 11points
##   ..- attr(*, "unit")= int 8
##  $ panel.background          : list()
##   ..- attr(*, "class")= chr [1:2] "element_blank" "element"
##  $ panel.border             : list()
##   ..- attr(*, "class")= chr [1:2] "element_blank" "element"
##  $ panel.spacing            : 'simpleUnit' num 5.5points
##   ..- attr(*, "unit")= int 8
##  $ panel.spacing.x          : NULL
##  $ panel.spacing.y          : NULL
##  $ panel.grid               :List of 6
##   ..$ colour    : chr "grey92"
##   ..$ linewidth : NULL
##   ..$ linetype  : NULL
##   ..$ lineend   : NULL
##   ..$ arrow     : logi FALSE
##   ..$ inherit.blank: logi TRUE
```

```
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ panel.grid.major         : NULL
## $ panel.grid.minor         :List of 6
##   ..$ colour     : NULL
##   ..$ linewidth  : 'rel' num 0.5
##   ..$ linetype   : NULL
##   ..$ lineend    : NULL
##   ..$ arrow      : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ panel.grid.major.x       : NULL
## $ panel.grid.major.y       : NULL
## $ panel.grid.minor.x       : NULL
## $ panel.grid.minor.y       : NULL
## $ panel.ontop              : logi FALSE
## $ plot.background          : list()
##   ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ plot.title               :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : 'rel' num 1.2
##   ..$ hjust      : num 0
##   ..$ vjust      : num 1
##   ..$ angle      : NULL
##   ..$ lineheight : NULL
##   ..$ margin     : 'margin' num [1:4] 0points 0points 5.5points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.title.position      : chr "panel"
## $ plot.subtitle            :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : NULL
##   ..$ hjust      : num 0
##   ..$ vjust      : num 1
##   ..$ angle      : NULL
##   ..$ lineheight : NULL
##   ..$ margin     : 'margin' num [1:4] 0points 0points 5.5points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.caption             :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : 'rel' num 0.8
```

```
##   ..$ hjust       : num 1
##   ..$ vjust       : num 1
##   ..$ angle       : NULL
##   ..$ lineheight   : NULL
##   ..$ margin      : 'margin' num [1:4] 5.5points 0points 0points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug       : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.caption.position    : chr "panel"
## $ plot.tag                 :List of 11
##   ..$ family      : NULL
##   ..$ face        : NULL
##   ..$ colour      : NULL
##   ..$ size        : 'rel' num 1.2
##   ..$ hjust       : num 0.5
##   ..$ vjust       : num 0.5
##   ..$ angle       : NULL
##   ..$ lineheight   : NULL
##   ..$ margin      : NULL
##   ..$ debug       : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.tag.position       : chr "topleft"
## $ plot.margin             : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.
5points
##   ..- attr(*, "unit")= int 8
## $ strip.background        : list()
##   ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ strip.background.x      : NULL
## $ strip.background.y      : NULL
## $ strip.clip              : chr "inherit"
## $ strip.placement         : chr "inside"
## $ strip.text              :List of 11
##   ..$ family      : NULL
##   ..$ face        : NULL
##   ..$ colour      : chr "grey10"
##   ..$ size        : 'rel' num 0.8
##   ..$ hjust       : NULL
##   ..$ vjust       : NULL
##   ..$ angle       : NULL
##   ..$ lineheight   : NULL
##   ..$ margin      : 'margin' num [1:4] 4.4points 4.4points 4.4points 4.4points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug       : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ strip.text.x            : NULL
## $ strip.text.x.bottom     : NULL
## $ strip.text.x.top        : NULL
## $ strip.text.y            :List of 11
```

```
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : NULL
##   ..$ hjust      : NULL
##   ..$ vjust      : NULL
##   ..$ angle      : num -90
##   ..$ lineheight : NULL
##   ..$ margin     : NULL
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ strip.text.y.left       :List of 11
##   ..$ family     : NULL
##   ..$ face       : NULL
##   ..$ colour     : NULL
##   ..$ size       : NULL
##   ..$ hjust      : NULL
##   ..$ vjust      : NULL
##   ..$ angle      : num 90
##   ..$ lineheight : NULL
##   ..$ margin     : NULL
##   ..$ debug      : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ strip.text.y.right      : NULL
## $ strip.switch.pad.grid   : 'simpleUnit' num 2.75points
##   ..- attr(*, "unit")= int 8
## $ strip.switch.pad.wrap   : 'simpleUnit' num 2.75points
##   ..- attr(*, "unit")= int 8
## - attr(*, "class")= chr [1:2] "theme" "gg"
## - attr(*, "complete")= logi TRUE
## - attr(*, "validate")= logi TRUE
```