Exploratory Data Analysis

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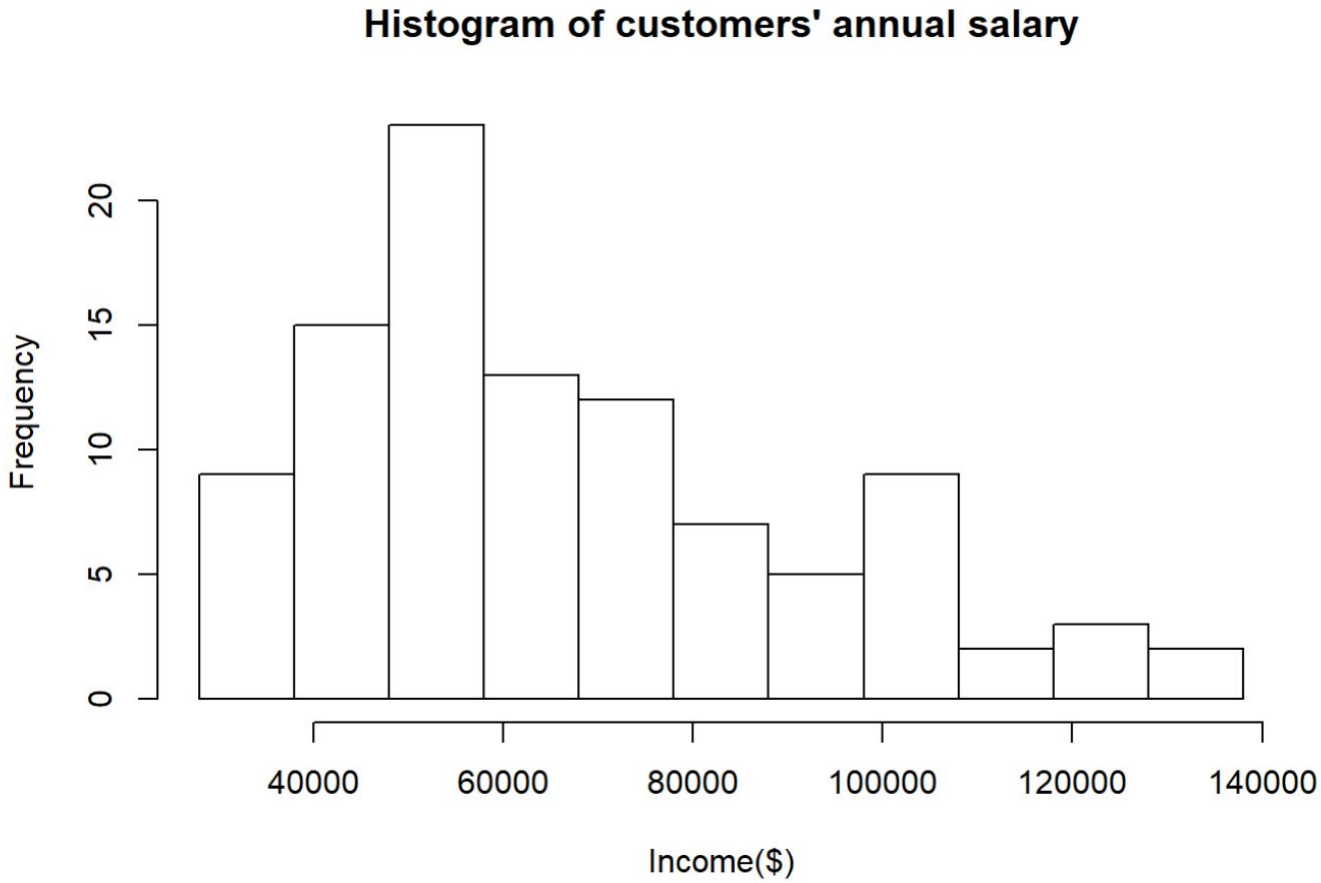

Histogram of customers' annual salary
Frequency
0
5
10
15
20
40000
60000
80000
100000
120000
140000
Income($)

```r
# firstly check the salary payment frequency of each customer
df_inc = data.frame(customer_id= unique(df_csmp$customer_id)) #create a data frame to store resu
lt

# create a mode function that will be used to find out what is the salary payment frequency
Mode <- function(x) {
  ux <- unique(x)
  ux[which.max(tabulate(match(x, ux)))]
}

# loop through all salary payment for each customer
# assume the salary level is constant for each customer over the observed period
for (i in seq(nrow(df_inc))){
  trans_data <- df[df$customer_id == df_inc$customer_id[i]
                   & df$txn_description=='PAY/SALARY',c("amount","date")] %>%
                group_by(date) %>%
               summarise(amount = sum(amount))

  total_s <- sum(trans_data$amount)
  count = dim(trans_data)[1]
  if ( count == 0){
    df_inc$freq[i] = NA
    df_inc$level[i] = NA
  } else {
    s=c()
    lvl = c()
    for (j in seq(count-1)){
      s = c(s,(trans_data$date[j+1]-trans_data$date[j]))
      lvl = c(lvl,trans_data$amount[j])
    }
    lvl = c(lvl,tail(trans_data$amount,n=1))
    df_inc$freq[i] = Mode(s)
    df_inc$level[i] = Mode(lvl)
  }
}
```

Continued

```
df_inc$annual_salary= df_inc$level / df_inc$freq *365.25

# visualise the distribution of customers' annual salary
hist(df_inc$annual_salary[!is.na(df_inc$annual_salary)],breaks=c(seq(28000,140000,by = 10000)),
     main = "Histogram of customers' annual salary", xlab= 'Income($)')
```

Explore correlations between annual salary and various customer attributes

```
# create a dataframe to store relevant features for customers

df_cus <-df_csmp %>%  # use df_csmp to summarize customers' consumption behavior
  select (customer_id,gender,age,amount,date,balance) %>%
  group_by(customer_id) %>%
  mutate(avg_no_weekly_trans= round(7*n()/length(unique(df$date)),0),max_amt = max(amount),
         no_large_trans = sum(amount>100), # an arbitrary $100 benchmark is selected based on th
e
                                           # transaction amount histogram created in task 1.3
         use_no_day=length(unique(date)),
         avg_trans_amt = mean(amount, na.rm =TRUE),
         med_bal = median(balance,na.rm=TRUE)) %>%
  select(-c("amount","date","balance")) %>%
  unique()

# create additional features
df_cus$age_below20 <- ifelse(df_cus$age<20,1,0)
df_cus$age_btw20n40 <- ifelse(df_cus$age>=20 & df_cus$age <40,1,0)
df_cus$age_btw40n60 <- ifelse(df_cus$age>=40 & df_cus$age <60,1,0)

# investigate the state where customers live
# assume they live where most transactions occured (indicated by merchant_state)
df_region <-df_csmp %>%
  group_by(customer_id,merchant_state) %>%
  summarize(trans_count=n()) %>%
  group_by(customer_id) %>%
  mutate (no_state = n()) %>%
  filter(trans_count == max(trans_count))
```

```
# For equal number of transactions between multiple States, pick the most likely State
n_occur = data.frame(table(df_region$customer_id))
cus_id_rep = n_occur$Var1[n_occur$Freq > 1]

state_by_cust_no <- rev(names(sort(table(df_region$merchant_state),rev = TRUE)))
t = data.frame(customer_id = cus_id_rep, merchant_state=NA)

for (i in seq(length(cus_id_rep))){
  s = df_region$merchant_state[df_region$customer_id == cus_id_rep[i]]
  for (state in state_by_cust_no){
    if (state %in% s){
      t[i,2] = state
      break
    }
  }
}

df_region <- df_region[!(df_region$customer_id %in% cus_id_rep), c(1,2)] %>%
              as.data.frame() %>%
              rbind(t) %>%
              rename( State = merchant_state)

# merge all the features into single dataframe
df_cus <- df_cus %>% merge(df_inc) %>%
```

Continued

```
                merge(df_region)

# extract relevant features
df_cus_attr <- df_cus %>%
               select("gender","annual_salary","age","avg_no_weekly_trans","max_amt",
                      "no_large_trans", "use_no_day","avg_trans_amt","med_bal","State")
plot(df_cus_attr)
```

Decision Tree

Listed the code under instructions

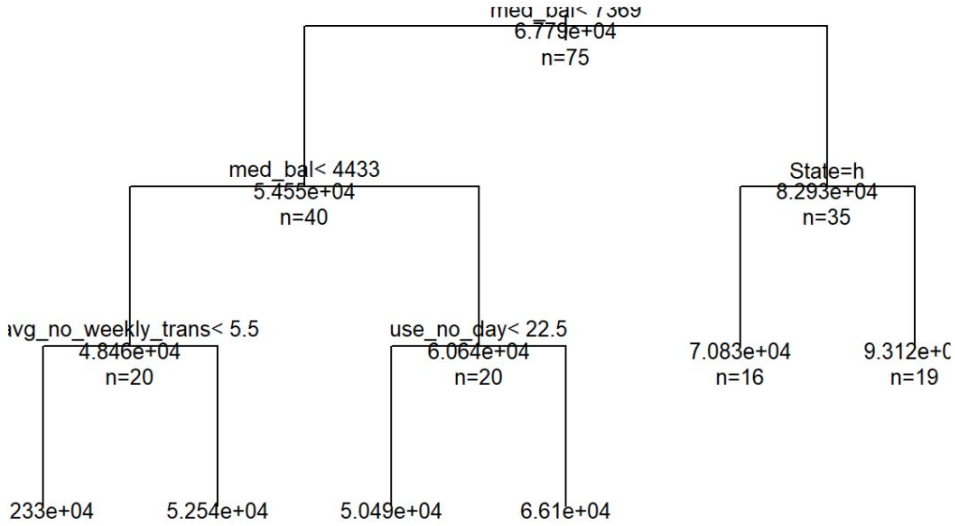
```
# split into train and test datasets
smp_size <- floor(0.75 * nrow(df_cus))

## set the seed to make your partition reproducible
set.seed(123)
train_ind <- sample(seq_len(nrow(df_cus)), size = smp_size)

df_cus_train <- df_cus[train_ind, ]
df_cus_test <- df_cus[-train_ind, ]

fit3 <- rpart(annual_salary ~gender + age + avg_no_weekly_trans +  max_amt + no_large_trans + us
e_no_day + avg_trans_amt + med_bal + age_below20 + age_btw20n40 + age_btw40n60 + State, method=
"anova", data=df_cus_train)

# plot tree
plot(fit3, uniform=TRUE,
   main="Regression Tree for Annual Salary ")
text(fit3, use.n=TRUE, all=TRUE, cex=.8)
```


Regression Tree for Annual Salary
med_bal< 7369
6.779e+04
n=75
med_bal< 4433
5.455e+04
n=40
State=h
8.293e+04
n=35
avg_no_weekly_trans< 5.5
4.846e+04
n=20
use_no_day< 22.5
6.064e+04
n=20
7.083e+04
n=16
9.312e+0
n=19
233e+04
5.254e+04
5.049e+04
6.61e+04

```
# examine the prediction accuracy
rmse(fit3, df_cus_test)


## [1] 25672.77
```

THE END